



**ADOLESCENT SUICIDAL BEHAVIOR: DEVELOPMENT OF A
THEORETICAL MODEL USING STRUCTURAL EQUATION
MODELING**

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ABSTRACT

The occurrence of approximately 4,600 completed suicides and 157,000 suicide attempts each year indicates that adolescent suicide continues to be a pervasive problem in the United States (Centers for Disease Control and Prevention, 2014a). This was an exploratory, quantitative study that sought to contribute to on-going efforts to prevent adolescent suicide. Structural equation modeling was used to develop a theoretical model using dataset number 117 of the National Data Archive on Child Abuse and Neglect to identify and explain relationships between variables that may contribute to suicidal behavior within adolescents. Three models were developed. Variables included in the models were: Biological sex, suicidal behavior, and factor TraumaMood (comprised of three indicator variables for trauma and two for depression). Model 3 demonstrated the best goodness of fit (*Satorra-Bentler* $X^2 = 11.80$, $p < .160$; CFI = .946; NFI = .981), and was retained. Model 3 acceptably explained about 40% of the variance in adolescent suicidal behavior. Of that 40%, the majority was attributed to depression and PTSD. Model 3 indicated that sex did not substantially contribute to adolescent suicidal behavior on its own, but that it did substantially contribute to PTSD and depression. Two Post-hoc theories were developed. One, that sex has an indirect path to adolescent suicide through depression and PTSD. Two, that internalization may be a latent factor not included in Model 3 that further explains adolescent suicidal behavior. Further research is needed to replicate the study and test the two Post-hoc hypotheses.

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Using Structural Equation Modeling

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To those in my life who have completed, attempted, or are survivors of suicide. You are
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CHAPTER I

INTRODUCTION

Adolescent suicide is a catastrophic and traumatic event for the surviving family, friends, and acquaintances left behind (Lindqvist, Johansson, & Karlsson, 2008). Additionally, adolescents with failed suicide attempts face “not only the stressors and events that led [them] to attempt suicide, but also the physical, emotional, and psychological trauma associated with attempting to end one’s own life” (Weeks & Jones, unpublished manuscript, p. 2). In light of this, increasing knowledge of the contributing factors of adolescent suicide and suicidal behavior is imperative. After a review of existing literature in this area, the current study sought to add to existing literature by using structural equation modeling to answer the question: What is the nature of the relationships between demographic characteristics, parental attachment, peer acceptance, depression, PTSD, and adolescent suicidal behavior?

CHAPTER II

LITERATURE REVIEW

It has been almost 2 decades since suicide was identified as the “3rd leading cause of death” in 10-24 year-olds (Centers for Disease Control and Prevention, 2014a, para. 1). It remains the 3rd leading cause of death in the year 2015. According to the Centers for Disease Control and Prevention, approximately 4,600 adolescents take their own lives annually, costing the U.S. government significant sums of money each year (2014a). Based on 2005 data, the average cost of suicide was approximately \$1,061,170 per person; that amounts to \$1,290,101.26 in 2014 dollars (Centers for Disease Control and Prevention, 2013a; Bureau of Labor Statistics, 2014). This means that the cost of 4,600 completed adolescent suicides in 2005 amounts to approximately \$5,934,465,796 in 2014 dollars ($\$1,290,101.26 \times 4,600$). While 4,600 youth and \$5,934,465,796 are tragic and staggering statistics, it is important to note that these estimates only include those who succeed in killing themselves; it does not take into account the medical, counseling, and other expenses of the 157,000 or so adolescents who experience failed suicide attempts annually (Centers for Disease Control and Prevention, 2014a). Adolescent suicide is clearly a costly health problem in the United States.

Survivors of Suicide

The cost of adolescent suicide is not limited to fiscal loss. Non-fiscal costs include the psychological, physical, social, and spiritual distress survivors of suicide (people who knew or were intimately connected to a person that committed suicide) face (Jordan, n.d.;

Robinson, 1989, introduction). The number of estimated suicide survivors varies between sources. In a book titled *Survivors of Suicide*, Rita Robinson stated that “dozens of acquaintances, friends, and family members” are impacted by each suicide (Robinson, 2001, p. 15); alternatively, Oulanova, Moodley, and Séguin (2014) estimated “that between 5-10 people are impacted by each suicide” (p. 152). The American Association of Suicidology (2014) estimated that 6 or more survivors result from every suicide.

While existing literature disagrees on the estimated number of survivors per suicide, it does acknowledge that, similar to people who lost a loved one to an accident, survivors of suicide are at increased risk to experience a variety of issues, including: prolonged feelings of guilt, depression, PTSD, complicated grief, and social withdrawal. However, survivors of suicide are unique in that they are also at increased risk to experience prolonged shame, prolonged loneliness from lack of social support, prolonged psychological/emotional disturbance from trying or being unable to unearth the true motive behind a suicide, suicidal ideation, suicide attempts, and suicide (Robinson, 2001; Peters, Murphey, & Jackson, 2013; Bertini, 2009; Lindqvist, et al., 2008; Jordan & McIntosh, 2011). This indicates that reducing the prevalence of adolescent suicide attempts may play an important role in efforts to reduce psychological and emotional distress, as well as suicidal ideation, attempts, and suicide within not only adolescents, but members of all age groups.

Adolescent Suicide Attempts

As mentioned above, approximately 157,000 suicide attempts occur each year (Centers for Disease Control and Prevention, 2014a). Adolescents with failed suicide attempts face “not only the stressors and events that [them] to attempt suicide, but also

the physical, emotional, and psychological trauma associated with attempting to end one's own life" (Weeks & Jones, unpublished manuscript, p. 2). Multiple sources indicate that adolescents who attempt suicide are at increased risk of: depression, PTSD, subsequent suicide attempts, and completed suicide (American Psychiatric Association, 2013; Centers for Disease Control and Prevention, 2014a; Maris, 2000; Ruby & Sher, 2013).

Due to the prevalence of adolescent suicide and suicidal behavior, achieving a greater understanding of their contributing factors is of the utmost importance (Dr. Alan Lipps, personal communication, 2014). The following section explored existing literature on 6 of these factors.

Contributing Factors

Demographics. Multiple studies have sought to determine whether various demographic characteristics place adolescents at an increased risk of committing suicide attempts and suicide. Among the demographic characteristics particularly scrutinized by researchers are: sex, gender, race, ethnicity, and socioeconomic status.

Sex and gender. Although the demographic terms sex and gender differ by definition, they are often used interchangeably in literature. To avoid confusion, the current study adhered to the following definitions of sex and gender:

Sex is assigned at birth, refers to one's biological status as either male or female, and is associated primarily with physical attributes such as chromosomes, hormone prevalence, and external and internal anatomy. Gender refers to the socially constructed roles, behaviors, activities, and attributes that a given society considers appropriate for boys and men or girls and women...While aspects of

biological sex are similar across different cultures, aspects of gender may differ (American Psychological Association, 2011, para. 3).

An adolescent's biological sex has been identified as a demographic characteristic that may impact the risk of adolescent suicide attempts. In Kim, Moon, and Kim's (2011) study that analyzed the relationship between suicidal behavior and psycho-social and physical variables, the results indicated that sex was "negatively correlated with suicidal behaviors" (p. 430). Kim et al.'s (2011) results also reflected findings of existing literature by indicating adolescent females are more likely to report a suicide attempt, while adolescent males are more likely to complete suicide (Kim et al., 2011; Centers for Disease Control and Prevention, 2014a; International Association for Suicide Prevention, 2014).

Research also indicates that adolescents who identify as intersex are at increased risk to attempt suicide (Savage & Harley, 2009; World Health Organization, 2014). Despite the fact that the term intersex refers to a biological condition in which "a person is born with a reproductive or sexual anatomy that doesn't seem to fit the typical definitions of male or female", almost all information on intersexed adolescents and suicidality found during the current review of existing literature was located in sources about gender and/or sexual orientation in adolescents (Intersex Society of North America, 2014, para. 1). Although it is beyond the scope of the current study, future studies could narrow this gap in existing literature by looking specifically at suicidality in the adolescent intersexed population.

Additionally, research indicates that adolescents who identify as transgendered are at increased risk of suicide attempts. Transgendered is a condition in which a person's

gender identity (internal sense of being male, female, neither male nor female, both male and female, etc.) is incongruent with that person's biological sex (Brennan, Barnsteiner, Siantz, Cotter, & Everett, 2012). In Grossman and D'Augelli's (2007) study that examined life-threatening behaviors among transgender youth, nearly half of the 55 participants reported seriously contemplating suicide, and approximately one quarter of the 55 participants reported one or multiple suicide attempts; most participants associated being transgendered with their suicidal thoughts and behavior.

Race and ethnicity. Like sex and gender, race and ethnicity are also two terms used interchangeably in literature, even though each has distinct and separate meanings. Race "refers to genetic differences among people that are manifested in physical characteristics such as skin color" or skeletal structure. Ethnicity "refers to mutual group features such as physical appearance, history, religion, and culture" (Nichols, 2012, p. 63). For the purposes of this study, racial and ethnic groups identified and discussed reflected the categorization model used by the U.S. Census Bureau (for more information, please see U.S. Census Bureau, 2010). Though race and ethnicity are ultimately different, researchers have looked at both as possible contributing factors to adolescent suicide.

Since 2005, American Indian and Alaskan Native adolescents continue to have the highest suicide rate of all racial groups (Comer, 2010; Centers for Disease Control and Prevention, 2013b; Centers for Disease Control and Prevention, 2014b). After the American Indian and Alaskan Native populations, the two racial groups with next-to-highest adolescent suicide rates are Caucasian and African American. Historically, African Americans have exhibited lower suicide rates than Caucasians (Bryant & Harder,

2008). While most sources and statistics available appear to reinforce this trend, Yen et al.'s (2013) study identified African American race as the only significant racial predictor of suicide in their analyses. Although a small African American participant population ultimately limited the conclusions that could be drawn from their data, it is worth mentioning because this study supported other authors' efforts to place a much-needed spotlight on the need to address African American adolescent suicidality (Crosby & Molock, 2006).

While conducting literature searches for information on race and ethnicity as contributing factors to adolescent suicidality, it quickly became apparent that sources disagree on whether the term Hispanic should be considered a racial or ethnic group. In compliance with the aforementioned U.S. Census Bureau's categorization model, the author of the current study categorized Hispanic as an ethnic group (U.S. Census Bureau, 2010). Among other sources, the CDC has reported that Hispanic youth are "more likely to report a suicide attempt than their [Caucasian] or [African American] non-Hispanic peers" (Centers for Disease Control and Prevention, 2012).

Although Native American and Alaskan Native, Caucasian, African American, and Hispanic adolescents are known to have higher rates of suicide attempts and suicide than other racial and ethnic groups (Ex. Pacific Islander or Asian American; Nauruan), it is still unclear whether race and ethnicity have a causal impact on adolescent suicide attempts or suicide. Much of the information unearthed during the current review of existing literature on the matter suggested that mediating or moderating variables may better explain the difference in adolescent suicidality amongst racial and ethnic groups. Regardless of the differences in defining racial and ethnic groups or whether or not race

and ethnicity are causal factors, it is clear that suicide attempts and suicide are very much an issue in need of addressing within American Indian and Alaskan Native, African American, Caucasian, and Hispanic adolescents.

Socioeconomic status. It was surprisingly difficult to find current literature related specifically to the impact of socioeconomic status on adolescent suicide attempts or adolescent suicide in the United States. The literature that was discovered typically focused on individual or several factors reported to occur in higher frequencies amongst people of low socioeconomic status (SES). A few such factors are: low per capita income, unemployment, lack of access to mental health care, and alcohol or substance abuse.

Notably, one of the few studies found that looked specifically at the impact of SES on suicide within age and race-defined groups found that increasing per capita income increased the risk for suicide among Caucasian and African American adolescents (Purselle, Heninger, Hanzlick, & Garlow, 2009). A potential explanation for this surprising result is that adolescents from lower-SES families are often relied more heavily upon to help support the family in one or more ways; because of this, they have an increased sense of purpose, and have fewer opportunities to become bored (Mary Lee, personal communication, November, 2014). Contrary to Purselle et al.'s (2009) findings, the American Psychological Association (2014) indicated that rates of suicide attempts increase with lower levels of SES. More research is needed on the impact of SES on risk of adolescent suicide in the United States to ascertain whether or not SES is a significant contributor to adolescent suicide.

Parental Attachment

Researchers have inquired as to whether a relationship exists between parental attachment and adolescent suicide attempts or suicide. Attachment theory was originally developed by John Bowlby (Fonagy, 2004). Bowlby's theory "posits that in early development, the emotional and physical needs of a child and whether or not they are met inform the development of internal working models of the self and others" (Venta, Shmueli-Goetz, & Sharp, 2014, p. 238).

In a qualitative study conducted by Bostik and Everall (2007), multiple adolescent participants identified the formulation of "a caring and supportive relationship with one or both parents" as a protective factor against suicidal behavior (p. 85). Bostik and Everall's (2007) finding of an indirect relationship between parental attachment and suicidal behavior support Holmes' (2011) view that "in general, suicide can be seen as triggered by a disturbance in or collapse of an individual's attachment network" (p. 154).

Additional sources that looked at attachment as a contributing factor to adolescent suicide attempts included a study conducted by Venta & Sharp (2014). In their study, 194 adolescents were recruited from an inpatient unit of a mental health facility to explore the relationship(s) between parental attachment and suicide-related thoughts and behavior. Surprisingly, results of the study indicated a non-significant relationship between parental attachment and suicide-related thoughts and behavior; however, the results did confirm the association between "psychopathology and [suicide-related thoughts and behavior] identified in previous research" (p. 64). Venta & Sharp (2014) attributed the results to the extreme level of psychopathology present in the sample population, as well as potential moderating variables not controlled for in the study. As acknowledged by Venta & Sharp

(2014), results of their study conflict with other existing literature on attachment and adolescent suicidality. For the most part, research indicates that parental attachment is related to adolescent suicidal behavior (Stepp et al., 2008).

Peer Acceptance

Over the last few years, more and more attention has been given to the role peers, peer acceptance, and peer rejection have on adolescent suicide attempts and suicide. For example, stories and research about adolescents committing suicide after suffering from bullying, cyber-bullying, and anti-gay bullying (popularly called ‘Bullycide’) have increased over the last decade or two (Heilbron & Prinstein, 2010; Hinduja & Patchin, 2010). One thing that all of these stories and studies on bullycide have in common is that at some point, every one of them touches on the concept of peer acceptance (or lack thereof). From these and other stories and studies, peer acceptance has been indicated to be a contributing factor to suicide.

Depression

A plethora of literature exists on the connections between adolescent suicidality and depression. In fact, it has been identified as one of the most commonly associated contributing factors to adolescent suicide attempts (Kim et al., 2011). It is estimated that “1 in 6 American females and 1 in 12 males” suffer from depression; of those adolescents, at least half will attempt suicide at some point (Rice & Sher, 2013, p. 69). Depression and adolescent suicide attempts are strongly associated with each other because suicidal ideation and recurrent thoughts of death are both identified symptoms of depression and identified risk factors for suicide attempts (American Psychiatric Association, 2013).

Post-Traumatic Stress Disorder (PTSD)

Though PTSD is most commonly associated with war veterans, it can impact people of all ages, whether or not they have been exposed to combat. Like adults, adolescents can get PTSD or experience sub-clinical PTSD symptoms through exposure to any stimuli or event perceived by the person to be life-threatening to themselves or others. Additionally, symptoms of PTSD can result from viewing disasters or other graphic material via media sources (Comer, 2010). Currently, “the causal chain of events linking PTSD and suicidal behavior remains unclear” (Ruby & Sher, 2013, p. 132). This being said, some symptoms of PTSD have been known to lead to depression, suicidal ideation, and suicide attempts (American Psychiatric Association, 2013). Additionally, the American Psychiatric Association states that the presence of PTSD “may indicate which individuals with ideation eventually make a suicide plan or actually attempt suicide” (p. 278).

The Current Study

The purpose of the current study was to contribute to on-going efforts to prevent adolescent suicide by attempting to develop and confirm a model to identify and explain relationships between variables that may contribute to suicidal behavior within youth aged 10-18. Although several studies have used structural equation modeling to analyze contributing factors to adolescent suicidal behavior, none of them (to the author’s knowledge) simultaneously analyzed the relationships between demographics, parental attachment, peer acceptance, depression, and PTSD. The current study attempted to answer the following question: What is the nature of the relationships between

demographic characteristics, parental attachment, peer acceptance, depression, PTSD, and adolescent suicidal behavior?

CHAPTER III
METHODOLOGY

Type of Study and IRB Exemption

The current study was exploratory and quantitative in nature. To avoid the potential risks associated with involving human subjects in a study on such a volatile topic as adolescent suicide attempts, pre-existing data was used. In light of this, the author applied for and received exemption from human subject overview by the Institutional Review Board of Abilene Christian University (see Appendix A).

Design

Sample

The current study utilized pre-existing data from dataset 117 of the National Data Archive on Child Abuse and Neglect (NDACAN). Dataset 117 originated from a 2008 follow-up study to a previous study conducted by Salzinger, Feldman, and Ng-Mak (2007). The original study “examined the social relationships and behavior of physically abused schoolchildren” (Larrabee-Warner & Salzinger, 2007, p. IV). The follow-up study “assess[ed] the outcomes in mid to late adolescence of preadolescent physically abused and matched non-maltreated children first studied at ages 9-12 years (Miller & Salzinger, 2008, p. IV). Dataset 117 contains information gathered during the 2008 follow-up study from 153 family units (as well as selected peers and teachers of the targeted adolescents); participants of the follow-up study were recruited from the initial 2007 study’s participants (N=200 family units) (Miller & Salzinger, 2008, p. 2).

Of the 153 children targeted for study, 61% were male, and 39% female. The mean age for the children was 16.5 years of age. Additionally, 38% of the children identified their ethnicity as black, 7% as white, 54% as Hispanic, and 2% as other. Of the 153 adolescents whose responses were included in dataset 117, 28 reported suicidal behavior and 125 did not.

The author of the current study initially planned to use NDACAN dataset 112 in addition to dataset 117. Dataset 112 is the dataset associated with Salzinger et al.'s original 2007 study. For reasons explained in the statistical analysis section, dataset 112 was ultimately excluded from the current study.

Measures

The current study utilized participants' responses or scores on items from measures used in Salzinger et al.'s (2008) study. Measures used in part or in whole within the current study included the: Achenbach Youth Self-Report Depression Scale, Inventory of Parent and Peer Attachment, Interpersonal Competence Scale rated by target adolescent, Center for Epidemiologic Studies Depression Scale by target adolescent, Adolescent Demographics Instrument, and PTSD section of the Diagnostic Interview for Children & Adolescents

The Achenbach Youth Self-Report Depression Scale is one of a set of instruments created to serve as a way to assess eight different constructs within children ages 4-18, including: "Social Withdrawal, Somatic Complaints, Anxiety/Depression, Social Problems, Thought Problems, Attention Problems, Delinquent Behavior, and Aggressive Behavior" (Miller & Salzinger, 2008, p. 3). The current study used only the summary score for the depression construct questions. The Inventory of Parent and Peer

Attachment is a 50-item Likert-type scale instrument that uses 25 items to measure parent attachment and 25 items to measure peer attachment (Miller & Salzinger, 2008, p. 6). The current study utilized targeted adolescents' mean scores of parental attachment and peer attachment items. The Interpersonal Competence Scale is an 18-item instrument that uses a "7-point bipolar scale" to measure social development within children and adolescents (Cairns, Leung, Gest, & Cairns, 1995, p. 726). The current study used the summary scores for adolescents' self-rated interpersonal competence. The Center for Epidemiologic Studies Depression Scale is a 20-item self-report instrument designed to measure depression within the general population without discriminating between subtypes of depression (Miller & Salzinger, 2008, p. 4). The current study used adolescents' mean scores. The Adolescent Demographics Instrument was used by Salzinger et al. (2008) to gather and record certain information for the 153 targeted adolescents in the study. This included: demographics, places adolescents lived, future expectations, and job stress (p. 14). Information used from the Adolescent Demographics Instrument in the current study included adolescents' age, ethnicity, whether they were abused or not, and biological sex. No information was provided on this measure's validity and reliability. The PTSD section of the Diagnostic Interview for Children & Adolescents is a 4-point instrument that measures for DSM-III-R and DSM-IV criteria among children and adolescents (Miller & Salzinger, 2008, p. 5). The current study used adolescents' summary scores.

Statistical Analysis

A structural equation modeling approach was used to develop models for the purpose of predicting adolescent suicide attempts through usage of statistics software

EQS. To develop the models, items from the aforementioned measures used in Salzinger et al.'s (2008) study were used to create indicator variables and latent variables. Indicator variables are variables that can be directly observed; Latent variables (also called factors) are "variables that are not directly observable or measured" (Schumacker & Lomax, 1996, p. 77).

As mentioned earlier, the author of the current study initially planned to use NDACAN dataset 112 in addition to dataset 117. Dataset 112 would have been used to cross-validate and confirm models developed with dataset 117. However, upon receiving the data, it was discovered that dataset 112 did not contain the entry-level or summary variables necessary to cross-validate. The decision was therefore made to exclude dataset 112 from the current study. This resulted in a change in methodology from developing and confirming theoretical models to only developing them.

In order to account for skewness and kurtosis issues within predictor variables (described in the results section), Case-Robust methods were used. Case-Robust methods address distributional abnormalities by weighting each case equally, thereby preventing subsequent analyses from being impacted by the distributional abnormalities (Bentler, 2006). To determine the models' level of fit and significance, the Satorra-Bentler Scaled chi-square, Bentler-Bonett Normed Fit Index (NFI), and Comparative Fit Index (CFI) were used.

The Satorra-Bentler Scaled chi-square is a chi-square analysis associated with using Case-Robust methods. The Satorra-Bentler Scaled chi-square differs from a typical chi-square analysis in that its calculations are based on Case-Robust equally weighted cases, as opposed to normally weighted cases (Bentler, 2006). A non-significant chi-

square ($p > .05$) indicates good model fit (one of the few times a researcher actually wants to fail to reject the null hypothesis). The NFI essentially rescales the chi-square statistic into a “0 (no fit) to 1.00 (perfect fit) range” (Schumacker & Lomax, 1996, p. 127). CFI, as the name would suggest, compares the fit of a proposed model to another (in this case the independence) model (Bentler, 1990). CFI is scaled with the same 0-1.00 system as NFI. For both the NFI and CFI, a score of .90 or above indicates ‘acceptable’ model fit (McDonald & Ho, 2002).

Additional analysis of demographic and other data was performed through use of SPSS. Analyses performed in SPSS included descriptive statistics of demographic data, Phi coefficient, Point Biserial, and a multiple regression. To simplify statistical analyses, one of the variables, Suicidal Behavior, was recoded from a scale variable in which a child’s number of ‘yes’ responses to suicide attempt and ideation questions were added into a nominal ‘yes’/‘no’ variable. All analyses were performed under the supervision of Dr. Alan Lipps.

CHAPTER IV

RESULTS

To better understand data used to develop structural equation models (SEMs), descriptive statistics, correlations, and a multiple regression analysis were performed. Structural equation modeling was used to identify a model that best fit identified relationships amongst the data. Each step is described below.

Descriptive Statistics

Analysis of the frequencies and percentages of demographic data yielded results identical to those specified in the methodology. Additionally, results of an analysis of the distribution pattern for each variable indicated that variables Suicidal Behavior, sum of PTSD section of the Diagnostic Interview for Children & Adolescents (PTSD), Victim of Violence, Achenbach Youth Self Report Depression Scale, and Friend Attachment Score had abnormal levels of skewness or kurtosis, which are illustrated in Table 1. This information was used to inform subsequent decisions as to which methods would be used to evaluate model fit of the SEMs developed (discussed later within the subsection devoted to SEMs).

Table 1

Descriptive Statistics

	Skewness	Kurtosis
Suicidal Behavior	2.78	7.12
PTSD	1.05	
Victim of Violence	2.03	5.58
Achenbach Youth Self Report Depression Scale	1.39	1.94
Friend Attachment Score	-1.00	1.83

Correlations

Correlations were performed to preliminarily examine relationships between variables. First, Crosstabulations were used to determine Phi coefficients between Suicidal Behavior and whether the adolescent was abused or not (Abused Child), Sex, Ethnicity, Victim of Violence, Witness of Violence, and Achenbach Youth Self Report Depression Scale. Results of the crosstabs can be viewed below in Table 2. Direct correlations were observed between Suicidal Behavior and Abused Child ($\phi = .246, p < .002$), Sex ($\phi = .278, p < .001$), Victim of Violence ($\phi = .427, p < .006$), and Achenbach Youth Self Report Depression Scale ($\phi = .545, p < .001$).

Table 2

Correlations of Suicidal Behavior and Other Variables

Variable	<i>Phi</i>	<i>P</i>
Abused Child	.246	.002
Sex	.278	.001
Ethnicity	.061	.905
Victim of Violence	.427	.006
Witness of Violence	.403	.586
Achenbach Youth Self Report Depression Scale	.545	.001

Next, a Point Biserial analysis was performed to evaluate relationships between Suicidal Behavior and Age, PTSD, Center for Epidemiologic Studies Depression Scale score, Parental Attachment, Friend Attachment, and Interpersonal Competence. Table 3 depicts the results. A significant direct relationship was observed between Suicidal Behavior and Age ($r = .218, p < .007$), as well as between Suicidal Behavior and PTSD ($r = .445, p < .000$). An indirect relationship was also observed between Suicidal Behavior and Parental Attachment ($r = -.306, p < .000$). Other direct relationships between variables included: Age and PTSD ($r = .167, p < .041$), PTSD and Center for Epidemiologic Studies Depression Scale score ($r = .357, p < .000$), Parental Attachment and Interpersonal Competence ($r = .320, p < .000$), and Friend Attachment and Interpersonal Competence ($r = .328, p < .000$). Other indirect relationships observed included: PTSD and Parental Attachment ($r = -.352, p < .000$), Parental Attachment and Center for Epidemiologic Studies Depression Scale score ($r = -.374, p < .000$), and Friend Attachment and Center for Epidemiologic Studies Depression Scale score ($r = -.305, p < .000$).

Table 3

Pearson Correlation Matrix of Observed Variables

Pearson r	Suicidal	Age	PTSD	P-Attach.	F-Attach.	CESD
Age	.218**					
Sum of PTSD	.445**	.167*				
Parental Attachment	-.306**	-.027	-.352**			
Friend Attachment	.069	-.075	.060	.152		
CESD ^a	.148	.062	.357**	-.374**	-.305**	
Interpersonal Competence	-.059	-.094	-.111	.320**	.328**	-.411

* $p < .05$; ** $p < .005$ Note: CESD^a = Center for Epidemiologic Studies Depression Scale score

Structural Equation Models

Multiple SEMs were hypothesized and evaluated for goodness of fit. Attempts to include aforementioned variables Age, Ethnicity, Parental Attachment, and factor Peer Acceptance (whose indicator variables were Friend Attachment and Interpersonal Competence) in the models below ultimately failed due to model non-convergence or collinearity. Model non-convergence occurs in EQS when a model has failed to converge, or come together, after 30 iterations (iterations are mathematical repetitions that use the “result of one stage as input for the next”) (Everitt, 2002, p. 197). Collinearity occurs when “variables are related by a linear function”, thereby rendering coefficient estimation impossible (p. 251). Additionally, SES was not included in the models due to insufficient data necessary to create a factor for SES. In the end, three one-factor models emerged.

The sample covariance matrix, variance, and discrepancies of data utilized to create the models are provided below (see Table 4). When reviewing the sample covariance matrix, the largest levels of covariance occurred between Achenbach Youth Self Report Depression Scale and PTSD, Witness of Violence and PTSD, and Victim of Violence and PTSD. Alternatively, the smallest covariance levels were found between Witness of Violence and Sex, Center for Epidemiologic Studies Depression Scale score, and Suicidal Behavior and Center for Epidemiologic Studies Depression Scale score. When variance for each variable was analyzed, Sex displayed the greatest amount of variance, followed by Witness of Violence and Center for Epidemiologic Studies Depression Scale score. Finally, when discrepancies for the interactions between variables were analyzed, the largest amount of discrepancy was found between variables

Witness of Violence and Center for Epidemiologic Studies Depression Scale score and variables PTSD and Center for Epidemiologic Studies Depression Scale score.

Model 1. In light of research discussed within the literature review, it was hypothesized in the first model that Suicidal Behavior was directly influenced by indicator variable Sex and factor TraumaMood. TraumaMood consisted of indicator variables Center for Epidemiologic Studies Depression Scale score (CESD), Achenbach Youth Self Report Depression Scale, PTSD, Victim of Violence, and Witness of Violence. Error values were then specified for the aforementioned indicator variables that made up the factor TraumaMood. The error values for TraumaMood's indicator variables were grouped and correlated according to whether they measured mood/depression (CESD Scale score and Achenbach Youth Self Report Depression Scale) or trauma (PTSD, Victim of Violence, and Witness of Violence). This was done to address the potential influence of unspecified variables on the variance within the two subgroups. Finally, error was specified for the relationship between TraumaMood and Suicidal Behavior. Figure 1 illustrates the initially specified paths.

Table 4

Variances, Covariances, and Discrepancy Values for Model Variables

	Sex	PTSD	Victim of Violence	Witness of Violence	CESD ^a	YSR ^b Depr.	Suicidal Depr.
Sex	28.138	-0.009	-0.016	-0.035	-0.056	-0.014	0.000
PTSD	2.498	4.917	0.002	0.000	0.120	0.029	0.002
Victim of Violence	-0.072	14.216	4.588	0.007	0.097	0.003	0.043
Witness of Violence	0.015	38.549	8.166	7.196	0.179	0.032	0.036
CESD ^a	0.025	2.691	0.243	0.624	5.959	0.000	-0.073
YSR ^b Depression	0.861	44.277	2.756	3.032	1.593	4.773	-0.016
Suicidal Behavior	0.050	2.681	0.226	0.212	0.026	0.898	4.895

Note: Observed covariances are in lower triangle, robust estimates of variances are in diagonal and bold font, and discrepancies (i.e. errors) are in the upper triangle.

^aCESD = Center for Epidemiologic Studies Depression Scale; YSR DEPr.^b = Achenbach Youth Self-Report Depression Scale

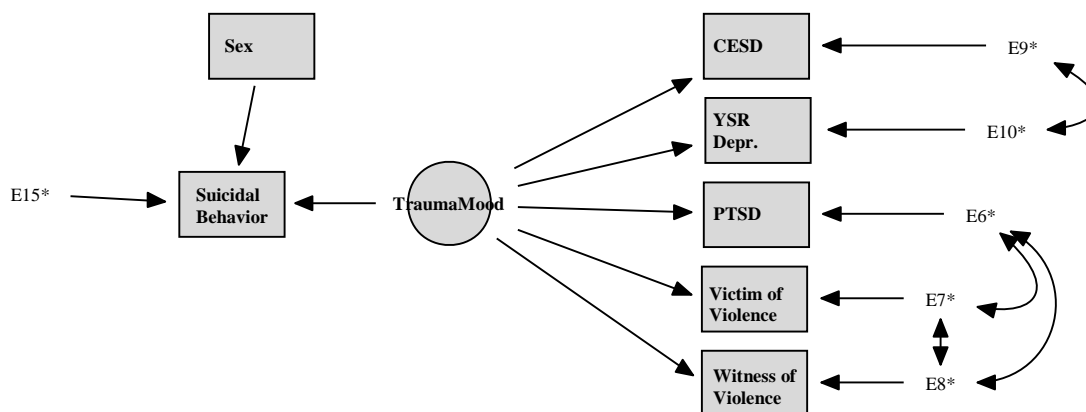


Figure 1. Model 1

When an analysis of model goodness of fit was performed, Model 1 had a significant Satorra-Bentler Chi-Square ($X^2 = 41.47, p < .000$), along with NFI (.811) and CFI (.842) scores that fell below the .90 threshold (see Table 5 below for a visual comparison of goodness of fit results for all three models). Since Model 1 did not meet minimal standards to be considered an ‘acceptably’ fitting model, the model underwent respecification. To avoid confusion, the respecified model was titled Model 2.

Table 5

Structural Equation Models, Comparison of Goodness of Fit Indices

Model	Satorra-Bentler X^2	X^2 Probability	Df	NFI	CFI
Model 1	41.47	.000	10	.811	.842
Model 2	17.15	.046	9	.922	.959
Model 3	11.80	.160	8	.946	.981

Model 2. The second model contained all relationships hypothesized in Model 1, along with an added correlation between Sex and TraumaMood in an attempt to improve model fit. The rationale behind the added correlation was from aforementioned research on depression that noted a difference between the percentage of adolescent males (1 in 12) and females (1 in 6) that experience depression, one of the two subgroups of variables that make up factor TraumaMood (Rice & Sher, 2013, p. 69). Figure 2 illustrates Model 2 with the added path.

When evaluated for goodness of fit, Model 2 also had a significant Satorra-Bentler Chi-Square ($X^2 = 17.15, p < .046$). However, Model 2 did have NFI (.922) and CFI (.959) scores that surpassed the .90 threshold. Although Model 2 demonstrated better model fit than Model 1, a model with a significant Chi-Square and .90+ NFI and CFI was desired. So, the model was respecified once more under the new title of Model 3.

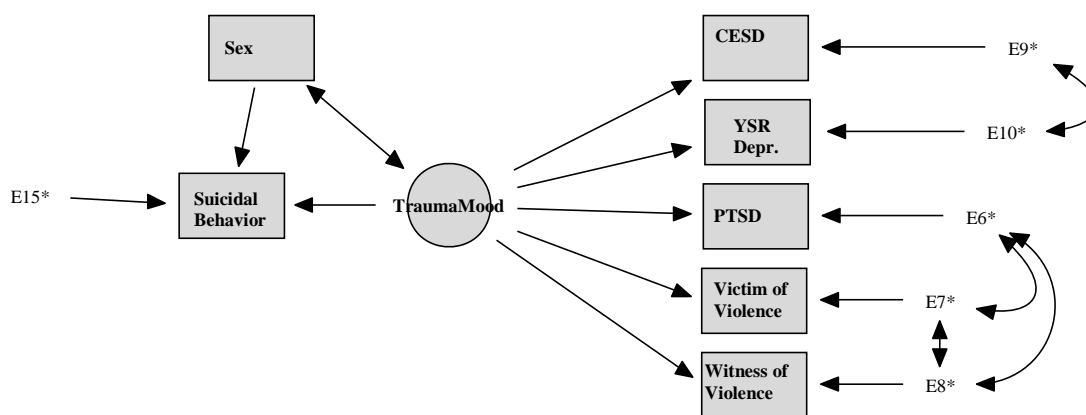


Figure 2. Model 2

Model 3. The third model contained all relationships previously hypothesized in Model 1 and Model 2, plus an added relationship in which Sex directly influenced Victim of Violence. The inspiration behind this added relationship developed from the DSM-5, which lists being female as a risk factor for developing PTSD after experiencing trauma, the other subgroup of the factor TraumaMood (American Psychiatric Association, 2013). Figure 3 illustrates Model 3.

Analysis of Model 3's goodness of fit indicated that Model 3 had an insignificant Satorra-Bentler Chi-Square value ($X^2 = 11.80, p < .160$), and index scores above .90 (NFI = .946; CFI = .981). Of the three models, Model 3 was the only one to meet these requirements. Consequently, the decision was made to retain Model 3 for further analysis. In light of this, the remainder of this paper is dedicated solely to Model 3.

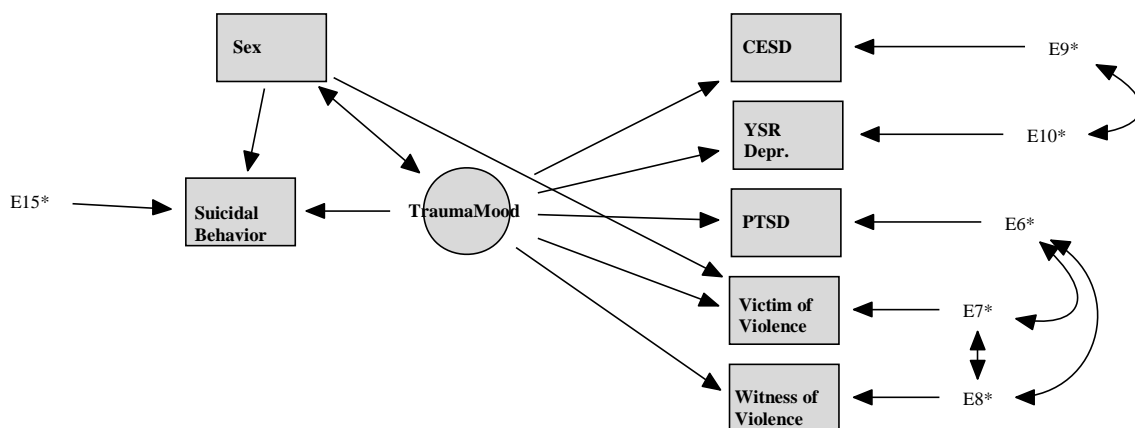


Figure 3. Model 3

Overall, approximately 40% of the variance in Suicidal Behavior was explained by a combination of sex and TraumaMood (aka. F1; $p < .05$); as seen in Table 6, TraumaMood made up almost all of that 40%. TraumaMood also contributed moderately to Achenbach Youth Self Report Depression Scale ($p < .05$) and PTSD, although TraumaMood's contribution to PTSD was not statistically significant.

Table 6

Model 3 Standardized Path Coefficients

Dependent Variable	Factor 1	Sex	Error	R^2
PTSD	0.701		0.713	0.491
Victim of Physical Violence	0.364	-0.213	0.947	0.103
Witness of Physical Violence	0.083		0.997	0.007
Center for Epidemiologic Studies Depression Scale	0.338		0.941	0.114
YSR Depression	0.726		0.687	0.528
Suicidal Behavior	0.656	-0.052	0.774	0.401

CHAPTER V

DISCUSSION

Analysis of Models 1, 2, and 3 indicated that Model 3 best explained relationships between PTSD, depression, sex, and adolescent suicidal behavior. Model 3 acceptably explained about 40% of the variance in adolescent suicidal behavior. Of that 40%, the majority was attributed to depression and PTSD. The finding that depression and PTSD are significant contributors to adolescent suicidal behavior was supported by a plethora of literature, some of which was mentioned in the literature review.

Interestingly, Model 3 indicated that biological sex did not substantially contribute to adolescent suicidal behavior on its own. However, Model 3 did indicate that sex substantially contributed to PTSD and depression. This suggests the effect of sex on adolescent suicidal behavior is indirect; Sex contributed to PTSD and depression, which in turn contributed to suicidal behavior (Dr. Alan Lipps, personal communication, April 2015). A Post-hoc hypothesis was thus formulated that sex indirectly contributes to suicidal behavior through its contributions to PTSD and depression. This Post-hoc hypothesis is consistent with the American Psychiatric Association's (2013) identification of being female as a risk factor for PTSD and depression. This was later supported by Valdez and Lilly's (2014) study that looked at the influences of biological sex and gender role on what was formerly called Criterion A2. Criterion A2 was the PTSD criterion for helplessness, horror, or intense fear in the DSM-IV-TR (American Psychiatric Association, 2000). Valdez and Lilly found that biological sex accounted for

a “significant amount of variance in Criterion A2”, when specific trauma event exposure was statistically adjusted for (p. 38).

The statistically significant standardized coefficients for TraumaMood’s correlated indicator variable errors suggested that TraumaMood did not explain all of the covariances in its indicator variables. Indicator variables’ variances unexplained by factor TraumaMood resulted from a combination of measurement error and unspecified influences. Significant covariances between error terms suggested that a significant chunk of the unexplained variance is systematic, as opposed to random measurement error (Dr. Alan Lipps, personal communication, April 2015). It is possible that one or more other latent factors could explain the systematic error.

One possible latent factor is internalization. Past literature has indicated a relationship between internalizing behavior, depression, and suicidality (Yoder, Longley, Whitbeck, & Hoyt, 2008). Additionally, literature has suggested that females are more likely to exhibit internalizing behavior than males (Maschi, Morgen, Bradley, & Hatcher, 2008). A second post-hoc hypothesis was formed—that internalizing behavior was a latent factor not accounted for within Model 3 that contributed to the model’s unexplained variance. More research is needed to confirm this hypothesis.

Limitations and Implications

As with any study, the current study encountered several limitations. One limitation was that the inability to use dataset 112 to confirm developed models prevented results of this study from being generalizable to adolescents outside of the sample population used to create dataset 117. IRB and NDACAN requests for permission to replicate the current study with another dataset are pending.

A second limitation to the current study was a difference in versions of the Diagnostic and Statistical Manual of Mental Disorders (DSM) was used between Salzinger et al.'s (2008) follow-up study and the current study. Salzinger et al. (2008) used measures for PTSD and depression based on DSM-III-R and DSM-IV criteria. The current study used DSM-5 criteria. The difference in DSMs used may have influenced the results of this study. This limitation can be addressed by replicating the study with a dataset in which DSM-5 criteria were used in measures utilized to gather the data.

A third limitation was the potential for human error. The potential for human error exists every time data is entered into a database, as well as every time a statistical test is prepared, executed, and interpreted. Although utmost caution was used throughout each step of the research process, it would be naïve to eliminate the potential for human error as a limitation from such a complex project.

A fourth limitation to the current study, as with any study utilizing quantitative analysis, is that quantitative methods are limited in their capacity to capture certain information. While numbers are ideal in that they can be used to discover and predict trends in behaviors, they often fail to encapsulate valuable qualitative information (Ex. Mannerisms exhibited or phrases spoken by suicidal adolescents around loved ones prior to an attempt). When studying an issue as pervasive and devastating as adolescent suicidal behavior, it is imperative to not limit the search for helpful information to one source, perspective, or method of research. It is therefore recommended that future studies seek to incorporate qualitative methods into the methodology in addition to quantitative methods. A mixed-methods approach may shed light on information unobtainable from an only quantitative or only qualitative methodology.

Despite these limitations, implications could still be drawn. Review of relevant literature prior to conduction of the current study indicated a lack of research focused on suicidality within intersexed adolescents. Future research could narrow this gap by either focusing on suicidality within the intersexed adolescent population or making efforts to ensure this demographic is proportionally represented in sample populations of future studies. Review of relevant literature also revealed a great need for researchers, agencies, and governmental entities alike to reach a consensus on the definitions of sex, gender, race, and ethnicity. The inability to reach a consensus or correctly use basic demographic terminology undermines researchers' attempts to publish quality research and hinders readers' ability to correctly identify demographics used in a given study.

Analysis of Model 3 indicated a need for further analysis of the relationship between sex and PTSD and how it contributes to adolescent suicidal behavior. The same can be said for the relationship between sex and depression and its contribution to adolescent suicidal behavior. Gaining additional insight into these relationships could aid efforts of those working directly with adolescents to successfully identify adolescents at highest risk of suicidal behavior and intervene before a suicide attempt is made.

Additionally, the significant standardized coefficients for TraumaMood's correlated indicator variable errors support the need for future research to identify additional variables that may contribute to adolescent suicidal behavior, such as internalization. Future research endeavors should seek to identify and include things that increase adolescents' risk of exhibiting suicidal behavior, as well as things that enhance resiliency against suicidal behavior. Doing so could yield a better-fitting model.

Conclusion

Analysis via structural equation modeling indicated that PTSD and depression are significant contributors to suicidal behavior within adolescents. These findings were supported by current literature on adolescent suicidality. Model 3 significantly explained portions of the relationships between PTSD, depression, and suicidal behavior. Model 3 also indicated that biological sex did not substantially contribute to adolescent suicidal behavior on its own, but that it did substantially contribute to PTSD and depression. Two Post-hoc theories were developed as a result. One, that biological sex has an indirect path to adolescent suicide through depression and PTSD. Two, that internalization may be a latent factor not included in Model 3 that further explains adolescent suicidal behavior.

Due to the exploratory nature of the current study, results need to be cross-validated through replication with another dataset. From there, attempts can be made to include additional potential risk-increasing and resiliency-enhancing indicator variables and factors in subsequent analyses. In the end, the current study affirmed the reality that no single model, no matter how high the goodness of fit indices are, can explain 100% of the occurrence of a phenomenon as complex as adolescent suicidal behavior. Not everyone experiences or responds to traumatic events, depression, or suicidal ideation in the same manner (American Psychiatric Association, 2013). Nevertheless, continual attempts to understand the contributing factors to adolescent suicidal behavior (and the relationships amongst them) are vital to addressing the “third-leading cause of death among adolescents” in the United States (Centers for Disease Control and Prevention, 2014a, para. 1).

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APPENDIX A

INSTITUTIONAL REVIEW BOARD EXEMPTION LETTER

ABILENE CHRISTIAN UNIVERSITY
Educating Students for Christian Service and Leadership Throughout the World
Office of Research and Sponsored Programs
323 Hardin Administration Building, ACU Box 29103, Abilene, Texas 79699-9103
325 674 2885



November 4, 2014

Ms. Alena Weeks
School of Social Work and Sociology
ACU Box 27866
Abilene Christian University

Dear Ms. Weeks,

On behalf of the Institutional Review Board, I am pleased to inform you that the IRB has determined that your project titled "Predicting Adolescent Suicide: An Adventure in Structural Equation Modeling" is exempted according to IRB statute.

If at any time the details of this project change, please resubmit to the IRB so the committee can determination whether or not the exempt status is still applicable.

I wish you well with your work.

Sincerely,

A handwritten signature in black ink, appearing to read "Mark Billingsley". The signature is fluid and cursive, with a long, sweeping underline that extends to the right.

Mark Billingsley, M. A.
Director of Research and Sponsored Programs

cc: Dr. Alan Lipps

