Suicide Ideation and Attempts in Adolescents: A Narrative Review

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ABSTRACT

This narrative review is based on a literature search on PsyclNFO and PubMed using the term adolescent suicide. Following exclusion criteria, 44 papers published during the last year (2018) could be classified as prevalence and risk factor studies. The rates of suicide ideation and attempts in adolescents have varied by gender, age and culture, and they are generally increasing, especially for young adolescent females. Frequent risks/predictors of suicide ideation and attempts in this literature include lifetime history and family history of suicide, exposure to suicide and suicide intent. Other predictors include self-harm behavior, psychiatric problems, addictions to alcohol and illicit substances, social media problems, including internet addiction and cyberbullying as well as personality factors including perceived burdensomeness, hopelessness and non-disclosure. Still other risk factors are school problems, including performance, absenteeism and peer harassment. Methodological limitations of this literature include the almost exclusive focus on prevalence and risk factors that have typically been only self-reported by the adolescents. Further, important variables, including relationships, loneliness and isolation have been missing in this recent literature.Longitudinal, multivariate studies are needed to formulate profiles of at-risk adolescents to further inform screening and intervention programs.

INTRODUCTION

Suicide ideation is typically defined as thoughts of engaging in suicidal behavior but without intention. A suicide attempt, in contrast, is self-inflicted, potentially injurious behavior with some evidence of an intent to die but no fatal outcome. This narrative review of research on suicide ideation and attempts in adolescents was written because of the increasing prevalence and severity of these problems as well as their multiple risk factors, but their limited interventions.And, a large number of adolescent suicide studies for the year 2018 had not yet been reviewed. The rationale for the narrative review was to accommodate the diversity of the current research and the variability of the risk measures to potentially better inform interventions for adolescent suicide ideation and attempts.

The method for the review was to conduct a literature search for studies published over the last year (2018). The terms adolescent suicide and 2018were entered into the PsyclNFO and PubMed literature databases. This search yielded 72 papers. The inclusion criteria were empirical studies, reviews and meta-analyses on suicide ideation, attempts and completed suicides. Exclusion criteria were case studies and

pilot studies. In addition, studies that included youth who fell outside the World Health Organization definition of adolescents ranging in age from 10 to 19 were excluded except when a strictly adolescent sample was compared to a non-adolescent sample. After meeting these criteria, 44 publications on adolescent suicide are summarized here. Most of the publications from 2018 focused on the prevalence and on predictors/ risk factors for suicide ideation and attempts in adolescents. This review is accordingly divided into sections on the prevalence and on the risk factors for suicide ideation and attempts followed by discussions on theoretical models, methodological limitations of the literature and future directions for research.

PREVALENCE

Suicide has been one of the top three leading causes of death in the pediatric population of the U.S. and is the second leading cause of mortality among young people globally [1]. The prevalence of suicide ideation and attempted suicides among adolescents varies by culture and by the age range of the samples as well as by gender (see table 1 for a listing of the prevalence figures given in different studies). All of the studies in this section are cross-sectional surveys or secondary analyses of archival databases unless otherwise indicated (Table 1).

Table 1: Prevalence of suicide ideation, attempts and completed suicides in adolescents in different cultures.

Prevalence Location Age First author			
Ideation 4-67%	California	grades 9 & 11	Berbenishty
Ideation 19%	Hawaiian, Indian& Alaskan	grades 9-12	Subica
Ideation 23%	Ethiopia	15-19 years	Amare
Attempts 4%	Mexico	Middle/High School	Orozco
Completed 9%	New Zealand	10-19 years	Roh
4%	United States		
1%	Portugal		

Cultural differences

Cultural differences in prevalence rates are apparent when looking at studies from the U.S., Ethiopia and Mexico, although these databases cannot be directly compared because they involve different age groups of adolescents and different measures. In a secondary analysis of the California Healthy

Kids Survey conducted in two large, representative samples of California high school students (N=751,516 adolescents from grades 9 and 11), rates of suicide ideation ranged between 4 and 67% with a mean of 20% [2].

Slightly lower rates were noted in the large Combined National Youth Behavioral Risk Surveys (N=184,494) of U.S. Native Hawaiian and other Pacific Islander, American Indian/Alaskan Native and multiracial youth (grades 9-12) [3]. The rates of suicidal thoughts, suicide planning and suicide attempts in this sample were 19%, 15% and 8% respectively. It's not clear, however, why these different ethnic groups were combined, as they had different prevalence rates and they varied on other factors as well including the ethnic diversity of their schools. In another sample within the U.S., the rates of suicide ideation and attempts also varied by ethnic group. In this cross-sectional study of African American, Asian American and European American students (N=463 students from middle and high schools), suicide ideation and attempts differed by ethnic group not only on rates, but also on predictors of attempts [4]. For example, suicide ideation was a significant predictor of suicide attempts in the European American group, but not in the African American or Asian American groups.

An unusually high prevalence was noted for suicide ideation (23%) and attempts (16%) in an Ethiopian school-based cross-sectional study of 573 students who ranged in age from 15-19 with a mean age of 17 [5]. The high prevalence may relate to this being an older, more impoverished sample.In contrast to the high prevalence in the Ethiopian sample, an unusually low prevalence was noted for suicide attempts in the Mexican National Survey of Students' Drug Use (N=28,519) (3% for middle school and 4% for high school students) [6]. These extremely low rates are difficult to interpret, especially given that the average completed suicide rate for adolescents in the U.S. is the same as the suicide attempt rate in Mexico (4%) [7].

In one of the only cross-cultural comparison studies, WHO mortality data were combined with data released by the 29 OECD countries (Organization for Economic Cooperation and Development) by a research group from Seoul Korea [7]. And, multi-dimensional scaling was used to compare those countries on completing suicide rates. Significant differences were noted across countries in the completed suicide rates of 10-19-year-old youth [7]. The rate of completed suicide (per 100,000) was

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highest in New Zealand (9%) and significantly lower in the US (4%), and the lowest rate was reported in Portugal (1%) [7]. The markedly different rates across countries, with the New Zealand rate being more than twice the U.S. rate and the U.S rate being 4 times the rate for Portugal, may relate to the different types of data collection in the different countries. Cross-country comparisons also need to be made in the context of potentially confounding demographic variables, including gender and age-range that appeared to vary across these studies.

Demographic risk factors/predictors

Gender and age have been the most frequently reported demographic risk factors/predictors of adolescent suicide ideation and attempts. These risk factors have been assessed in many large sample studies and have been consistently predicted. Universal risk factors for suicide were late adolescence and male gender, for example, in the large WHO-OECD sample already discussed [7].

Gender differences

In the sample of44 studies included in this narrative review on adolescent suicide, gender differences were noted in virtually all of the studies. Typically, the rates of suicide ideation and attempts have been greater for female adolescents, and the rates for completed suicides have been greater for male adolescents. In the world-wide OECD sample, for example, the male rates for completed suicides across countries were two–three times higher than those for females and were significantly higher for older adolescents, i.e. the 15–19-year–old group had more completed suicides than the 10–14-year-old-group [7]. Across time, a decrease was noted in male suicide rates, reputedly because of the reduction in firearms as well as improved mental health over the years of the data collection. In contrast, a significant increase in suicide rates has been noted in Germany, but for females, not males [8]. The increase was noted for gassing/self-intoxication which was greater for females (500%) versus males (164%). The frequency of gassing suicides, in turn, was associated with internet searches for "carbon monoxide poisoning" for both females and males and independent of age.

As already noted, the rates of ideation and attempts are typically greater for females versus males. Schools with a greater number of girls and greater levels of victimization have also had higher rates of suicidal ideation [2]. These data were not surprising given that the prevalence of victimization is greater among female adolescents, and victimization has been related to suicidal ideation [9]. Females have also had higher rates of repeated self-harm which is a prevalent risk factor for suicide attempts.The rate of repeated self-harm was greater for females than males, for example, in the National Death Index [10].

Other risk factors have also differed by gender. For example, in a study from Korea, suicide rates for male adolescents (15-19 years) were positively correlated with depressed mood, suicide ideation, suicide attempts, drinking and smoking and were negatively correlated with self-perceived healthiness, obesity and being physically active [11]. For females, the suicide rates were positively correlated with being sexually active and negatively correlated with obesity.

Even higher rates of suicide ideation and attempts have been reported for lesbian, gay and bisexual (LGB) youths in a large UK sample (N=3,275) [12]. In this retrospective study called Youth Chances Project, 45% had suicidal ideation during the past year, 14% had made suicide attempts (lifetime) and 10% said that future suicide attempts were more likely. The LGB discrimination experiences that were associated with all three aspects of suicidality included school stigma factors. Examples of these were lessons being negative about sexual minorities, other LGB–related harassment and negative reactions to "coming out" from friends and family. Other factors included "not feeling accepted where one lives", and younger sexual minority identification. Non-LGB risk factors included female gender, anxiety/depression help–seeking, sexual abuse and less social support. Although this study is retrospective so that causal relationships cannot be determined, the extremely high incidence of suicide ideation highlights the need for interventions targeting the specific risk factors of LGB youth.

Age-range differences

The variability of suicide ideation by different age ranges is illustrated by studies from the UK and Canada.In a large UK sample (4772 members of the Avon Longitudinal Study of Parents and Children), adolescents were assessed via self-report [13]. Despite this being a longitudinal study, only cross-sectional data are given for the adolescents at 16 years-old. For this one year of adolescence, 10% experienced suicidal

ideation while 7% attempted suicide. A greater prevalence was noted for both ideation and attempts in a Canadian sample (The National Survey of Children and Youth), probably because it included a wider age range [14]. In this national survey study that compared different age groups, over 70% of the adolescents with suicidal thoughts and attempts were between 11 and 16 years of age and the other 30% were between 11 and 13 years of age. The prevalence given to adolescents was, not surprisingly higher in this study because it sampled a wider age range than, for example, the previously described UK study that reported data exclusively on 16-year-old adolescents [13].

Thus, the demographic risk factors of gender and age have been highlighted in many studies. The mixed effects across studies may relate to variability on the measures that were used for screening for those risk factors. Unfortunately, many of the demographic risk studies, despite sampling large numbers of adolescents, were focused almost exclusively on prevalence rates rather than the potential underlying mechanisms for the gender and age differences. Other risk factors/predictor variables, including psychological and behavior risk factors/predictors are summarized in the next section.

PSYCHOLOGICAL AND BEHAVIOR RISK FACTORS/PREDICTORS

Psychological/psychiatric risk factors have been the primary focus of the largest number of the 44 studies on adolescent suicide ideation and attempts included in this review (9 studies), followed by self-harm as a risk factor (7), social media (6), addictions (5), lifetime history (3), family history (3), suicide exposure (3), peer harassment (3), perceived burdensomeness (3), and child maltreatment (2). Single studies have focused on school absenteeism, school performance, and hopelessness. This section is accordingly divided into six sub-sections including: 1) Lifetime suicide history, family history of suicide, and exposure to suicide; 2) Self-harm as a risk factor; 3) Related psychological/psychiatric problems; 4) Addictive behaviors; 5) Personality variables; and 6) School-related risk factors (see table 2 for a listing of these risk factors/predictors) (Table 2).

Lifetime suicide history

Among the frequent predictors of suicide are previous attempts, family history of suicide, and exposure to others' suicide. These exposure-to-suicide variables are grouped together in this section.

Lifetime history of at least one prior suicide attempt has been common in some samples. For example, 14% of an Australian sample of 1143 youths had prior suicide attempts that were associated with suicide thoughts and self-harm [15]. Recurrent attempts were associated with being older and with comorbid alcohol/substance use. And, recurrent attempts were predictive of worse clinical outcomes for the young people who were receiving mental health services in that sample. The severity of clinical symptoms has also notably increased with the number of attempts in a sample from Spain (Villar, Castellano-Tejedor, Verge, Sanchez, & Blasco-Blasco, 2018). Another research group reported a much higher rate of lifetime suicide attempts (30%) for adolescents (10-17-years) based on a Utah Department of Health database [16]. However, this rate was a combination of rates in the history of both ideation and attempts.

Table 2: Risk factors/predictors.	
Risk factors/predictorsFirst author	
Lifetime suicide history	Iorfino, Annor
Family history	Sandoval, Lee
Exposure to peer suicide in school	Gould, Cha
Exposure to suicide on the media	Chen, Gould
Intent	Peters
Self-harm	Milner, Olfson, Beckman, Sheperd
Depression and anxiety	Acka, Paik
ADHD	Giupponi
Smoking and drinking	Subica, Park
Excessive media use	Rostad, Paul, Poonai
Perceived burdensomeness	Hains, Eaddy, Horton
Hopelessness	Wolfe
Non self-disclosure	Levi-Belz
School absenteeism	Amare
School performance	Orozco
Peer harassment	Mitchell, Sandoval, Ato, Brailovshaia

Family history of suicide

Having a family history of suicide has contributed to a greater risk of suicide in a school sample in northern Peru [17]. In this sample of 289 youth, 20% were at risk for suicide. In Taiwan's death registry, children who experienced maternal suicide, paternal suicide or the suicide of both parents, were four times

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more likely to die by suicide [18]. This risk was significantly higher in older female offspring versus older male offspring. Of course, both genetic and environmental factors may contribute to family history of suicide being a risk factor for adolescent suicide. Genetic research would be difficult given that suicides are retrospective data. However, genetic and environmental influences could at least be assessed in samples featuring intergenerational suicide ideation and attempts.

Exposure to peer suicide

Significant effects have been reported for both seeing a peer's suicide in person and seeing peer suicides on social media, although comparisons have not been made between observing a peer suicide and seeing one on social media. In a study in New York City, 2865 students at six schools where a student had died were compared to 2419 students at six schools were no suicide had occurred [19]. The students who were friends, but not close friends, of the suicide student had the greatest risk for serious suicide ideation/behavior. Further, the students in the exposed schools generally had more positive attitudes toward help-seeking. The help-seeking in the exposed schools might be expected, but it's not clear why friends, but not close friends, had the greatest risk for serious suicide ideation/behavior. A possible interpretation is that close friends were more familiar with the psychological problems of the suicide peer, had tried to intervene unsuccessfully and sought help for themselves. The non-close friends may have experienced untreated post-traumatic stress symptoms. For example, in a Korean school that featured a student suicide, 9% of the students showed post-traumatic stress symptoms after the incident [20].

Exposure to suicide through social networks has led to suicide contagion in at least one study on Turkish students (N=2035) [21]. Exposure to the suicidal behavior of the media in that sample was associated with an increased risk of suicide attempts, especially among girls. Media exposure has also had positive effects inasmuch as one sample who was exposed to suicide on social media had more positive mental health/suicide prevention benefits [22]. These mixed data are not surprising given that suicide exposure can be contagious as well as therapeutic, as has been noted in the therapy-seeking behavior by exposing adolescents described earlier [19]. Future studies might explore the individual differences between adolescents who are at greater risk for suicide ideation/attempts by contagion and those who experience positive mental health/prevention benefits.

Self-harm behavior as a risk factor

Self-harm behavior, sometimes referred to as non-suicidal self-injury, has been a significant risk factor for suicide in adolescents [23]. In this study, self-harm episodes frequently preceded suicide attempts, serving as warning signals for suicidal behavior. In turn, predictors of self-harm have been studied in an attempt to understand risk factors for suicidal behavior.

In the Millner et al., [23] prospective study, suicidal behaviors were assessed upon admission to psychiatric inpatient units, upon discharge and 3 months later. Suicide attempters compared to non-suicidal controls reported a greater incidence of self-harm. In data from the National Death Index (Medicaid Analytical Extract data from 45 states in the U.S.), the 12-month mortality rate after self-harm was significantly higher for adolescents than for young adults [10]. The risks of repeated self-harm were greater for patients with personality disorder and those who had used violent self-harm methods.

Types of self-harm have also been compared to determine whether some methods were associated with a greater risk of suicide. In a Swedish national, population-based cohort study on 10-24-year-olds, for example, violent methods (gassing, hanging, strangulation/suffocation, drowning, jumping and firearms) were more predictive of future suicide, especially in the adolescents versus the younger adults [24].

Earlier-in-life predictors, in turn, have been related to self-harm, including childhood traumatic experiences and emotion regulation deficits. In an Australian sample from a youth detention center (N=215), one third of the sample reported previous self-harm and 12% reported having made at least one suicide attempt [25]. These authors also reported an association between childhood traumatic experiences and suicidal behavior. In an Italian sample, 306 students were given the Childhood Experience of Parent Abuse Questionnaire as well as the Depressive Experiences Questionnaire and the Suicide History Self-Rating Screening (Falgares et al, 2018). Their results indicated that lack of care and psychological abuse were significantly associated with suicide risk, and this association was partially mediated by self–harm.

Emotion regulation deficits have also been assessed along with self-harm (self-injury) and suicide ideation in 367 community adolescents at two times 6 months apart [26]. After controlling for baseline suicide ideation, emotion regulation deficits predicted suicide ideation at the 6-month follow-up. Self-harm was a moderator variable that strengthened that relationship.

Psychological/psychiatric problems as risk factors

Several psychological/psychiatric problems have been noted as risk factors for suicide in this recent literature. These include depression, anxiety, post traumatic stress disorder, bipolar disorder and Attention Deficit Hyperactivity Disorder (ADHD). In a study on 348 adolescents, significant relationships were noted between suicide risk as assessed by the Suicide Probability Scale and depression as well as anxiety [27]. Other risk factors that emerged in this study included education, psychiatric treatment, self–harm, and smoking and drinking. This relationship was limited to youth self–reported, not parent–reported symptoms.

In a review of the literature on ADHD and suicide, several researchers have reported a correlation between ADHD and suicide ideation and attempts [28]. However, the results of these studies were difficult to compare as they featured different designs and samples and some of the authors suggested that the association between ADHD and suicidal behavior depended on pre-existing comorbid conditions.

Data from the Korean National Statistical Office were used to assess the relationship between psychiatric disorders and suicide death rates among South Korean adolescents (less than 18 years old) post discharge from psychiatric units [29]. The rank order of psychiatric problems from the highest to lowest incidence was psychosis, depression, conduct disorder, bipolar disorder, posttraumatic stress disorder, anxiety disorder and ADHD. These data highlight the need for suicide screening and post discharge interventions for children and adolescents with psychiatric problems.

Addictive behaviors as risk factors

Addictive behaviors that have been noted as risk factors for suicide ideation and attempts include drinking, smoking and addiction to social media. Surprisingly, illicit drug use was not a prevalent risk factor in this recent literature on suicide behavior in adolescents.

Smoking and drinking have been notable risk factors in studies from the U.S. and South Korea. In the U.S. study, alcohol and cigarette use were independently associated with two times the risk for attempted suicide among U.S. native Hawaiian, Pacific Islander, American Indian/Alaskan native, multiracial and non-Hispanic white adolescents [3]. In this sample,non-Hispanic whites had a greater illicit substance use, for example, marijuana and heroin along with excessive alcohol and cigarette use. Smoking and drinking have also been notable risk factors for suicide among South Korean adolescents [11]. However, significant correlations between suicide rates and smoking and drinking were only noted for male adolescents in this sample. It is not clear in either of these studies whether excessive drinking was occurring immediately prior to suicide behavior/attempts.

Excessive media use is also an addictive behavior/ risk factor for suicide in adolescents. This relates not only to the general use of the media, but also to the specific exposure to others' suicidal thoughts and methods via social media. In One study based on data from the Youth Risk Behavior Survey, excessive media use, defined as 5 or more hours per school day (television and computer/video game use), was associated with suicide risk in U.S. high school students (N=15,624) [30]. Prevalence ratios were generated by logistic regressions that were controlled for demographic and substance use variables. While suicide risk and media exposure were the focus of this research, suicide risk was also associated with bullying for both males and females. In contrast, victimization was only associated with suicide risk for males. That was a surprising finding given that victimization is more often experienced by females [31]. These associations may have increased since this 2015 survey, as the incidence of internet addiction in adolescents has increased since then [9]. Although Rostad et al suggested that "limiting adolescent media use, as part of comprehensive prevention programming, might relate to reductions in risk for victimization and suicide", data have been mixed on prevention and intervention programs for both adolescent internet addictions [9] and adolescent cyberbullying [31].

Social media have also been used by suicidal adolescents to obtain information on methods of suicide. For example, data from the Federal Statistics Office of Germany were used to

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explore trends in death by suicide [8]. Regression analyses indicated significant increases in the suicide rate for females. As already mentioned, the largest increase was noted for gassing which was associated with Internet searches for carbon monoxide poisoning, and the increase in gassing suicides was greater for females than males (500% vs. 164%). Although this suggests a strong influence of social media, another study revealed that exposure to a suicide YouTube video did not affect the increasing rate of emergency department visits for suicide attempts by children and adolescents (age 11-17 years) [32]. Despite these mixed data, machine classifiers are being designed to classify texts relating to suicide on Twitter [33]. Using lexical, structural, emotive and psychological features extracted from Twitter posts, classifiers have identified suicide ideation including flippant references to suicide. This may be an important development for identifying those at risk and for intervention programs given that Twitter posts and other social media posts are a popular form of communication for adolescents.

Despite the growing evidence of addictive behaviors and typical multiple addictive behaviors in adolescents, they are often well-concealed risk factors given a lesser propensity for adolescents to self-report addictive behaviors, for example drinking and internet addiction [9]. Some research has focused on other personality variables that may be more frequently self-reported.

Personality variables as risk factors

Personality variables that have been associated with suicidal behaviors include perceived burdensomeness, thwarted belongingness, hopelessness and non-disclosure. The Interpersonal Theory of Suicidehas provided a model for these constructs. In this model, the simultaneous presence of thwarted belongingness and perceived burdensomeness (and hopelessness about these states) combined with capability for suicide are key constructs [34]. In a test of this model on 226 Australian youth (age 12-24) who were receiving psychological treatment for suicide related behaviors, the relationships between change scores on depression, hopelessness and suicide risk were mediated by changes in perceived burdensomeness but not thwarted belongingness [35]. Most of this sample was young adolescents who might not perceive that they were "not belonging" as they were living at home and had friends at school. On the other hand, it is not clear why they perceived burdensomeness, as most adolescents are expected to be dependent on their parents, although they might sense that the adolescent stage is a burden on their parents. This construct (perceived burdensomeness), as already mentioned, mediated the relationship between emotional dysregulation and suicide risk in a different sample of 151 adolescents (aged 12-17) hospitalized on an inpatient psychiatry unit [36].

Hopelessness has also been positively related to suicide ideation, especially in adolescent girls [37]. In this sample of 158 depressed adolescents who were being given antidepressants, hopelessness was positively related to suicide ideation over the course of the treatment period independent of depression severity decreasing.

Self-disclosure is another personality variable that has been assessed in adolescents who have made a suicide attempt without disclosing it to parents or other significant others versus adolescents who made suicide attempts that were communicated to others [38]. The suicide attempters who were non-disclosing had more intense suicide ideation, distress and victimization. Given the connectedness of adolescents as peers, it is surprising that non-disclosures did not disclose to peers. It is also surprising that adolescents who had made suicide attempts without disclosing them to anyone later acknowledged having made suicide attempts to a research group for the purposes of a study. Perhaps the intensity of the suicidal ideation had decreased by the time of the study making it easier to participate in the study and/or the non-disclosures may have experienced some remorse for not having disclosed and later agreed to participate in research that might help reduce non-disclosure.

School-related risk factors

School-related risk factors for suicide ideation and attempts have included absenteeism, inferior academic performance, peer harassment, bullying and cyberbullying. Social support for teachers has decreased the risk of suicide behaviors. In a study from Danglia Town, Ethiopia, for example, school absenteeism and poor social support were positively correlated with suicidal ideation, and poor social support and being physically hurt were associated with suicide attempts [5]. Unlike other studies on adolescent suicide in low income countries, no associations

were found between gender or alcohol use and suicide thoughts or attempts in this Ethiopian study.

School performance was a significant factor in the Mexican National Survey of Students' Drug Use database on 28,519 middle and high school students [6]. Following multiple regression analyses that controlled for sociodemographic and school characteristics, the academic performance indicators for suicide attempts in middle school students included a higher number of failed courses, not being in school the year before and having worse self-perceived performance. Indicators for the older high school students were self-perceived performance and failed courses. Directionality is difficult to determine in these studies, as many risk factors for suicide ideation/attempts, for example, failed courses could also be considered the effects of suicide ideation/attempts.

Peer harassment/bullying/cyberbullying has been a significant risk factor for suicide ideation in adolescents. In one study on 791 youth in the United States, peer harassment/ victimization had occurred in 66% of youth with suicide ideation [39]. Those youth who reported both in–person harassment as well as harassment via technology were eight times more likely to report suicide ideation in the past month compared to those who had not experienced peer harassment during the past year. In a study of 289 students in northern Peru, 20% were at suicide risk and had some type of depression [17]. Of those in the upper tertile on the bullying scale, 38% had suicidal ideation. The frequency of suicide risk was not only related to the bullying score but also for being depressed, having a family history of suicide, having the "passive desire to die", having planned suicide at some point and studying in a private school. In another study on 225 students, cyberbullying was related to suicidal ideation/behavior [40]. Positive mental health, defined as high levels of emotional, cognitive and psychological well-being, was noted to buffer the association between cyberbullying and suicide ideation/behavior in that sample.

The samples of these bullying/cyberbullying studies were primarily victims, and victims, according to cyberbullying research, are frequently prone to suicide behavior [31]. Being victimized not only relates to peer harassment but also to psychopathology, including depression, anxiety and post traumatic stress [31]. Again, risk factors for suicide such as

cyberbullying may also be considered as the effects of suicidal behavior and related psychopathology. The direction of effects in these studies is difficult to determine given the cross-sectional and retrospective nature of the data and the questionable reliability of self-reports about the timing of events like cyberbullying. Nonetheless, peer harassment in any form has been highly predictive of suicide behavior [31]. Longitudinal multivariate studies and more complex forms of data analyses such as structural equations or profile analysis are needed to determine the directionality and relative significance of these variables.

INTERVENTIONS FOR PREVENTION OF SUICIDE

Despite the prevalence of suicide among adolescents and the many risk factors for suicide ideation/attempts, very few protective factors and intervention/prevention studies could be found in the recent literature (see table 3 for a listing of the different intervention models). A notable natural intervention is support of teachers and other school adults [41]. In this study, the risk factors for suicide were being born outside the United States and not having enough to eat. However, the odds of suicide attempts were decreased by approximately one third when students had positive relationships with school adults. Another protective factor was post-high school education plans. These two factors, i.e. closeness to school adults and having plans for further education, are likely related and highlight the importance of educational counseling in high school. The authors of this study suggested that school breakfasts should be provided to reduce the hunger problem (Table 3).

Table 3: Interventions.	
Interventions	**First Author**
Support by school adults	Hall
Restriction of access	Sueki, Roh
Psychiatric services	Sueki, Roh
Peer-led programs	Pisani
Gate keeper training	Mo
Dialectical Behavior Therapy	McCauley

Preferred suicide prevention strategies have been studied in Japan, where the participants were given questionnaires on their preferred strategies [42]. The profile conjoint analysis yielded preferences for two out of six prevention strategies, including restriction of access to the means and enhancement of

psychiatric services. Lower suicide rates have been reported in countries where adolescents have less access to firearms, for example, in Portugal versus the U.S. [7]. However, no cross-cultural comparisons could be found in the provision of psychiatric services.

Peer-led programs like those that have been effective for cyberbullying have also been effective for suicide prevention [31]. An example is a peer-led school suicide prevention program in the U.S. that focused on rural adolescents [43]. In this program called Text4Strength, 42 ninth grade students received 28 interactive message sequences over the course of nine weeks. The categories of the text messages included sources of strength, friends, mentors, family support, healthy activities, generosity, spirituality, medical access and emotion regulation strategies. The messages were conveyed via games, requests for advice, questions about students' own experiences, and the sequences also included peer testimonial videos. Spirituality and generosity were the only content areas that did not elicit student replies. Surprisingly few students watched the videos, but 90% of the participants agreed that the program should be repeated. That high percent was not expected given that only 52% of the students responded to more than a third of the text messages.

After a school-based crisis intervention program (including screening tests, educational sessions and psychiatric interviews) the post-traumatic stress symptom rate of 9% was reduced to 3% [20]. This 66% reduction in post-traumatic stress symptoms would make this intervention one of the more effective school-based programs, although, as in many intervention programs, the effects of the different components are not clear. In a review of the literature on school-based gatekeeper training programs, only 14 studies could be included in the systematic review [44]. The authors noted that although most of the studies showed improvement on gatekeepers'knowledge, attitudes, self-efficacy, skills and likelihood to intervene, most of the studies also had methodological limitations [20].

The only psychotherapy study that could be found in this recent literature on adolescent suicide was a randomized clinical trial of Dialectical Behavior Therapy for adolescents at high risk for suicide [45]. In this trial, a Dialectical Behavior Therapy (DBT) group was compared to combined individual and group supportive therapy group. Both groups of high-risk adolescents

met weekly for 6 months. Dialectical behavior therapy was noted to lead to more significant decreases in suicide attempts, non-suicidal self-injury and self-harm. And treatment completion rates were greater for the DBT group (76% versus 55%). Although the sample size was reasonable for this study (N=173), the age range of the participants was wide (12 to 18 years) and the sample was diverse on suicide attempts defined as more than three prior self-harm episodes, suicide ideation or emotional dysregulation.

These studies may reflect a limited sample of intervention/prevention programs as most intervention programs do not have research protocols because of the additional significant costs involved. It is also possible that many have not been published because of confounding treatment variables. Even in those published intervention studies, the nature of the intervention, for example, combining individual and group support [45] results in the question of which treatment component is the most effective. And, variables like school adult support [41] have been vaguely defined or not operationalized in such a way that replication studies could be conducted. Further, while it would seem that programs like the peer-led text messaging program may be more cost-effective than a DBTprogram, both have been effective and would be worth comparing in a carefully matched sample for their reduction in suicide ideation and attempts.

THEORETICAL MODELS FOR SUICIDE IDEATION/BEHAVIOR

Only a few papers could be found in the recent literature on theoretical models for adolescent suicide (see table 4 for a listing of the theoretical models described here). In one of the papers, the interactive model of pain and hopelessness accounted for a significant portion of the variance in suicide ideation [46]. This was true for males and females as well as for all age groups. Connectedness was a protective factor in this sample, but suicide capability predicted suicide attempt history more than current and lifetime suicide ideation (Table 4).

Table 4: Theoretical models.	
Pain & hopelessness	Dhingra
Psychache	Montemarano
Interpersonal Theory of Suicide	Hains, Eaddy, VanOrden

The theory of "psychache" has also been advanced as a cause of suicide. In this theory, psychache or intense mental pain/anguish (psychological and emotional pain that reaches an intolerable intensity) is the most significant predictor of suicide ideation. Other psychological variables, including depression and hopelessness are thought to relate to suicide, but only through psychache [47]. This theory was tested as a cause of suicide in one of the only longitudinal studies in this recent literature [48]. In this longitudinal study of 82 students, only baseline psychache predicted suicide ideation. Further, only psychache, not depression or hopelessness, predicted 4-year change in suicide ideation.

The most complex theory on suicide was developed in studies on adults [49] and was originally labeled the Interpersonal Psychological Theory of Suicide. In this theory, individuals are thought to die by suicide, only if they have both the desire to die and the capability to die as elaborated by Joiner's research group [34]. Suicide ideation or the desire to die is thought to derive from two psychological states called thwarted belongingness and perceived burdensomeness. If the individual feels hopeless about these states, the hopelessness may result in suicide ideation. It is then necessary to have the capability for suicide, which is characterized by fearlessness about death and by physical pain tolerance which results from repeated exposure to physical pain and/or fear. These are considered traits in this model. The combination of the suicide states and traits could then result in lethal or near lethal suicide attempts [34]. Joiner and his colleagues have recommended that interventions target the state like thwarted belongingness and perceived burdensomeness because they are considered more amenable to change than the fearlessness and high pain threshold traits involved in the capability for suicide [34].

This theory, now called Interpersonal Theory of Suicide, has been tested recently on clinical samples of adolescents by two groups, one in the U.S. [36,] and one in Australia [35]. In the first of the two US studies, this theory was assessed in a sample of 147 adolescents (12-17 years, 76% girls) on an inpatient psychiatric unit. Several questionnaires were administered including the Interpersonal Needs Questionnaire that taps thwarted belongingness and perceived burdensomeness [50], the Acquired Capability for Suicide Scale – Fearlessness About Death [51], an item on the severity of suicide ideation in the past week, the Quick Inventory of Depressive Symptomatology – Adolescent Version Self – report [52] and the Hopelessness Scale For Children (Kazdin et al, 1986). Hierarchical logistic regressions and mediation analyses revealed main effects for each of the constructs in the theory (except for a marginal effect for thwarted belongingness) and interaction effects for thwarted belongingness by perceived burdensomeness by acquired capability in association with suicide symptom severity. In an attempt to explain the greater relationship of suicide ideation to perceived burdensomeness versus thwarted belongingness, the authors raised the possibility that the self-hate aspect of perceived burdensomeness might be related to being rejected by typical peers to then joining deviant peers resulting in low academic performance that ultimately leads to perceived burdensomeness. This study, while controlling for gender, age, depression and hopelessness, did not include a pain tolerance measure which is one of the "capability for suicide" measures. And, other potential confounding variables such as childhood abuse and exposure to suicide were not assessed. In addition, the majority of the sample was female and included both adolescents who frequently thought about suicide and those who had planned suicide. Multiple measures of suicide such as the number of suicide attempts might strengthen the outcome measure. Item analysis and qualitative interviewing might further inform the literature on adolescents' thwarted belongingness and perceived burdensomeness.

In a subsequent study, the same research group explored the relationships between the variables in their original study and how they relate to emotion dysregulation in a slightly larger sample of adolescents (N=151) [36]. Once again, perceived burdensomeness was a significant measure. In this analysis, the relationship between emotion dysregulation and suicide risk was explained not only by perceived burdensomeness but also by a capability for suicide. Again, ideation was tapped rather than a history of attempts. In addition, the generalizability was limited by the sample being primarily Caucasian girls who were hospitalized.

Perceived burdensomeness was also a significant predictor variable in an Australian study on short-term Cognitive Behavior Therapy with students (N=226 students, 68% female, 56% history of suicide ideation) [35]. In this study, a semi-structured clinical interview was used to assess suicide risk which

may be more reliable than a single question on suicide that was used in the U.S. studies just described [36]. In a mediation analysis, there was no evidence that thwarted belongingness directly influenced the therapy-related change in suicide risk, but perceived burdensomeness had a significant direct effect on that change. These authors, like the authors of the U.S. studies, seemed to have difficulty interpreting this finding which is not surprising given that adolescents may be thought to have more difficulty with belongingness than burdensomeness. For an interpretation, they quoted Chu et al., [53] who suggested that perceived burdensomeness may be a more important contributor to suicidal behavior, but thwarted belongingness may play a greater role in the capability for suicide. This interpretation was based on their multivariate results showing that the interaction between capability for suicide and thwarted belongingness was stronger than the interaction between capability and perceived burdensomeness [53].

It would seem that the perceived burdensomeness and suicide risk relationship has been reportedly stronger than the thwarted belongingness relationship in at least these three studies. Conducting an item analysis on the scale that measures perceived burdensomeness and thwarted belongingness may be important, especially since these are considered important foci for intervention programs. An item on the perceived burdensomeness subscale may be explaining the variance in suicide risk. The subscales of the Interpersonal Needs Questionnaire that were used in this study may also be problematic insofar as the burdensomeness subscale contains six of the 15 items that are all negatively phrased whereas the belongingness subscale that features nine of the items has only three of nine being negative while six of the nine items that are positive are reverse scored. In a recent factor analysis of the five different versions of the Interpersonal Needs Questionnaire, the versions that contain 10 and 15 items had the best, most consistent model fit in confirmatory factor analysis [54]. However, both burdensomeness and belongingness consistently predicted concurrent suicidal ideation only on the 10–item scale. And, although the 10-item scale was balanced in terms of having five items for burdensomeness and five items for belongingness, still 3 of the 5 items on belongingness were negative [54]. These results that were derived from two university student and one adolescent

inpatient psychiatric sample suggest that future studies use the 10 item rather than the 15 item questionnaire.

The generalizability of these studies is limited by being clinical samples. Adolescents in a clinical sample have sought help which may "suggest some ambivalence about dying" [35]. Secondly, the samples were predominantly females who are less likely than males to die by suicide and more likely to seek treatment. Another limitation of the therapy study is the lack of details on the Cognitive Behavior Therapy protocol [35].

Surprisingly, physiological/biochemical models have not been explored in this recent literature. As in the social pain research literature [55], physiological and biochemical markers for psychache and hopelessness could be assessed. Those individuals who have psychache, for example, may have higher cortisol and lower serotonin levels as well as lower vagal activity than those who are simply depressed with no suicidal ideation. Profiles that included both self-report and physiological/biochemical measures would likely be more predictive than self-report alone.

LIMITATIONS AND FUTURE DIRECTIONS

Several limitations can be noted in this recent literature. While the samples for most of the studies seemed adequate, the data sets were limited to very few variables and sometimes focused on only one variable. Given the sample sizes, it is surprising that so few variables were assessed. Multivariate models that could be tested by structural equations, moderating/mediating, profile or multiple regression analyses would seemingly yield more information on profiles of adolescents at risk for suicide. Studies from an older literature typically featured multivariate models including, for example, a study that showed that family relationships, loneliness, anger, depression and substance abuse were related to suicidal ideation [56]. And, in another older study, adolescents who reported suicide ideation differed from those who did not on a number of variables, including family relationships, family history of depression, peer relations, emotional well-being, drug use and grade-point average [57]. A stepwise regression on these data indicated that unhappiness explained 46% of the variance in suicidal ideation and number of friends, anger, and marijuana use explained an additional 20% for a total of 66% of the variance. Although 34% of the variance remained unexplained, these multivariate data suggest that at least these four factors should be included in a screening for suicide ideation. These studies combine to suggest

that family relationships, peer relationships, loneliness and unhappiness are contributing to suicidal ideation. Surprisingly, these variables have not been included in studies in the recent literature. Recent research has instead focused on the prevalence of suicide ideation and risk factors that haven't included relationships or loneliness. Related relationship variables like heartbreak and break up distress which are reportedly the most common presenting problem at student counseling centers have also been missing from this literature [55]. And, somatic symptoms that accompany this distress, for example, sleep disturbances would also be informative.

Other problems include the almost exclusive use of self-report measures that have questionable anonymity given that most were taken at school. The students may have been under-reporting or "faking good" to avoid embarrassment or shame related to their suicide ideation/attempts. Thus the data would have questionable generalizability. In addition, several of the self–report variables for suicidal ideation/attempts and the risk factors and personality variables were rarely measured by psychometrically sound instruments. The surveys/questionnaires were likely made short and simple in the interests of student compliance. Further, the direction of effects is questionable given that many of the risk factors for suicide ideation could be considered the effects of suicidal ideation. For example, suicide ideation could lead to inferior school performance as much as inferior school performance could be considered a risk factor for suicide ideation.

Longitudinal multivariate studies are needed to provide a more comprehensive profile of adolescents at risk for suicidal behavior. These might include parent, teacher, sibling and peer assessments as well as in-depth interviews of those adolescents who have reported suicidal ideation/attempts. Most of the studies have been cross–sectional instead of longitudinal, limiting any inferences about causality.

Several of the studies have grouped all levels of suicide behavior together as an outcome variable rather than categorizing different levels of suicidal behavior, i.e. non-suicidal self–injury, suicide ideation, suicide plans, suicide attempts and completed suicide. Some have given specific rates for suicidal thoughts, suicide planning and attempted suicide, for example, 19% for thoughts, 15% of plans, and 8% of attempts in the Subica and Wu [3] study. Others have

spoken to a specific trajectory and classified adolescents as non-ideators, as high ideators (4%), as high-fluctuating ideators (8%) and as high-decreasing ideators (4%) [4]. In their database, being ideators was not a predictor of suicide attempts for African-Americans, whereas in the Asian American group being a high – fluctuating ideator was a significant predictor of suicide attempts, and in the European American group, being any type ideator predicted suicide attempts. The authors further suggested that the timing of onset, the patterns of change and the peak time in the trajectories of these different ethnic groups were markedly different, highlighting the need for more specific classification of the different levels of suicidal behavior and the relative risk factors.

Surprisingly, very few studies published in 2018 explored the relationship between suicide ideation/intent and suicide attempts in adolescents. It is not clear whether that relationship had been explored in a large literature that predates 2018 or whether the risk of ideation for attempts is difficult to study except of course retrospectively. And, those who have made attempts may not be willing to participate in research on that question and/or their parents might not be willing to provide consent for those adolescents given potential harm that might result from re-exposure to depressing experiences. Hospitalized samples would be more accessible for studies of this kind. Not surprisingly, in a sample of 103 adolescents hospitalized for a suicide attempt or significant suicidal ideation, intensity of suicide intent was associated with suicide attempts as well as with non-suicidal self-injury [58]. These data highlight the importance of suicide intent intensity as a predictor of suicide attempts.

Given the prevalence and severity of suicide ideation and attempts, it is surprising that very few intervention studies appeared in this recent literature. The importance of further intervention research is highlighted by the seriousness and prevalence of suicide ideation and suicide behavior in adolescents and the statistic that suicide is the second most frequent cause of death in adolescents [1]. It would appear from this limited literature that school-based and peer-led interventions have been the most effective in preventing suicide ideation and behavior in adolescents [59]. Although this literature has a number of limitations, it has highlighted the importance of continuing theoretical and empirical research on

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suicide ideation and attempts in adolescents as well as interventions to prevent suicide ideation and attempts in adolescents.

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