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Examining the Effects of Life Expectancy and Expectations for Future Health on Adolescent Suicidal Behavior

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ABSTRACT

Research has linked various constructs with a shared focus on the future to suicidal behavior. This study examined: (1) whether life expectancy and expectations for future health were associated with reduced odds of suicidal ideation and attempted suicide, and (2) whether the reducing effect of having high levels of future expectations on suicidal ideation was stronger among individuals with lower levels of depression. Study participants were youths from the National Longitudinal Study of Adolescent to Adult Health (Add Health), a multi-wave panel study of how individual, family, peer, and school factors contributes to youth developmental outcomes. Sequential logistic regression models on 14,644 youths (average age = 14.7 years; 51.3% female; 58.7% white) indicated that higher reported levels of life expectancy and expectations for future health were associated with reduced odds of engaging in suicidal ideation and attempted suicide, net of an array of well-established correlates of suicidal behavior. Depression moderated this relationship such that the association between future expectations and suicidal behavior was amplified among youths with lower levels of depression. The findings suggest that interventions that address suicidal thoughts and actions should promote positive thinking about the future.

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Introduction

Suicide is a significant public health concern among youths in the United States. For persons aged 10 to 24 years, completed suicide is a leading cause of death (Drapeau and McIntosh 2014); and nonfatal suicidal thoughts (e.g., ideation) and actions (e.g., attempted suicide) are relatively commonplace. For example, one in six youths seriously contemplates suicide, and 8% of the youths attempt suicide in any given year (Grunbaum et al. 2014). Mortality, therefore, reflects only a small portion of suicidal behavior, which often manifests as more frequent, albeit less serious, behaviors.

There is an array of documented risk factors for suicidal behavior, perhaps most notably depression (Hawton and James 2005). Research has also linked various, but distinct, psychological constructs with a shared focus on the future to suicidal behavior. For example, hopelessness, typically measured by the Beck Hopelessness Scale (Beck et al. 1974) and defined as a negative outlook toward the future, has been substantiated as a close correlate of suicidality (O'Connor, Armitage, and Gray 2006). Optimism and pessimism, which reflect positive and negative expectancies for the future, respectively, have been linked to suicidal behavior, independent of depression and hopelessness (Carver, Scheier, and Segerstrom 2010; Kuo, Gallo, and Eaton 2004). To a lesser extent, studies have examined the protective role of positive future thinking and future orientation (FO): a predisposition to think about and develop a positive outlook about the future and to strive toward the achievement of identified goals (Hirsch et al. 2007; O'Connor et al. 2007).

Building upon this line of research, we examine whether suicidal behavior varies as a function of life expectancy and expectations for future health. But, unlike prior research, we: (1) treat future expectations as a contemporaneous attitude that impacts adolescents' rational behavioral intentions through risk perception, and (2) focus on life expectancy and expectations for future health as specific domains of the future. Our conceptual framework is consistent with Fishbein and Ajzen (2010) theory of reasoned action which links the perceived severity of an expected outcome to the intention to act. In short, we posit that suicidal thoughts and actions will be perceived as more "risky" and therefore less viable options among individuals who anticipate living long and healthy lives.

We also investigate the types of individuals for whom life expectancy and expectations for future health are the most salient, focusing on one of the strongest correlates of suicidal behavior – depression – as an individual distinguishing characteristic. Conceptually, we expect depression to inhibit the behavioral intention to avoid risk (and therefore to avoid suicidal thoughts and actions) among individuals who expect to live long and healthy lives. Empirically, we posit that depression will weaken the relationship between future expectations and suicidal behavior. Ultimately, we examine the direct and indirect effects through which life expectancy and expectations for future health impact suicidal behavior.

Linking suicidal behavior to an anticipated future

Various constructs with a shared focus on the future have been linked to suicidal behavior. Hopelessness, defined as a negative outlook toward the future, has long been considered a key factor in the path from depression to suicide (Beck, Kovacs, and Weissman 1975). Hopelessness has been linked to suicidal thoughts, attempted suicide, and completed suicide in both non-psychiatric (Kuo, Gallo, and Eaton 2004) and clinical populations (Brown et al. 2000; Forman et al. 2004). Optimism and pessimism, which reflect generalized positive and negative expectancies for the future, respectively, have also been linked to suicidal behavior, independent of depression and hopelessness (Carver, Scheier, and Segerstrom 2010; Kuo, Gallo, and Eaton 2004). And, future orientation – defined as a predisposition to think about and develop a positive outlook about the future – has been demonstrated as a correlate of suicidal behavior, independent of depression, hopelessness, and pessimism/optimism (Hirsch et al. 2007; O'Connor et al. 2007).

While hopelessness, optimism/pessimism, and future orientation have received considerable attention in the empirical literature, the effects of life expectancy and expectations for future health warrant additional attention. Life expectancy and expectations for future health, while not specifically linked to suicidal behavior, have been associated with a host of negative adolescent developmental outcomes, including school maladjustment (Caldwell, Wiebe, and Cleveland 2006), cigarette smoking (McDade et al. 2011), medical ailments such as stroke (Morgenstern et al. 2011), violent delinquency, nonviolent delinquency, and drug use (Haynie, Soller, and Williams 2014). There is thus an empirical basis for examining negative life outcomes associated with diminished life expectancy and expectations for future health.

There is also a theoretical rationale for linking life expectancy and expectations for future health to self-harming thoughts and behaviors. For example, the theory of reasoned action promulgated by Fishbein and Ajzen (2010) links cognitive vulnerabilities (e.g., perceived early mortality) to the behavioral intention to act (e.g., suicidal thoughts) through risk perception. Under the theory, individuals "form beliefs about an object by associating the object with various characteristics, qualities, and attributes" (Fishbein and Ajzen 2010: 96). Beliefs about the object subsequently facilitate a behavioral intention to act through the perceived severity of that act. In the context of this study, youths form beliefs about the future (the object) by associating the future with early mortality and disease contraction (the attributes). In turn, negative expectancies about the future enable the intention for self-harm by discounting the perceived risks (e.g., early death) associated with suicide. Put simply, individuals who anticipate dying young or contracting a life-threatening disease will attach less weight to the most severe outcome (i.e., death) associated with thinking about and attempting suicide.

Conversely, suicidal thoughts and actions may be perceived as more risky, and therefore less viable options, among individuals who anticipate living long and healthy lives.

Depression and suicidal behavior

Depression is among the most prominent predictors of suicidal behavior. In fact, depression has been associated with over 90% of all suicidal behaviors (Moscicki 2001). Moreover, although research has indicated that individuals with severe depression are more than twice as likely to die by suicide than those with lower levels of depression (Hawton et al. 2013), the risk of suicide is heightened at mild and moderate levels of depression as well. This suggests that depression at all levels is relevant for suicidal behavior (Cukrowicz et al. 2011).

While the direct effect of depression on suicide is well documented, recent research also supports the investigation of depression as a moderating factor in the etiology of suicidal behavior. For example, interaction effects have been observed between depression and individual differences (e.g., brooding and reflective rumination), family factors (e.g., family connectedness), and neighborhood characteristics (e.g., religiosity, pervasive violence) (Au, Sing, and Lee 2008; Cheref et al. 2014; Maimon and Kuhl 2008; Zimmerman 2013). The results of these studies are suggestive of a diathesis-stress model, under which individual vulnerabilities (e.g., depression) interact with other “triggers” for suicidal behavior (Mann 2002). Inspection of depression as a moderator of other risk factors for suicidal behavior is nascent, but existing research suggests that it is worthy of additional investigation.

Based on this line of research, we examine whether depression moderates the relationship between expectations for the future and suicidal behavior. We focus on depression as a moderator because it is one of the strongest correlates of suicidal behavior. Perhaps more importantly, evidence suggests that cognitions reflective of future attitudes (e.g., hopelessness) interact with depression in the development and manifestation of suicidal thoughts and actions (see Mills and Kroner 2008).

The present study

This study bridges a part of the previously mentioned void in the literature on suicidal behavior by investigating the effects of life expectancy and expectations for future health on suicidal behavior. Specifically, we expect life expectancy and expectations for future health to be associated with reduced odds of suicidal ideation and attempted suicide (Hypothesis 1). We further anticipate the association between life expectancy and expectations for future health and suicidal behavior to vary across levels of individual depression such that the reducing effect of elevated future expectations on suicidal ideation is stronger among individuals with lower levels of depression (Hypothesis 2). We test these hypotheses while controlling for an array of previously established correlates of suicidal behavior.

Method

Participants

As a multi-wave panel study of how individual, family, peer, and school factors contributes to youth development, the National Longitudinal Study of Adolescent to Adult Health (Add Health) is particularly well suited to address the study hypotheses. Add Health is a school-based study representing a nationally representative sample of American adolescents in grades 7 through 12. A multistage cluster sampling design was used to identify adolescents for the study (see Bearman, Jones, and Udry 1997; Harris 2009 for a detailed description of the Add Health sampling design).

In the first stage of data collection, 80 high schools were selected from a list of all high schools in the United States (a list generated from the Quality Education Database) that included an 11th grade and enrolled more than 30 students. The selection probability was proportional to the size of the school. For schools that did not also contain a 7th grade, a “feeder” school – one that included a 7th grade and

at least five students who moved on to the selected high school – was included in the study. This resulted in a total of 132 middle schools and high schools from the US. sampled to assure representativeness on size, school type, geographic region, urbanization, and racial composition. Schools in the study varied in size (from less than 100 students to more than 3,000 students), and represented over 70% of contacted high schools; those that declined to participate were replaced randomly with schools in their strata. Students in the sampled schools were administered an in-school questionnaire during a 45–60 minute class period from September 1994 through April 1995. The response rate was over 80%, generating completed in-school questionnaires from over 90,000 students.

In the second stage of data collection (also called the wave 1 in-home survey), a sample of students was selected from rosters of enrolled students in each school (this included students who did not participate in the in-school survey) and students not on a roster who completed an in-school questionnaire. At this stage of data collection, 20,745 90 min in-home interviews were conducted between May 1995 and December 1995, for a response rate of 80%. The adolescent in-home interviews were conducted using ACASI technology to reduce the possibility of interviewer or parental bias (Turner et al. 1998). Roughly 85% of these interviewed adolescents also had parents who were interviewed.

Adolescents who participated in the wave 1 in-home survey were re-interviewed between April and September 1996 (the wave 2 in-home survey). High school seniors during the wave 1 in-home survey were not asked to participate in the wave 2 in-home surveys. The wave 2 in-home survey response rate was over 85%, generating 14,787 interviews.

Our final study sample consists of 14,644 respondents who were interviewed during the wave 1 and wave 2 in-home surveys and answered the suicidal behavior questions (discussed below) at the wave 2 in-home interview. Respondents were aged 10–19 years at the time of the wave 1 in-home interview.

Approximately 36% of respondents were missing data on at least one study variable. To maintain statistical power and to avoid potential estimate biases resulting from the list-wise deletion of cases (Acock 2005), multiple imputation techniques were used to produce parameter estimates and standard errors based on the combination of models from 10 imputed data sets. The data sets were constructed using chained equations (within school clusters) on all study variables. Summary statistics are presented in Table 1.

Suicidal behavior

Respondents reported their involvement (0: no; 1: yes) in two suicidal behaviors during the 12 months preceding the wave 2 interviews: suicidal ideation (seriously thinking about committing suicide) and attempted suicide. These items follow a recent consensus on the definition of nonfatal suicidal behavior (Nock et al. 2008; Silverman et al. 2007a, 2007b). Approximately 10.7% and 3.5% of the sample respondents reported suicidal ideation and attempted suicide, respectively, during the time frame indicated.

Life expectancy and expectations for future health

At wave 1 of the study, respondents were asked: (1) What are the chances you will live to age 35? (2) What are the chances you will be killed by age 21? (reverse-coded); and (3) What are the chances you will get HIV or AIDS? (reverse-coded). These items, ranging from 1 = no chance to 5 = almost certain, were summed to reflect life expectancy and expectations for future health ($\alpha = .57$). Although the reliability of this scale is below the conventional standard (.70) for internal consistency, different combinations of these items have been: (1) validated in prior research with similar levels of internal consistency, and (2) linked to adverse health outcomes ranging from cigarette smoking to violence (Borowsky, Ireland, and Resnick 2001; Harris, Duncan, & Boisjoly, 2002; McDade et al. 2011; Morgenstern et al. 2011). In addition, these items load onto a single factor in factor analysis. In our sample, individuals on average had high levels of expectations for the future (13.2 out of 15).

Table 1. Descriptive statistics.

Continuous Variables	Mean	SD	Min – Max
Age	14.71	1.58	10–19
Depression	11.32	7.57	0–54
Future Expectations	13.19	1.78	3–15
Impulsivity	8.82	2.53	4–20
Overall Health	3.88	.91	1–5
Somatic Symptoms	9.77	5.15	0–49
Religiosity	6.35	1.58	2–8
Exposure to Violence	.52	1.18	0–10
Family Bonding	18.42	2.13	4–20
Neighborhood Connectivity	10.58	2.49	2–14
Categorical Variables	Percent	Frequency	
Sex			
Male	48.70	7,131	
Female	51.30	7,513	
Race			
White (Reference)	58.70	8,580	
Black	20.77	3,044	
Other	20.53	3,020	
Substance Use			
Yes	35.48	5,205	
No	64.52	9,439	
Exposure to Suicide			
Friend Attempted/Completed Suicide	17.78	2,610	
Family Attempted/Completed Suicide	4.46	12,034	
Parents Marital Status			
Married	70.09	10,372	
Not Married	29.91	4,372	
Suicidal Behavior			
Suicidal Ideation	10.71	1,569	
Attempted Suicide	3.46	507	

ABBREVIATIONS: SD = standard deviation; Min = minimum; Max = maximum

Depression

Depression, one of the most salient correlates of suicidal behavior (Borowsky, Ireland, and Resnick 2001; Thompson and Light 2011) was measured using 18 items from the widely known and validated Center for Epidemiologic Studies Depression (CESD) scale (Watts and McNulty 2013). Items asked respondents about depressive symptoms in the year preceding the wave 1 interview (e.g., Did you feel depressed? Did you feel too tired to do things? Did you feel lonely?). Note that we excluded one item from the original CESD scale that asked respondents whether they felt hopeful about the future. This was to avoid confounding the depression scale with the future expectations scale. Item responses, which ranged from 0 = never or rarely to 3 = most of the time or all of the time, were summed ($\alpha = .87$). On average, individuals in the sample exhibited low levels of depression (11.3 out of 54).

Demographic covariates

Demographic characteristics include age, race – white (reference category), black, and other – and sex (1 = male). The average age of study participants at wave 1 was 14.7 years; 51.3% of sample respondents were female; and the majority of respondents (58.7%) were white. These demographic characteristics are commonly used as controls in studies on adolescent suicidal behavior (Borowsky, Ireland, and Resnick 2001; Thompson and Light 2011).

Individual differences

Several personality traits and behavioral factors were assessed at the wave 1 in-home interview and used as statistical controls in the present study. Variables include impulsivity, substance use, general health, religiosity, exposure to suicide, and exposure to violence.

Impulsivity

Impulsivity was constructed as a respondent's level of agreement to four statements measuring cognitive decision-making and problem-solving skills at wave 1: (1) When you have a problem to solve, one of the first things you do is get as many facts about the problem as possible; (2) When you are attempting to find a solution to a problem, you usually try to think of as many different ways to approach the problem as possible; (3) When making decisions, you generally use a systematic method for judging and comparing alternatives; and (4) After carrying out a solution to a problem, you usually try to analyze what went right and what went wrong. The items, ranging from 1 = strongly agree to 5 = strongly disagree, were summed ($\alpha = .74$). This scale has been linked to suicidal behavior and validated in prior work (Chen and Vazsonyi 2011; Dumais et al. 2005; Kasen, Cohen, and Chen 2011). Higher levels of the scale reflect higher levels of impulsivity. Overall, respondents reported moderate levels of impulsivity (8.8 out of 20).

Substance use

Substance use is a binary variable indicating whether a respondent got drunk in the 12 months preceding the wave 1 interview or ever smoked marijuana ($\rho = .50$; $p < .001$). Substance use has been demonstrated as one of the strongest correlates of depression and suicidal behavior (Borowsky, Ireland, and Resnick 2001; McManama et al. 2014). Approximately 35% of sample respondents reported substance use.

General health

Respondent health was assessed using two variables. General health was self-reported at wave 1 and ranged from 1 = poor to 5 = excellent. A scale representing somatic symptoms was constructed by summing respondents' responses to 13 questions about the presence of various ailments (e.g., headaches, stomach aches, coughing, chest pains) during the 12 months preceding the wave 1 interview ($\alpha = .78$). Items were rated on a scale of 0 = never to 4 = every day. Overall, respondents reported high levels of overall health (3.9 out of 5) and low levels of somatic symptoms (9.8 out of 49). These measures have been associated with suicidal behavior in prior studies using the Add Health dataset (Borowsky, Ireland, and Resnick 2001; Thompson and Light 2011).

Religiosity

There is evidence that religiosity is an insulating factor against suicidal behavior (Borowsky, Ireland, and Resnick 2001; Thompson and Light 2011). We measured religiosity as the sum ($\rho = .47$; $p < .001$) of two items: (1) the frequency with which respondents attended religious services (ranging from 1 = once a week or more to 4 = never; reverse coded); and (2) the importance of religion (ranging from 1 = very important to 4 = not important at all; reverse coded). Sample respondents, on average, reported high levels of religiosity (6.4 out of 8).

Exposure to suicide

Exposure to suicide is represented by two dichotomous variables measured at wave 1: (1) whether the respondent had a friend who had ever completed or attempted suicide, and (2) whether the respondent had a family member who had ever attempted or completed suicide. Similar measures have been demonstrated as robust correlates of suicidal behavior (Borowsky, Ireland, and Resnick 2001; Thompson and Light 2011; Tong et al. 2014; Zimmerman and Posick 2014). Approximately 17.8% of the sample respondents had a friend who attempted or completed suicide, and 4.5% of respondents had a family member who had attempted or completed suicide.

Exposure to violence

Exposure to violence was constructed as the sum of five items measuring direct or indirect violent victimization during the 12 months prior to the wave 1 interview ($\alpha = .67$). On a scale ranging from 0 = never to 2 = 2 or more times, respondents were asked whether: (1) someone

pulled a knife or gun on them; (2) someone shot at them; (3) someone cut or stabbed them; (4) they got jumped; and (5) they saw someone shoot or stab another person. These items have shown adequate internal reliability and validity in prior research using the Add Health data and have been linked to suicidal outcomes in similar studies (Borowsky, Ireland, and Resnick 2001; Schreck and Fisher 2004; Thompson and Light 2011). On average, respondents reported low levels of exposure to violence (.5 out of 10).

Family covariates

Family-level variables measured at wave 1 include parents' marital status (1 = married) and family bonding. The majority of respondents had married parents (70.1%) at wave 1 of the study. Family bonding captures parent-child connectedness and attachment and was measured using four items: (1) How close do you feel to your mother?; (2) How close do you feel to your father?; (3) How much do you think she [mother] cares for you?; and (4) How much do you think he [father] cares for you? The items, ranging from 1 = not at all to 5 = quite a bit, were summed ($\alpha = .72$). This scale has shown adequate reliability and validity and has been linked to suicidal behavior in prior studies (Borowsky, Ireland, and Resnick 2001; Peña et al. 2011; Schreck and Fisher 2004; Thompson and Light 2011; Zimmerman and Posick 2014). Respondents in this study reported high levels of family bonding (18.4 out of 20).

Neighborhood connectivity

To measure neighborhood connectivity (Simons et al. 2005), respondents rated their level of agreement to six statements at wave 1 of the study: (1) You know most of the people in your neighborhood; (2) In the past month, you have stopped on the street to talk with someone who lives in your neighborhood; (3) People in this neighborhood look out for each other; (4) Do you usually feel safe in your neighborhood?; (5) On the whole, how happy are you with living in your neighborhood?; (6) If, for any reason, you had to move from here to some other neighborhood, how happy or unhappy would you be? These items were converted to z-scores (due to different response categories across items) and then summed ($\alpha = .63$). Respondents reported fairly high levels of neighborhood connectivity (10.6 out of 14).

Analytic strategy

The first stage of analysis examined bivariate correlations between the focal independent variable – expectations for the future – and all study covariates. In the second stage of analysis, sequential logistic regression models were estimated in *STATA 13* to examine the correlates of suicidal ideation and attempted suicide (both binary variables). Robust standard errors were used to account for clustering within schools, and all continuous variables were standardized or grand-mean-centered (age) to reduce collinearity and to make the intercept more interpretable (Raudenbush and Bryk 2002). The models were unaffected by multicollinearity based on the criteria of 3.0 for the variance inflation factor (VIF) threshold and .40 for the tolerance threshold (Allison, 1999). Baseline logit models examined the direct correlates of suicidal ideation and attempted suicide. An interaction term between life expectancy and expectations for future health and depression was subsequently added to the models to examine the potential moderating effects of depression on the relationship between life expectancy and expectations for future health and suicidal behavior.

Table 2. Bivariate correlations between life expectancy and expectations for future health and study variables.

Variable	Bivariate Correlation with Life Expectancy and Expectations for Future Health
Age	-.11***
Male	-.01
Black ^a	-.06***
Depression	-.28***
Impulsivity	-.09***
Substance Use	-.15***
Overall Health	.16***
Somatic Symptoms	-.15***
Religiosity	.03***
Family Attempted/Completed Suicide	-.04***
Friend Attempted/Completed Suicide	-.09***
Exposure to Violence	-.20***
Parents Married	.06***
Family Bonding	.17***
Neighborhood Connectivity	.13***
Suicidal Ideation	-.10***
Attempted Suicide	-.08***

^aReference category = white

*** $p < .001$

Results

Zero-order correlations between future expectations and study covariates

Table 2 presents the bivariate correlations between life expectancy and expectations for future health and each study variable. Related to the demographic characteristics, older youths and black youths have lower levels of future expectations. Sex is unrelated to future expectations. In terms of individual differences, higher levels of depression are associated with lower levels of future expectations; higher levels of impulsivity, increased substance use, and the presence of somatic symptoms is inversely related to future expectations; and higher levels of overall health and religiosity are associated with higher levels of future expectations. Furthermore, individuals who have been exposed to friend and family suicidal behavior and to violence have lower levels of future expectations. Pertaining to the family factors, individuals with married parents and those with higher levels of family bonding report increased expectations for the future. And, higher levels of neighborhood connectivity are associated with higher reported levels of future expectations. The suicidal outcome measures in the study – suicidal ideation and attempted suicide – are significantly and inversely associated with future expectations.

Sequential logistic regression models predicting suicide ideation

Table 3 investigates the correlates of suicidal ideation. The results of the baseline model in Model 1 indicate that a one standard deviation increase in life expectancy and expectations for future health is associated with a 9% decrease in the odds of suicidal ideation $[(.91-1) \times 100\%]$. Model 1 also indicates that a one standard deviation increase in depression is associated with a 49% increase in the odds of suicidal ideation $[(1.49-1) \times 100\%]$. Depression is among the strongest correlates of suicidal ideation, along with exposure to friend and family suicidal behavior. In addition, sex (being male), race (being black), and age (being older) are associated with reduced odds of suicidal ideation; higher levels of substance use and somatic symptomology are associated with increased odds of suicidal ideation; and family bonding and neighborhood connectivity are inversely associated with suicidal ideation.

Model 2 in Table 3 incorporates the interaction between future expectations and depression. The interaction is positive and significant, indicating that the reducing effect of having high levels of future expectations on suicidal ideation is stronger among individuals with lower levels

Table 3. Sequential logistic regression models of suicidal ideation on future expectations, a future expectations × depression interaction, and study covariates.

Variable	Model 1		Model 2	
	OR	95% CI	OR	95% CI
Future Expectations	.91**	[.85,.96]	.88***	[.82,.94]
Future Expectations × Depression	–	–	1.05*	[1.01, 1.09]
Male	.76***	[.67,.87]	.76***	[.67,.87]
Black ^a	.63***	[.51,.77]	.63***	[.51,.77]
Age	.87***	[.83,.91]	.87***	[.83,.91]
Depression	1.49***	[1.39, 1.59]	1.51***	[1.42, 1.61]
Impulsivity	1.05	[.99, 1.11]	1.05	[.99, 1.11]
Substance Use	1.36***	[1.18, 1.58]	1.36***	[1.18, 1.57]
Overall Health	1.01	[.96, 1.07]	1.01	[.96, 1.07]
Somatic Symptoms	1.12**	[1.05, 1.19]	1.12**	[1.05, 1.19]
Religiosity	.97	[.91, 1.03]	.97	[.91, 1.03]
Friend Attempted/Completed Suicide	1.77***	[1.58, 1.99]	1.77***	[1.57, 1.98]
Family Attempted/Completed Suicide	1.56***	[1.25, 1.96]	1.56***	[1.25, 1.96]
Exposure to Violence	1.02	[.96, 1.08]	1.02	[.96, 1.08]
Parents Married	1.06	[.91, 1.24]	1.06	[.91, 1.24]
Family Bonding	.82***	[.76,.89]	.82***	[.76,.89]
Neighborhood Connectivity	.94*	[.88,.99]	.94*	[.89,.99]
Intercept	.09***	[.07,.10]	.09***	[.07,.10]

ABBREVIATIONS: CI = confidence interval

^aReference category = white; the models also control for “other” race

****p* <.001; ***p* <.01; **p* <.05

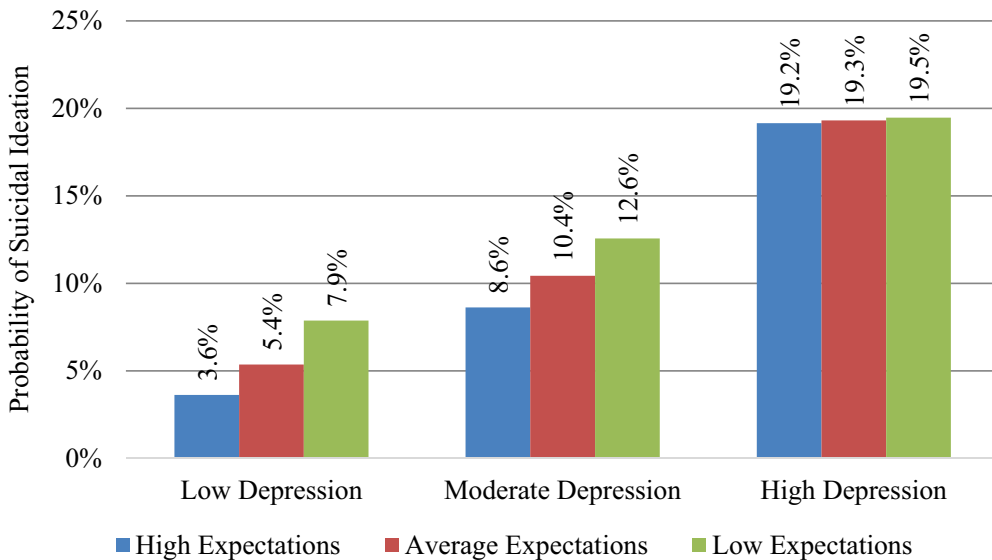


Figure 1. The probability of suicidal ideation as a joint function of life expectancy and expectations for future health and depression. The figure ranges from 2 standard deviations below the mean (i.e., “Low”) to 2 standard deviations above the mean (i.e., “High”) of the standardized future expectations variable. The standardized future expectations variable ranges from – 4 to 2.4, but 95.6% (13,995/14,644) of respondents reported levels of future expectations in the displayed range. The figure ranges from 1.5 standard deviations below the mean (i.e., “Low”) to 2.5 standard deviations above the mean (i.e., “High”) of the standardized depression variable. The standardized depression variable ranges from – 3.2 to 4, but 97.9% (14,337/14,644) of respondents reported levels of depression in the displayed range. The distribution of data points throughout the entire range of depression and future expectations, along with sensitivity analysis with values more than three standard deviations below and above the means of these variables recoded to negative and positive three, respectively, ensure that the interaction is not attributed to outliers at either the upper end or the lower end of the continuums of the variables.

Table 4. Sequential logistic regression models of attempted suicide on future expectations, a future expectations \times depression interaction, and study covariates.

	Model 1		Model 2	
	OR	95% CI	OR	95% CI
Future Expectations	.86**	[.79,.94]	.81***	[.72,.91]
Future Expectations \times Depression	–	–	1.07*	[1.01, 1.14]
Male	.52***	[.43,.64]	.52***	[.43,.64]
Race – Black ^a	.81	[.59, 1.12]	.81	[.58, 1.12]
Age	.81***	[.75,.87]	.81***	[.75,.87]
Depression	1.54***	[1.40, 1.69]	1.59***	[1.44, 1.76]
Impulsivity	1.05	[.96, 1.14]	1.05	[.96, 1.14]
Substance Use	1.46**	[1.15, 1.85]	1.45**	[1.14, 1.83]
Overall Health	1.01	[.92, 1.10]	1.01	[.92, 1.10]
Somatic Symptoms	1.15**	[1.05, 1.26]	1.15**	[1.05, 1.26]
Religiosity	1.02	[.91, 1.13]	1.02	[.92, 1.14]
Friend Attempted/Completed Suicide	2.19***	[1.80, 2.66]	2.17***	[1.79, 2.64]
Family Attempted/Completed Suicide	1.42*	[1.02, 2.00]	1.42*	[1.02, 2.00]
Exposure to Violence	1.19***	[1.08, 1.30]	1.19***	[1.09, 1.29]
Parents Married	1.11	[.88, 1.41]	1.11	[.88, 1.40]
Family Bonding	.83**	[.75,.93]	.83**	[.75,.93]
Neighborhood Connectivity	.99	[.89, 1.09]	.99	[.89, 1.09]
Intercept	.02***	[.01,.03]	.02***	[.01,.03]

ABBREVIATIONS: CI = confidence interval

^aReference category = white; the models also control for “other” race

*** $p < .001$; ** $p < .01$; * $p < .05$

of depression. Specifically, a one standard deviation decrease in depression is associated with a 42% increase in the relationship between future expectations and suicidal ideation $[(1.05 - 1.00) / (.88 - 1.00) \times 100\%]$.

Figure 1 graphically illustrates the probability of suicidal ideation as a function of the interaction between future expectations and depression. At high levels of depression, the difference in the probability of suicidal ideation between individuals with low future expectations and those with high future expectations is practically indistinguishable. However, at low levels of depression, the probability of suicidal ideation increases from 3.6% among individuals with high expectations of the future to 7.9% among individuals with low expectations about the future.

Sequential logistic regression models predicting attempted suicide

Table 4 investigates the correlates of attempted suicide. The results presented in Model 1 indicate that a one standard deviation increase in life expectancy and expectations for future health is associated with a 14% decrease $[(.86 - 1) \times 100\%]$ in the odds of attempted suicide. In addition, depression is among the strongest correlates of attempted suicide, as a one standard deviation increase in depression is associated with a 54% increase $[(1.54 - 1) \times 100\%]$ in attempted suicide. The results also indicate that males and older individuals are less likely to attempt suicide; and, higher levels of substance use, somatic symptoms, exposure to family and friend suicide, and exposure to violence are associated with increased odds of engaging in attempted suicide. Family bonding acts as a protective factor against attempted suicide.

Model 2 in Table 4 incorporates the interaction term between future expectations and depression. The interaction is again positive and significant, indicating that a one standard deviation decrease in depression is associated with a 37% increase in the relationship between future expectations and attempted suicide $[(1.07 - 1.00) / (.81 - 1.00) \times 100\%]$.

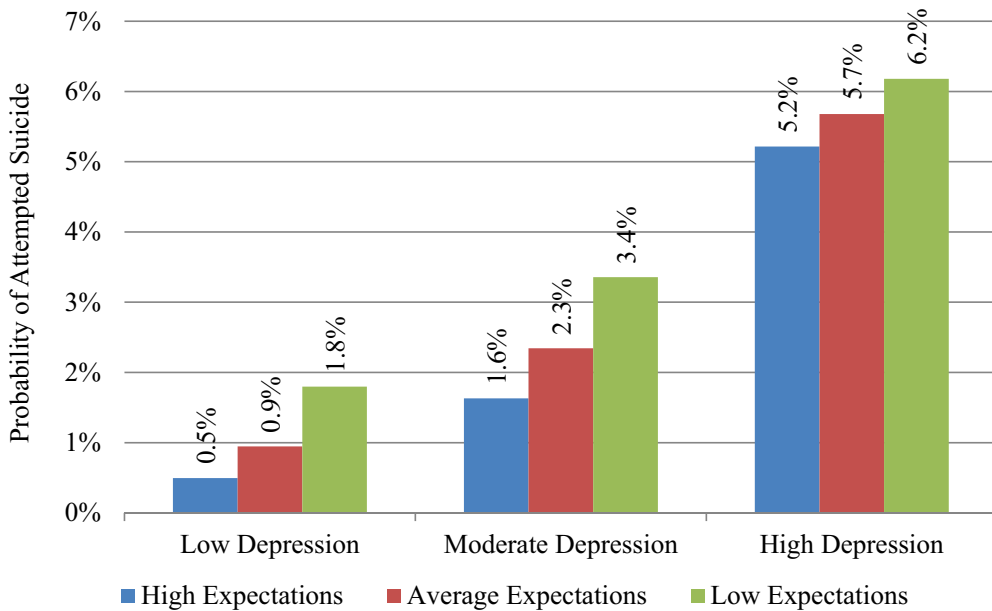


Figure 2. The probability of attempted suicide as a joint function of life expectancy and expectations for future health and depression. The figure ranges from 2 standard deviations below the mean (i.e., “Low”) to 2 standard deviations above the mean (i.e., “High”) of the standardized future expectations variable. The standardized future expectations variable ranges from -4 to 2.4 , but 95.6% (13,995/14,644) of respondents reported levels of future expectations in the displayed range. The figure ranges from 1.5 standard deviations below the mean (i.e., “Low”) to 2.5 standard deviations above the mean (i.e., “High”) of the standardized depression variable. The standardized depression variable ranges from -3.2 to 4 , but 97.9% (14,337/14,644) of respondents reported levels of depression in the displayed range. The distribution of data points throughout the entire range of depression and future expectations, along with sensitivity analysis with values more than three standard deviations below and above the means of these variables recoded to negative and positive three, respectively, ensure that the interaction is not attributed to outliers at either the upper end or the lower end of the continuums of the variables.

The interaction between future expectations and depression is illustrated in [Figure 2](#). At high levels of depression, the probability of attempted suicide is reduced by 16% from 6.2% among individuals with low future expectations to 5.2% among individuals with high expectations. However, at low levels of depression, the probability of attempted suicide is reduced by 72% from 1.3% among individuals with low expectations of the future to 0.5% among individuals with high expectations about the future.

Discussion

Summary

This study seeks to expand the knowledge-base on suicidal behavior by examining whether suicidal ideation and attempted suicide vary as a function of life expectancy and expectations for future health. Unlike previous research on hopelessness, optimism/pessimism, and future orientation, we treat future expectations as a contemporaneous attitude that impacts adolescents’ rational behavioral intentions through risk perception, and we focus on life expectancy and expectations for future health as specific domains of the future.

Bivariate analyses revealed that the vast majority of study variables were linked to life expectancy and expectations for future health. Most notably, mental and physical health variables (depression, overall health, somatic symptoms, and substance use) were among the most salient correlates of future expectations (along with exposure to violence and family bonding). The multivariate results indicated that youths with higher reported levels of life expectancy and

expectations for future health were less likely to think seriously about suicide and to attempt suicide. The results also indicated that the reducing effect of positive future thinking on suicidal behavior was amplified as levels of depression decreased, as demonstrated by a significant interaction term between future expectations and depression.

Importantly, the analysis controlled for a number of individual, family, and neighborhood factors associated with suicidal thoughts and actions. The results pertaining to these control variables substantiated the strength of the data and modeling techniques. Perhaps more importantly, accounting for these control variables added to the viability of future expectations as a meaningful correlate of suicidal behavior.

Implications for research and practice

Understanding the ways in which future expectations may mitigate suicide risk is critical to the implementation of effective interventions. By increasing life expectancy and expectations for future health, interventions may reduce not only suicidal behavior, but an array of adverse medical and psychological outcomes (Haynie, Soller, and Williams 2014; Morgenstern et al. 2011). This is of particular import for adolescents, given that: (1) the focus of thinking during adolescence shifts from “what is” to “what might be,” and (2) the increase in forward-thinking during adolescence has implications for risky behavioral intentions and actions.

The results of this study suggest that suicide preventions and interventions should promote positive thinking about the future. This is consistent with recommendations to: (1) screen underprivileged youths and psychiatric patients for feelings of hopelessness (Kuo, Gallo, and Eaton 2004), and (2) focus intervention efforts on altering the way youths form beliefs about the future (Fishbein and Ajzen 2010). The “Creating Positive Futures” initiative holds promise in this regard. This short-term, workshop-based program is focused on defining “the future” and generating positive future expectations for individuals with high levels of hopelessness (Gidley 2001). While evaluation research on this program is nascent, the theoretical foundation is consistent with the results of this study.

The results also suggest that efforts to combat suicidal behavior by targeting depressive symptomatology need to consider other risk factors that may interact with depression in the etiology of suicidal behavior. In this study, the effects of depression and future expectations were intertwined. This follows an emerging line of research on depression as a moderating factor in suicidology. As noted above, interaction effects have been observed between depression and individual, family, and neighborhood characteristics. Focusing on depression as a moderator of other risk factors for suicidal behavior, as well as on factors that may moderate the relationship between depression and suicide, represents a promising avenue to combat suicidal behavior.

The results pertaining to the interaction between future expectations and depression also suggest that efforts to increase life expectancy and expectations for future health may be particularly fruitful among youths who have low levels of depression (or those who are not clinically diagnosed with mood disorders). Unfortunately, these may be the youths most likely to fall through the cracks. We, therefore, encourage suicide prevention programs, which have the ability to reach the general population of adolescents, to promote positive future thinking. For example, the school- and community-based “Sources of Strength” (SOS) program seeks to reduce suicide by promoting help-seeking behaviors and bridging connections through social networks. Rather than focusing solely on reducing risk factors for suicide, SOS facilitates coping, builds positive future thinking, and promotes youth health through connectedness and social bonding. Evaluations of this program indicate that it significantly reduces self-reported suicide attempts (Aseltine and DeMartino 2004). This type of outreach, which is currently available in one-third of US. states, has the ability to reach a wide range of adolescents.

This is not to discount the importance of programs that target clinical populations, as mental health disorders such as depression play a key role in suicidal behavior. Indeed, depression emerged as one of the strongest predictors of suicidal behavior in this study. Preventing suicidal behavior via alleviating depressive symptoms should thus remain a top priority. Interestingly, a 5-year depression

management education program for general practitioners (GPs) produced an almost 10% decline in the annual suicide rate in a high suicide geographical area (Southwest Hungary). This program educated GPs on depression and its link to self-harming behavior. GPs were also encouraged to use depression screening tools, such as the Beck Depression Inventory, to identify potentially suicidal patients early (Szanto et al. 2007). Such tools can provide early detection of key correlates of self-harming behavior and can also provide clarity on where to direct limited resources.

We also note the strength of the exposure to suicide variables in this study. Notably, exposure to friend and family suicide were robust correlates of adolescent suicidal behavior. This is consistent with a long line of research on suicidal contagion (see Mueller and Abrutyn 2015). Preventing suicidal behavior among adolescents is therefore a clinical and social responsibility that must target an array of known risk factors. Future expectations are but one of the myriad of risk factors for suicidal ideation, attempts, and completions.

Study limitations

We note four potential limitations associated with our analysis. First, our measure of future expectations has fairly low internal consistency. Moreover, it is but one that has been operationalized in the literature. Replications of this study with additional measures of future expectations and controlling for hopelessness and pessimism/optimism (unavailable in the Add Health data) would: (1) solidify the importance of life expectancy and expectations for future health, and (2) rule out confounding effects. Second, the Add Health data represent a nationally representative sample of youths, and the study results may vary in clinical samples or in samples in which study participants have diagnosed mental illnesses. We, therefore, caution against the overgeneralization of our results. Third, our analysis included two suicidal behaviors: suicidal ideation and attempted suicide. Examining the impact of life expectancy and expectations for future health on completed suicides, while difficult, would provide further support for the study findings. Finally, there are several ways to measure depression, including major depressive disorder and bipolar disorder. Replicating this study with other, and more serious, forms of depression is warranted.

Conclusion

We conclude by reiterating that higher reported levels of life expectancy and expectations for future health were associated with reductions in adolescent suicidal ideation and attempted suicide. Moreover, these relationships were most salient among individuals with lower levels of depression. Interventions that address suicidal thoughts and actions should, therefore, promote positive thinking about the future, but not indiscriminately, among adolescents.

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