Suicidal ideation and suicide attempts in children and adolescents with bipolar disorder: a systematic review of prevalence and incidence rates, risk factors, and targeted interventions

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Abstract

Objective—Pediatric bipolar disorder (PBD) is associated with poor outcomes, including suicidal ideation (SI) and suicide attempt (SA). However, frequencies and risk factors of SI/SA and targeted intervention trials for SI/SA in PBD have not been reviewed systematically.

Methods—We conducted a systematic PubMed review, searching for articles reporting on prevalences/incidences, correlates and intervention studies targeting SI/SA in PBD. Weighted means were calculated, followed by an exploratory meta-regression of SI and SA correlates.

Results—Fourteen studies (n = 1,595) with 52.1% males aged 14.4 years reported data on SI/SA prevalence (N = 13, n = 1,508) and/or correlates (N = 10, n = 1,348) in PBD. Weighted mean prevalences were: past SI = 57.4%, past SA = 21.3%, current SI = 50.4%, and current SA = 25.5%; incidences (mean: 42 months follow-up were: SI = 14.6% and SA = 14.7%. Regarding significant correlates, SI (N = 3) was associated with a higher percentage of Caucasian race, narrow (as opposed to broad) PBD phenotype, younger age, and *higher quality of life than SA.* Significant correlates of SA (N = 10) included female gender, older age, earlier illness onset, more severe/episodic PBD, mixed episodes, comorbid disorders, past self-injurious behavior/SI/SA, physical/sexual abuse, parental depression, family history of suicidality, and poor family functioning. Race, socioeconomic status, living situation, and life events were not clearly associated with SA. In a meta-regression analysis, bipolar I disorder and comorbid attention-deficit hyperactivity disorder were significantly associated with SA. Only one open label study targeting the reduction of SI/SA in PBD was identified.

Conclusions—SI and SA are highly common but under-investigated in PBD. Exploration of predictors and protective factors is imperative for the establishment of effective preventive and intervention strategies, which are urgently needed.

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Keywords

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According to the National Institute of Mental Health, in 2010, suicide was the fourth and third leading cause of death for youth aged 5–14 and 15–24 years, respectively (3). However, completed suicide was fortunately less common in children and adolescents than in adults: the one-year incidence rates for suicide ranged from 0.03/100,000 (5–9 years old children), 1.29/100,000 (10–14 years old youth), and 7.53/100,000 (15–19 years old youth) to between 13.92/100,000 (20–29 years old) and16.69/100,000 (40–49 years old) in adults (4). In contrast to completed suicide, suicidal ideation (SI) and suicide attempt (SA) are relatively common in youth. In the general population, as many as 19% of teenagers aged 15–19 years reported SI and 8.8% reported at least one SA within a 12-month period (5). In comparison, reported lifetime rates were 12.1% for SI and 4.1% for SA in 13–18 year old youth (6). The marked contrast between these relatively high incidence and prevalence rates of SI/SA compared to fortunately relatively low completed suicide rates of about one in 10,000 youth with bipolar disorder (BD) (4) suggest that ideation, attempt, and completed suicide may be different phenomena that could be associated with different risk factors and correlates. However, as 33.9% of adolescents with SI go on to make a SA (6), and as past SI and SA are strongly correlated not only with a consecutive suicide attempt (7,8), but also with completed suicide (9–11), enhancing our ability to predict and prevent SI and SA remains a major national health goal.

The strongest risk factor for SI and SA in youth is a psychiatric diagnosis. Approximately 70% to 91% of youth in community settings who attempt or think about suicide are diagnosed with a psychiatric disorder (12–14). The most common diagnoses include mood disorders, specifically BD (15, 16), as well as anxiety, disruptive, and substance use disorders (13). Completed suicide has been associated with BD in particular (17, 18).

However, the interpretability and comparability of studies on suicidality is limited due to inconsistent nomenclature of suicidal ideation and behavior (19–21). To systematize and homogenize the terminology of suicidal events in medication trials, Posner and colleagues (19) categorized potential *adverse events*, covering the full spectrum of suicidality, distinguishing between suicidal, indeterminate and non-suicidal events (Table 1). This terminology has since become widely accepted and used beyond medication trials.

Furthermore, although there are a number of clinical rating scales for the severity of suicidality, only few have been validated in children and adolescents. Validated scales include the Columbia Suicide Severity Rating scale (C-SSRS) (22), the Reasons for Living Inventory for Adolescents (RFL-A) (23), and the Inventory of Suicide Orientation (ISO-30) (24).

As mentioned above, in adults, BD has been associated with one of the highest rates of SAs and completed suicides among all psychiatric disorders (25). Moreover, SAs are much more lethal in BD than in the general population. While in the general US population, completed suicide occurs once in every 30 attempts, the ratio is as high as one in every 3–4 attempts in patients with BD (26). However, due to greater illness severity and burden and substantial behavioral disinhibition, pediatric-onset BD subtype (PBD) may be associated with even higher SA rates (7, 27), making it a particularly significant focus in this vulnerable population. Although prevalence rates for PBD vary widely, a recent meta-analysis suggested an estimate of 1.8% [95% confidence interval (CI): 1.1–3.0%] (28). Of note,

however, this meta-analysis did not find a significant increase of prevalence rates over time, which is in contrast to several publications originating in the U.S. that have reported a strong, up to 40-fold increase of bipolar spectrum diagnoses in children and adolescents in recent years, using for example data from the National Ambulatory Medical Care Survey (1999–2003) (29) or the National Hospital Discharge Survey (NHDS) (1996–2004) (30).

While formal DSM-IV criteria do not distinguish between adults and children or adolescents, there are features of PBD that may predispose to SI and SA (31, 32). These include a shorter duration and lack of demarcation of mood episodes with less euthymic inter-episode intervals compared to adults, high levels of irritability and impulsivity, as well as prevalent rapid cycling, mixed mania and psychosis (34–42).

Due to the fact that suicide is most prevalent in BD and that youth with PBD are a particularly vulnerable patient group, we conducted a systematic review of studies reporting on the prevalence or incidence rate, or correlates of SI or SA in PBD. In addition, we searched for intervention studies aiming to prevent or reduce SI or SA in PBD. We hypothesized that PBD patients had SI and SA rates that are at least as high, or higher, than those reported for adults with BD. We further hypothesized that risk and protective factors would overlap, except that due to the greater immediate role of family functioning for pediatric patients family history of psychiatric disorders and family distress/discord would be more relevant in PBD.

Methods

Literature search

We conducted a systematic electronic literature search for prevalence or incidence rates, risk- and protective factors, and prevention/intervention trials of SI and SA in youth with bipolar spectrum disorders [bipolar I disorder (BD-I), bipolar II disorder (BD-II), and BD not otherwise specified (BD-NOS)].

We searched PubMed from database inception until 08/01/2012, using the following search terms without language restrictions: (*childhood* or *children* or *child* or *adolescence* or *adolescent** or *pediatric* or *youth*) and (*bipolar* or *mania*) and (*suicid** or *suicidal ideation* or *self-harm* or *self-injur** or *overdose* or *wish to be dead* or *die*). In case of reports on overlapping samples, we only included details of the study with the largest sample size, but also reported the results of studies with smaller sub-samples for outcomes that were not included in the report on the largest sample.

Inclusion criteria

Included were only studies that reported data on (i) either the prevalence or incidence rates of SI or SA (and not just of *suicidality*); or (ii) correlates, risk, or protective factors of SI or SA; or (iii) randomized trials testing an intervention for the reduction or prevention of SI or SA; and (iv) patients aged 18 years old; and (v) youth with a clinical or research diagnosis of a bipolar spectrum disorder (i.e., BD-I, BD-II, BD-NOS).

Statistical analyses

For prevalences, incidences ad correlates, descriptive statistics were used, calculating weighted means whenever possible. When adjusted prevalence or incidence numbers were provided, we calculated raw prevalence or incidence numbers in order to increase comparability across the studies. Furthermore, we categorized and analyzed results separately for SI and SA and according to the time frame of the assessment, i.e., suicidal SI or SA at time of study assessment, during lifetime and during prospective follow-up.

Finally, we conducted exploratory, meta-regression analyses of correlates across the studies reporting on the frequency of SI and SA, respectively. Whenever SI or SA frequencies were reported for more than one of the three time frames (i.e., lifetime, current or prospective), we counted the highest rate for the meta-regression analysis. Since correlates were not reported unanimously across a large enough number of studies, we were not able to a conduct a multivariate regression analysis and report only univariate regression analysis results.

All analyses were conducted in JMP5 (SAS statistical software), alpha was set at .05 and all analyses were two-sided. Due to the exploratory nature of the analyses, we did not correct for multiple testing.

Results

Search

Using the search criteria listed above, the electronic search yielded 624 hits. Of these, 570 were excluded by review of the title or abstract. Of the 54 retrieved full text articles, 20 publications reported on suicidality in samples of children and adolescents with BD. Two studies with SI/SA data were excluded, as their definition of BD was clearly not validated, using either the disputed Child Behavior Checklist–Juvenile Bipolar (CBCL-JBD) criteria (43), or categorizing youth as being merely at-risk for BD based on the presence of cyclothymic-hypersensitive temperament (CHT) (44). In addition, a third study was excluded (45), as the data referred to suicidal threats and self-injuriousness. Furthermore, one study reporting on an intervention to prevent SI/SA (46) is only reported in the intervention section but excluded from the prevalence section, as it only reported on past *suicidality* without distinguishing between SI and SA. Two groups had published more than one article on an overlapping sample that was counted as one study. These included the Course and Outcome of Bipolar illness in Youth (COBY) group (7, 8, 47) and Lewinsohn et al. (48, 49). Therefore, finally 14 individual studies of non-overlapping PBD samples [reported in 17 publications: (7, 8, 47–61)], which included 1,595 children and adolescents and reported on either SI or SA prevalence or incidences (N = 13, n = 1,508) and/or correlates (N =10, n = 1,348) were included in this systematic review (Table 2).

Study and patient characteristics

Most of the included studies were cross-sectional (N = 8, 57.1%), four (28.6%) were longitudinal, and two (14.3%) provided both cross-sectional and longitudinal data (Table 2). Six studies (42.9%) included outpatients, five (35.7%) included community samples, three (21.4%) focused on inpatients, and two (14.3%) included both inpatients and outpatients. The mean age at study inclusion was 14.4 (range: 3–18) years, 52.1% were male and 70.5% were white. The mean age of BD illness onset was reported as 8.1 years (seven studies with information). Most patients had BD-I (54.6%), followed by BD-NOS (22.3%), BD-II (17.1%) and cyclothymia (6.4%). Mixed mania (62.1%) and psychosis (28.3%) or 'lifetime psychotic disorders' (25.8%) were common. Comorbidities were very common, the most common being anxiety disorders (66.0%), depression (46.9%, in patients with BD-NOS), oppositional defiant disorder (44.8%), attention-deficit hyperactivity disorder (ADHD) (44.2%), and personality disorders/traits (35.0%) (Table 2). In addition, family psychiatric history was very common, including particularly major depressive disorder (MDD) (55.2%), BD/mania (44.9%), substance use disorders (31.2%), and personality disorders (11.5%), with schizophrenia being rare (1.1%). Finally, family history of suicidality was only assessed in the COBY study (8), finding a family history of SA in 29.7% and of completed suicide in 4.7% of patients (Table 2).

Suicidal ideation and suicide attempt measures

SI and SA were assessed with the suicidality items of different versions of the Kiddie-Schedule for Affective Disorders and Schizophrenia (K-SADS) in five studies (35.7%), followed by unstructured clinical interviews (N = 4, 28.6%), and one study each (7.1%) use of questionnaire items, and the definition of 'need for medical attention'. Three studies (21.4%) did not specify the suicidality measure (Table 2).

Past and current prevalence as well as incidence of SI and SA—Altogether, 13 studies (92.6%) reported on the prevalence of SI (N = 9) or SA (N = 11) (Table 2).

<u>Suicidal ideation:</u> Suicidal ideation was common, both in the past (N = 6, 57.4%, range: 19.6–93.5%) and *currently*, i.e., at the time of the study (N = 4, 50.4%, range 29.2–67.1%) (Table 2). In one study with 42 months follow-up (52), the SI incidence was 17.1%.

<u>Suicide attempts:</u> Suicide attempts were also relatively common, both in the past (N = 7, 21.3%, range: 9.4–64.5%) and *currently*, i.e., at the time of the study (N = 4, 25.5%, range 6.5–57.1%) (Table 2). Across four studies with a mean of 42 months of follow-up, the SA incidence was 14.7% (range: 5.9–20.0%).

Correlates of suicidal ideation and suicide attempts in PBD—Ten (71.4%) of the 14 included studies investigated correlates of SI and/or SA in a total of 1,348 youth with PBD (Tables 3 and 4).

<u>SI:</u> Only two studies reported on a total of five correlates of SI (50, 54) (Tables 3 and 4). Across these studies, patients with SI were more likely to be Caucasian and to have a narrowly rather than broadly defined BD phenotype compared to patients without SI. Moreover, patients with SI were significantly younger (10.5 versus 13.6 years) and had higher quality of life than those with SA. However, no difference was found regarding mania vs. hypomania (yet samples were small, which could have led to a type II error).

<u>SA:</u> Ten studies reported on a total of 32 different correlates of SA (i.e., one correlate: N = 8, 9 correlates: N = 1 (45), 17 correlates: N = 1 (7, 8, 47) (Tables 3 and 4).

Across these ten studies, SA was significantly associated with older age, earlier illness onset, more severe/episodic PBD illness characteristics, mixed episodes, higher rates of comorbid disorders, past self-injurious behavior, SI/SA and physical/sexual abuse, as well as parental depression, family history of suicidality and poor family functioning. No clear effect on SA status was reported for sex, race, socio-economic status, living situation and life events. Moreover, SA was not clearly correlated with more severe BD diagnostic subgroups, but samples, sample sizes and observation periods were limited.

The only publication reporting on a regression model of correlates of prospectively assessed SA in PBD found (controlling for sex) depression and mixed mania symptoms, substance use and greater number of weeks of outpatient psychosocial services in the eight weeks preceding the SA to be associated with higher risk for SA (8).

<u>Meta-regression of correlates of SI and SA:</u> In our exploratory univariate meta-regression analysis of correlates of study defined SI or SA, no significant correlates emerged for SI in the eight studies with data. By contrast, we identified the following 2 significant correlates that were each associated with higher rates of SA: proportion of patients with BD-I (N = 5, p = 0.027) and proportion of patients with comorbid ADHD (N = 5, p = 0.047).

Intervention and prevention trials—Our search identified one open study in 10 PBD youth aged 14–18 years (mean: 15.8) (46) aiming to reduce SI and SA. In this pilot study, one-year adapted dialectic behavioral therapy, added to pharmacotherapy and provided in 24 sessions over six months intensely and in further 12 sessions over the next six months, significantly reduced suicide attempts or the presence of SI from 80% to 0% at study conclusion. Moreover, none of the participants attempted suicide during the one-year study period and non-suicidal self-injurious behavior, emotional dysregulation and depressive symptoms improved as well.

Discussion

This systematic review indicates that PBD is associated with a substantial risk for SI as well as SA. In the identified studies, as many as at least one out of two youth had either current or a lifetime history of SI, and one out of four or five youth had either current or a lifetime history of SA. Moreover, during a mean follow-up of 3.5 years in the few prospective studies, SI and SA incidence rates were 27% and 15%, respectively. These prevalences in youth with a mean age of 14.4 years are staggering, highlighting the importance of early illness identification, adequate psychosocial and pharmacologic treatment as well as for the specific assessment for suicide risk and for general and indicated preventive actions. Although suicidality can be categorized into suicidal ideation, preparatory acts, suicide attempts and completed suicide (13), most of the available data in PBD focused on suicide attempts and, to a much lesser degree, on suicidal ideation. Although SI and SA are in and of themselves preeminent risk factor for completed SA and although among all suicide completers BD is highly prevalent (9–11, 17, 18), our search did not yield any studies reporting rates or correlates of completed suicide within pediatric BD samples. Given these enormous prevalence and incidence rates of SI and, especially, of SA, the relative dearth of studies focusing on this important illness aspect is concerning. Moreover, only two studies investigated more than one correlate/risk factor for SI or SA that could inform targeted prevention efforts. Furthermore, despite the prevalence and importance of SI and SA in PBD youth, our search identified no studies investigating specifically protective or resiliency factors, and only one open dialectic-behavioral therapy study investigated an intervention to treat or prevent SI or SA in PBD (46).

Suicidal ideation

Despite the heterogeneity of the individual study results, the reported current and past SI frequencies in PBD of 50% and 57%, respectively, are considerable and concerning, especially, as SI is a clear risk factor for SA (1). These prevalence figures appear to be higher than in adults with BD where rates have ranged from 14–59%, with earlier age of onset being one significant risk factor (62, 63). Notably, past-year SI prevalence rates in youth with BD were higher than in those with depression (72.2% versus 52.4%) (49) . Furthermore, youth with subsyndromal BD had a lower, yet still considerable lifetime reported frequency of SI (41.2%), indicating presence of a dose response relationship between more severe PBD diagnoses and SI.

Suicide attempts

As expected, the frequency of SA in PBD was fortunately lower than that of SI. However, the weighted current and past prevalences were still as high as 25.5% and 21.3%, respectively. Moreover, during a five-year period, 8% had multiple attempts (8), while in an assessment of SA during the past year 38.9% of youth attempted a second SA (49). Only two studies reported the severity of SAs. In one report, SAs were described as as *severe enough to require medical attention* (61), while Goldstein and colleagues (7) reported *extreme anticipation of death* in 11% and *moderate to high lethality* in 16% of the 32% of

PBD youth with suicide attempts in their sample. Although SA rates in adults have varied across studies, published results indicate that approximately one third to one half of adults with BPD attempt suicide at least once, and approximately 15–20% die from suicide (64–69). However, whether or not SAs occur more frequently in youth or adults with BD cannot be concluded from the indirect comparisons of point estimates and ranges, and studies including BD patients without age limitations are needed to shed more light on this issue. As for SI, past-year frequencies of SA in adolescents with BD were higher (44.4%) than in youth with MDD (21.8%) or with subsyndromal BD (17.6%) (49).

Taken together, these data clearly indicate that suicide prevention programs are needed, particularly for youth with bipolar spectrum disorders and that PBD youth with SI or past SA need to be identified and treated early. However, only 15 studies with relevant data on SI or SA in PBD were identified. This limited availability of research is in strong contrast to the prevalence and relevance of suicidality in children and adolescents with PBD.

Correlates of suicidal ideation and suicide attempts

Moreover, with few exceptions, the identified studies reported only limited risk factors for SA and, even less so, for SI. In the only two studies with data, SI in PBD was associated with Caucasian race and a narrowly defined PBD phenotype compared to non-SI patients, and younger age and higher quality of life compared to patients with SA. By contrast, in adults, SI has been associated with psychotic symptoms, past SA, alcohol abuse or dependence, panic disorder symptoms, and earlier illness onset (62, 63). Additional risk factors include dysphoric mania and mixed affective episodes (67, 70–72).

In youth with PBD, a large number of correlates of SA were reported, albeit few studies reported on overlapping correlates. Significant correlates included female gender, older age, earlier illness onset, more severe/episodic PBD, mixed episodes, more comorbid disorders, past self-injurious behavior/SI/SA, physical/sexual abuse, and parental depression, family history of suicidality and poor family functioning. Moreover, in our meta-regression, BD-I and comorbid ADHD were each significantly associated with SA in PBD youth. Many of these correlates overlapped with those identified in adults with BD (32), but some differences also emerged, including age, gender and family environment.

Demographic factors—Although older age was associated with SA cross-sectionally (7, 50), no age difference was found for SA within a prospective five-year follow-up period only (8). Interestingly, however, similar to adults, earlier illness onset was associated with SA in PBD (7, 57). However, within PBD, older age was associated with SA. This suggests that, although overall earlier illness onset is associated with increased SA risk, within those with early onset, older youth either have more means to commit SA or are less supervised than younger youth. Nevertheless, it is not entirely clear if age of onset is an independent risk factor or if this relationship is mediated by higher illness severity of, rapid cycling, more axis I and II comorbidities, and increased childhood physical and sexual abuse that are each associated with earlier age of BD onset (73). Furthermore, in adults with BD SA is equally frequent in males and females, whereas the number of completed suicides is higher in men (32, 74). In PBD youth, however, three of four studies found odds ratios for females of 2.8–3.5 (55, 75). In a comparison of attempters versus non-attempters, Goldstein and colleagues (8) also found significantly more SAs in females in a prospective five-year follow-up period, yet, there was no sex difference regarding lifetime history of SA in that sample (7). Finally, as expected and consistent with the greater importance of family environment for youth, parental depression and poor family functioning were additional correlates of SA identified particularly in PBD.

Finally, race, socioeconomic status, family history of a number of psychiatric conditions, family living situation and life events, identified as risk factors for SA in adults with BD (32), were not clearly associated with SA in PBD , but data were mostly scarce.

Clinical factors—Correlates that were similar to those identified in adults with BD included mixed episodes, psychotic symptoms, more severe/episodic PBD, mixed episodes, more comorbid disorders, past self-injurious behavior/SI/SA, physical/sexual abuse. Mixed mania, which is more common in children and adolescents than prototypical distinct episodes (36, 76), appears to be associated with a history of suicide attempts in youth (8, 50), but not with recent suicide attempts (8). This association is also supported by findings from a community sample, in which SA frequencies were 21.9% for youth with mania and depression, 7.4% for those with mania only, and 16.3% for youth with mania or hypomania plus MDD (59). However, Dilsaver and colleagues (55) found the association between mixed states and suicidal ideation to be valid only for PBD females and not in the overall sample.

Psychotic symptoms were correlated with a past history of suicide attempts among PBD youth, but not with prospectively assessed suicide attempts within a prospective five-year follow-up period, where only 2% of SAs were reportedly associated with psychotic symptoms (8). However, general severity of illness, as estimated by the number of psychiatric hospitalizations, was significantly higher among PBD suicide attempters than non-attempters (75% versus 45%, p <0.001) (7). Other studies also indicated that worse symptoms and poorer functioning was associated with SA (53). The same was true for a number of comorbidities, including anxiety disorders, substance use disorders, ADHD, and eating disorders (7). For example, youth with a comorbid substance abuse disorder were three times more likely to report a history of suicide attempts than those without (7) and showed more attempts during a prospective five-year follow-up period, whereas only 5% of suicide attempts of young patients with BD were committed during intoxication (8). However, no significant effect of the number of comorbid conditions on suicide attempts was found in pediatric BD (50).

Furthermore, non-suicidal self-injurious behavior was reported to be more prevalent in youth with BD who have a history of suicide attempts than those who do not (7, 50) as well as those who attempted suicide within a 5-year long prospective follow up (8). Likewise, past SI and SA was associated with SA during prospective follow-up of PBD subjects (8). Importantly, a family history of suicide attempts, but not of suicidal behavior in general or of completed suicide, was also associated with lifetime and more recent SAs by youth with BD (7, 50). Moreover, in the COBY study, youth with BD with a history of SA reported a history of physical and sexual abuse significantly more often than non-attempters (32% versus 10%) (7), but a history of abuse was not associated with a higher prospective rate of suicide attempt over five years (8).

Protective factors and interventions—No study explicitly addressed protective factors that may inform interventions and preventive efforts and no randomized trial examined an intervention to treat or prevent SI or SA in youth with PBD pointing to the need for additional research. However, one open study on an adapted dialectic behavioral therapy program reported reduced SA and SI at one year (46). While these are data from a very preliminary pilot study, they provide the basis for larger randomized trials that are urgently needed in this population at high risk and with high need for help.

Limitations

The results from this study need to be interpreted within its limitations. Foremost, this review is limited by the low number of studies with relevant data as well as the heterogeneity of the design, sample ascertainment, characteristics and assessments and the inhomogeneous reporting of results. For example, participants included in- and outpatients and were drawn from clinical as well as community samples. The purpose of the studies was rarely the assessment of SI or SA frequencies or correlates, and only four studies provided prospective data. Moreover, studies assessed a mostly non-overlapping variety of correlates, typically assessed in only one to three studies, hampering comparison of results. While we were able in our exploratory meta-regression analysis to assess additional correlates based on individual study characteristics, these results are also limited by incomplete reporting and the low number of individual studies with relevant data as well as the heterogeneous time frames of the SI/SA prevalence ascertainment. Furthermore, there is a dearth of data on the timing of SI and SA regarding illness duration, course and episode polarity, as well as modifiable risk factors and precipitants. In addition, the interpretability and comparability of studies on suicidality is limited due to inconsistent nomenclature of suicidal ideation and behavior (19–21). Moreover, only few of the existing clinical rating scales for the severity of suicidality have been validated in children and adolescents. Nevertheless, this is the first comprehensive, systematic review of frequencies and correlates of SI and SA in PBD.

In conclusion, our study identified past or cross-sectional prevalence of SI in PBD of about 50–60% and of SA of about 20–25%. These figures are highly concerning and indicate the need for early identification as well as prevention and intervention programs aiming to reduce the risk for, and frequencies and negative consequences of SI and SA in PBD youth. The fact that only one small, open intervention study for the reduction of SI and prevention of SA was identified indicates an important research gap that needs to be filled urgently. Future descriptive studies should clearly indicate the time frame of their SI or SA assessments, utilize standardized methods and include a large number of variables summarized in this report that are potentially relevant moderators and mediators of SI and SA risk. As more data become available, subgroup analyses of prevalences of SI and SA by study and population types can be conducted. Furthermore, future meta-regression analyses of correlates should explore potential differences according to the time frame of observation, in that certain correlates may be risk factors for earlier or later emergence of SI or SA. Moreover, since rates of SI and SA are fortunately much higher than those of completed suicide, risk factors and predictors may differ. Therefore, psychological autopsy studies in patients with completed suicide are needed to complement investigations of predictors of SI and SA. Finally, mental health and non-mental health personnel need to be aware of the high prevalence of SI and SA among youth with PBD, as well as of the need for a proactive comprehensive assessment and the appropriate management of SI and SA in clinical care.

Acknowledgments

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Table 1

Classification of suicidal behaviors[a]

Classification/category	Definition
Suicidal events	
Completed suicide	A self-injurious behavior that resulted in fatality and was associated with at least some intent to die as a result of the act
Suicide attempt	i. A potentially self-injurious behavior, associated with at least some intent to die, as a result of the act ii. Evidence that the individual intended to kill him/herself, at least to some degree, can be explicit or inferred from the behavior or circumstance iii. A suicide attempt may or may not result in actual injury
Preparatory act toward imminent suicidal behavior	The individual takes steps to injure him/herself, but is stopped by self or others from starting the self-injurious act before the potential for harm has begun
Suicidal ideation	Passive thoughts about wanting to be dead or active thoughts about killing oneself, not accompanied by preparatory behavior
Nonsuicidal events	
Self-injurious behavior, no suicidal intent	i. Self-injurious behavior associated with no intent to die ii. The behavior is intended purely for other reasons, either to relieve distress (often referred to as *self-mutilation*, e.g., superficial cuts or scratches, hitting/banging, or burns) or to effect change in others or the environment
Other, no deliberate self-harm	i. No evidence of any suicidality or deliberate self-injurious behavior associated with the event ii. The event is characterized as an accidental injury, psychiatric or behavioral symptoms only, or medical symptoms or procedure only
Indeterminate or potentially suicidal events	
Self-injurious behavior, suicidal intent unknown	i. Self-injurious behavior where associated intent to die is unknown and cannot be inferred ii. The injury or potential for injury is clear, but why the individual engaged in that behavior is unclear
Not enough information	i. Insufficient information to determine whether the event involved deliberate suicidal behavior or ideation ii. There is reason to suspect the possibility of suicidality but not enough to be confident that the event was not something other, such as an accident or psychiatric symptom iii. An injury sustained on a place on the body consistent with deliberate self-harm or suicidal behavior (e.g., wrists), without any information as to how the injury was received, would warrant placement in this category

[a]According to the Columbia Classification Algorithm of Suicide Assessment (19).

Table 2

Study and sample characteristics

Study	Design/setting	N[a]	Age, years [range][a]	Sex (% males)/race[a]	Diagnosis and clinical state (%)[a]	Age of onset, years[a]	Comorbidities and trauma (%)[a]	Family history[a]	Suicide measure	Suicidality (%)[a]
Algorta et al. 2011 (50)	CS Outpatients with mental illness (n = 828)	138	11.2 [5–18]	55.8 NR	BD-I: 19.6 BD-II: 13.0 (mixed features: 76% BD-I/BD-II) BD-NOS: 32.6 Cyclothymic d/o: 34.7	NR	NR	NR	K-SADS-P/K-SADS	Past: SI: 17.4, SA: 9.4 Current: SI: 44.9, SA: 6.5
Axelson et al. 2006 (47)[b]	CS (COBY) Inpatients + outpatients	438	12.7 [7–18]	53.2 White: 81.7	BD-I: 58.2 BD-II: 6.8 BD-NOS: 34.9 C-GAS: 54.6 K-SADS-MRS: 22.9 K-SADS-DEP: 14.8 PSY: 27.6	9.3	ADHD: 59.5 MDD: 52.7 ANX: 39.7 ODD: 38.5 CD: 12.8 SUD: 8.9 PD: 5.4	MDD: 68.0 Mania: 32.2 SUD: 57.8 Schizophrenia: 1.1 Suicidality: (SA: 29.7, SC: 4.7)	K-SADS-P/K-SADS	Axelson (2006): Past: SI: 76.2, SA :30.7 Goldstein (2005): Past: SA: 32 (lethality: very high = 11, moderate = 16)
Goldstein et al. 2012 (8)	LT (COBY) Inpatients + outpatients (follow-up: 5 years)	413	12.6 [7–17]	53 White: 82	BD-I: 59.1 BD-II: 6.8 BD-NOS: 34.1 MS: 26.9 PSY: 22.3 Hopelessness: 87.5	NR	ADHD: 59.3 ANX: 39.2 CD: 11.9 SUD: 8.5 PD: 5.3 ODD: 3.9 Trauma (sexual or physical): 19.6	DEP: 82.1 SUD: 69 Mania/ hypomania: 50.8 SA: 40.7	K-SADS-P/K-SADS	Past: SI: 75.1, SA: 29.5 Prospective: SA after 5 years follow-up: 18.0(2 SAs: 8)
Bhangoo et al. 2003 (51)	CS Outpatients (ascertained via web survey)	87	EPI: 11.2 CHR: 11.1 [6–17]	EPI: 86 CHR: 84 NR	EPI: 39 CHR: 61	EPI: 6.1 CHR: 6.3	ADHD: EPI = 77, CHR = 67 ODD: EPI = 65, CHR = 81 CD: EPI = 22, CHR = 33	NR	NR	NR
Bronisch et al. 2005 (52)	LT Community sample (n = 3,021) (mean follow-up: 42 months)	96	NR [14–24]	NR/NR	Mania: 42.7 Hypomania: 56.3	NR	NR	NR	M-CIDI[d]	*Mania* Past: SI: 46.9, SA: 14.6 Prospective: SI: 17.1, SA: 2.4 *Hypomania* Past: SI: 31.3, SA: 7.3 Prospective: SI: 12.7, SA: 3.6

Study	Design/setting	N[a]	Age, years [range][a]	Sex (% males)/race[a]	Diagnosis and clinical state (%)[a]	Age of onset, years[a]	Comorbidities and trauma (%)[a]	Family history[a]	Suicide measure	Suicidality (%)[a]
Craney and Geller 2003 (53)	LT Outpatients	93	10.9 [7–16]	61.3 White: 89.3	BD-I: 100 Psychosis: 60.2 Mixed mania: 54.8 Rapid cycling: 77.4	6.8	ADHD: 87.1 ODD/CD: 78.1	NR	NR	Suicidality (follow-up duration not specified): 24.7
Dickstein et al. 2005 (54)	CS Outpatients	31	BD: 12.7 [NR]	58.1 NR	BD-I: 77.4 BD-II: 22.6	BD: 10.3 ED: 5.6	ANX: 77.4 ADHD: 67.7 ODD: 38.7 PSY (lifetime): 25.8 CD: 3.2	NR	Clinical interview	Past: SI: 93.5, SA: 64.5
Dilsaver et al. 2005 (55)	CS MDE outpatients (n = 247)	82	NR [12–17]	37.2 NR	BD-I/BD-II: NR Mixed states: 82	NR	NR	NR	Clinical interview	Current: SI: 67.1, SA: 57.1
Faedda et al. 2004 (56)	LT, CS Private mood disorder clinic (mean follow-up: 18 months)	82	10.6 [3–17]	65.9 NR	BD-I: 52.4 BD-II: 40.2 Cyclothymia: 7.3 PSY: 31.7	9.6	OCD: 26.8 ANX: 23.2 LD: 15.9 ADHD: 11.0 ED: 4.9 SUD: 3.7 Tourette's: 3.7	Mood d/o or SUD: 90.2	Questionnaire + semi-structured interview	Current: SI: 30.0
Friedman et al. 1984 (57)	CS, DEP Inpatients (n =34)	8	NR [NR]	NR/NR	NR	NR	NR	NR	SADS	Past: SA: 37.5 Current: SI: 37.5
Kutcher et al. 1990 (58)	CS Euthymic inpatients + outpatients	22	17.5 [NR]	55 NR	Euthymic: 100 Personality d/o: 35	16.4	Personality d/o: 35	NR	NR	Past: SA: 15
Lewinsohn et al. 1994 (48)[c] Lewinsohn et al. 2003 (49)[c]	CS, LT Community sample (n = 1709) (T1 = 0, T2 = 12 months, T3 = age 24 years)	18	16 [14–18] at study intake	33.3 White: 91.1	BD-I: 11.1 BD-II: 61.1 Cyclothymia: 27.8 PSY: 5.5 GAF: 76.3 Follow-up T3 -GAF: 75.6	11.8	ANX: 33.3 SUD: 22.2 ADHD: 11.1 OCD: 11.1 CD: 5.6	MDD: 43.3 SUD: 34.9 (alcohol), 27.9 (other) Personality d/o: 11.5 (antisocial), borderline (7.7) BD: 3.9	K-SADS	Past year: SI: 72.2, SA: 44.4 (2 SAs: 38.9) T3 follow-up SA: 5.9
Merikangas et al. 2012 (59)	CS Community sample (n = 10,123)	408	15.2 [13–18]	40.9 White: 52.4	BD-I and BD-II + MDD: 60.3 BD-I mania only: 39.7	NR	ANX: 64.5 SUD: 32.4 CD: 28.9 ADHD: 12.2 ED: 10.5 2 d/o: 49.0	Mania: 60.2 MDD: 41.9	Clinical interview	Past: SA: BD-I and BD-II + MDD: 21.9 BD-I mania only: 7.4 Weighted mean:13.7
Rucklidge 2006 (60)	CS Outpatients	24	15.7 [13–17]	41.7 White: 87.5	BD-I: 37.5 BD-II: 25.0	Post puberty	ODD: 45.8 CD: 25.0	NR	K-SADS	Past: SI: 62.5 Current: SI: 29.2

Study	Design/setting	N[a]	Age, years [range][a]	Sex (% males)/race[a]	Diagnosis and clinical state (%)[a]	Age of onset, years[a]	Comorbidities and trauma (%)[a]	Family history[a]	Suicide measure	Suicidality (%)[a]
	and healthy controls (n = 39)				BD-NOS: 37.5 GAF: 54.5 CBCL-parent: 71.5 YSR-youth: 61.9 TRF-teacher: 64.7		MDD: 25.0 ADHD: 20.8 SP: 20.8 PTSD: 16.7 SUD: 4.2 Trauma: 54.2			
Strober et al. 1995 (61)	LT Inpatientsv (follow-up: 5 years)	54	16 [13–17]	48.1 NR	Manic: 37.0 Depressed: 25.9 Mixed: 22.2 Cycling: 18.5 PSY: 27.7	NR	ADHD: 14.8 ANX: 13.0 Dysthymia: 11.1 SUD: 9.3 CD: 5.6	NR	*Medical attention needed* (no further details)	5-year follow-up: 20% 1 SA
Totals and weighted means across 14 studies	CS: (N = 8) LT: (N = 4) CS + LT: (N = 2 Community sample: (N = 5) Outpatients: (N = 6) Inpatients: (N = 3)Inpatients + outpatients: (N = 2)	1595	14.4 [3–18]	52.1 White: 70.5	BD-I: 54.6 BD-NOS: 22.3 BD-II: 17.1 Cyclothymia: 6.4 Mixed state: 62.1 PSY: 28.3	8.1 (N = 7)	ANX: 66.0 DEP (in BP-NOS): 46.9 ODD: 44.8 ADHD: 44.2 Personality d/o: 35.0 CD: 33.8 PSY (lifetime): 25.8 OCD: 24.0 SUD: 18.0 LD: 15.9 ED: 9.6 Tourette's: 3.7 Trauma (N = 2): 54.2 (sexual: 29.2, physical: 20.8, sexual or physical: 19.6, emotional: 8.3, neglect: 4.2)	MDD: 55.2 BD/mania: 44.9 SUD: 31.2 Personality d/o: 11.5 (antisocial), borderline: 7.7 Schizophrenia: 1.1 Suicidality (N = 1): SA: 29.7, SC: 4.7	K-SADS (N = 5) Semi-structured clinical interview: (N = 4) NR: (N = 3) M-CIDI: (N = 1) Medical attention needed: (N = 1)	SI: N = 10 SA: N = 11 Past: SI (N = 7): 57.4 SA (N = 8): 21.3 Current: SI (N = 4): 50.4 SA (N = 2): 25.5 Prospective: SI (N = 1, 42 months): 14.6 SA (N = 4, mean: 42 months): 14.7

ADHD = attention-deficit hyperactivity disorder; ANX = anxiety disorder; BD = bipolar disorder; BD-I = bipolar I disorder; BD-II = bipolar II disorder; BD-NOS = bipolar disorder not otherwise specified; CBCL = Child Behavior Checklist; CBQ = Child Bipolar Questionnaire; CD = conduct disorder; C-GAS = Child Global Assessment Scale; CHR = chronic; COBY = Course and Outcome of Bipolar Illness in Youth; CS = cross-sectional study; DEP = depression; d/o = disorder; ED = eating disorder; EPI = episodic; K-SADS (P)=Kiddie-Schedule for Affective Disorders and Schizophrenia (Present Episode Version); LD = learning disorder; LT = longitudinal study; M-CIDI = Munich-Composite International Diagnostic Interview; MDD = major depressive disorder; MDE = major depressive episode; MRS = Mania Rating Scale (KSADS); MS = mixed state; NR = not reported; OAS #11 = Overt Aggression Scale, item #11 (self-harm); OCD = obsessive compulsive disorder; ODD = oppositional defiant disorder; PD = panic disorder; PTSD = posttraumatic stress disorder; PSY = psychosis; SA = suicide attempt; SB = suicidal behavior; SC = suicide completion; SD = standard deviation; SES = socioeconomic status; SI = suicidal ideation; SP = social phobia; SUD = substance use disorder; SXS = symptoms; TRF = Teacher Report Form; YSR = Youth Self-report.

[a] Percentage based on the bipolar disorder (sub)group.

[b] Goldstein et al. 2005 (7) (n = 405), prior sample.

[c] Same sample.

[d] Suicide measure: M-CIDI items for SI: (i) *Has there ever been a period of two weeks or more where you thought a lot about death – either your own, someone else's, or death in general?*; (ii) *Has there ever been a period of two weeks or more when you felt like you wanted to die?*; (iii) *Have you ever felt so low that you thought about committing suicide?*; (iv) *Have you ever made a plan as to how you might do it*". M-CIDI item for SA: *Have you ever attempted suicide?*.

Table 3

Sociodemographic and bipolar disorder characteristics associated with suicide attempts and suicidal ideation in youth with pediatric bipolar disorder

Study	Sociodemographic characteristics					Bipolar disorder characteristics				
	Age	Sex	Race	SES	Living situation: with both parents	Age of onset	BD subtype	Mixed episode	Symptom/illness severity
Cross-sectional studies									
Algorta et al. 2011 (50)	SA older than SI and non-SI group (13.6 > 10.5 and > 11.0 years, p < 0.005)	SA versus non-SA: females (r = 0.24, p < 0.01)	SI versus non-SI: White > others (p < 0.01) SA versus non-SA: Hispanic and African American > White (< 0.05)	NR	NR	NR	SA: ns	SA > non-SA: mixed episode (p = 0.02)	SA > non-SA: depression (CDRS-R) (p < 0.005) SA = non-SA: mania (YMRS)
Bhangoo et al. 2003 (51)	NR	NR	NR	NR	NR	NR	SA versus non-SA: episodic (47%) > chronic (15%), p = 0.001	NR	NR
Bronisch et al. 2005 (52)	NR	NR	NR	NR	NR	NR	CS: SI: mania = hypomania (OR = 2.4, CI: 0.8–6.4) CS: SA: mania = hypomania (OR = 3.3, CI :0.7–13.4) LT: SI: mania = hypomania (OR = 1.9, CI: 0.7–4.8) LT: SA: mania = hypomania (OR = 2.3, CI: 0.5–9.6)	NR	NR
Dickstein et al. 2005 (54)	NR	NR	NR	NR	NR	NR	SI versus non-SI: BD (93.5%) > EMDYS (56.3%), p = 0.002 SA versus non-SA: BD (64.5%) > EMDYS (6.3%), p = 0.0001	NR	NR
Dilsaver et al. 2005 (55)	NR	SA versus non-SA: female > male (p < 0.001) SI versus non-SI: female > male (p = 0.004)	NR	NR	NR	NR	NR	NR	NR

Study	Sociodemographic characteristics						Bipolar disorder characteristics				Symptom/illness severity
	Age	Sex	Race	SES	Living situation: with both parents	Age of onset	BD subtype	Mixed episode			
Friedman et al. 1984 (57)	NR	NR	NR	NR	NR	SA earlier mania than non-SA: (11.0 versus 15.2 years, p < 0.05)	NR	NR			NR
Goldstein et al. 2005 (7) Goldstein et al. 2012 (8)	SA older than non-SA group (13.7 versus 12.3, p = 0.001)	SA = non-SA (52% female versus 53% male, ns)	SA = non-SA (85% versus 83% Caucasian, ns)	SA = non-SA (3.5 versus 3.4, ns)	SA = non-SA (40% versus 45%, ns)	SA earlier illness onset than non-SA (35% versus 25%)	SA > non-SA: BD-I > BD-NOS (p = 0.002)	SA > non-SA: (38% versus 19%, p <0.001)			SA > non-SA: Psychosis (44% versus 27%, p = 0.001 Hospitalization: 75% versus 45%, p <0.001
Merikangas et al. 2012 (59)	NR	NR	NR	NR	NR	NR	NR	SA = non-SA: Hypo/mania + MDD: 21.9 % MDD: 16.3% Only mania: 7.4%			NR
Rucklidge 2006 (60)	NR	NR	NR	NR	NR	NR	NR	NR			SA > non-SA: Hopelessness (p < 0.001) External locus of control (p <0.01) Low self-esteem (p < 0.05) More difficulties regulating anger (p < .05)
Longitudinal studies											
Bronisch et al. 2005 (52)	NR	NR	NR	NR	NR	NR	SI: mania = hypomania (OR = 1.9, CI: 0.7–4.8) SA: mania = hypomania (OR = 2.3, CI: 0.5–9.6)	NR			NR
Goldstein et al. 2005 (7) Goldstein et al. 2012 (8)	SA = non-SA, ns	SA versus non-SA: females (p = 0.03)	SA = non-SA (85% versus 83% Caucasian, ns)	NR	SA = non-SA (40% versus 45%, ns)	NR	SA = non-SA (BD-I, II, NOS, ns)	SA versus non-SA: (p = 0.18, ns)			SA > non-SA: C-GAS past (p = 0.009) SA = non-SA: depression (p = 0.001); psychosis (ns)
Totals	SI: younger than SA (1/1 study, 100%) SA versus non-SA: older age (CS: 2/2	SI: females (1/1 study, 100%) SA: females (3/4 studies, 75.0%)	SI: Caucasian (1/1 study, 100%) SA: non-Caucasian (1/2 studies CS and 0/1 study, 0% LT)	SA: no effect (1/1 study, 100%)	SA: no effect both CS and LT (1/1 study, 100%)	SA: earlier mania and illness onset (2/2 studies, 100%)	SI: more severe subtype (1/2 studies, 50%) not LT (0/1 study, 0%) SA: more severe/episodic subtype (3/5 studies, 60.0%) CS; not LT (0/2 studies 0%)	SA: mixed episode (2/3 studies, 66.7%) CS, not LT (1/1 study, 100%)			SA: CS (all 1/1 study, 100%): depression, psychosis, hospitalization, hopelessness, external locus of control, low self-esteem, more difficulties regulating anger LT past functioning rating

Study	Sociodemographic characteristics					Bipolar disorder characteristics			
		Age	Sex	Race	SES	Living situation: with both parents	Age of onset	BD subtype	Mixed episode	Symptom/illness severity
		studies, 100%; LT: 1/1 study, 100%)								(1/1, 100%)

BD = bipolar disorder; BD-I = bipolar I disorder; BD-NOS = bipolar disorder not otherwise specified; CDRS-R = Child Depression Rating Scale-Revised; C-GAS = Child Global Assessment Scale; CI = confidence interval; CS = cross-sectional; EMDYS = emotional dysregulation (broad bipolar phenotype with chronic irritability and without euphoria or grandiosity); LT = longitudinal; MDD = major depressive disorder; NR = not reported; ns = not significant; OR = odds ratio; SA = suicide attempt; SES = socioeconomic status; SI = suicidal ideation; YMRS = Young Mania Rating Scale.

Table 4

Clinical, environmental, and family factors associated with suicide attempts and suicidal ideation in youth with pediatric bipolar disorder

Study	Clinical factors			Trauma/stress		Family factors		
	Comorbidities	Self-injurious behavior	Past suicidality	Physical/sexual abuse	Life events	Family history of Psychiatric disorder	Family history of suicidality	Family functioning
Cross-sectional studies								
Algorta et al. 2011 (50)	SA = non-SA: no. of comorbid Axis I diagnoses	SA: past and Current episodes (p < 0.05)	NR	NR	NR	NR	NR	SA > non-SA: poor functioning (FAD) (p < 0.005) QoL (family) SA < SI and < no suicidality (< 0.05)
Goldstein et al. 2005 (7) Goldstein et al. 2012 (8)	SA > non-SA: PD (12% versus 3%, p < 0.001) SUD (17% versus 5%, p < 0.001) ADHD (48% versus 65%, p = 0.002) SA = non-SA: ANX (45% versus 38%, ns) CD (6% versus 12%, ns) ODD (35% versus 40%, ns)	SA > non SA: (54% versus 30%, p <0.001)	NR	SA > non-SA (32% versus 20%, p = 0.006)	NR	NR	SA = non-SA: Suicidal behavior (52% versus 42%, ns) SA (48% versus 37%, p = 0.05) Completed SA (6% versus 5%, ns)	NR
Kutcher et al. 1990 (58)	SA = non-SA: personality d/o (28.6% versus15.4%)	NR	NR	NR	NR	NR	NR	NR
Longitudinal studies								
Goldstein et al. 2005 (7) Goldstein et al. 2012 (8)	LT: SA > non-SA: SUD (p = 0.04) SA = non-SA (all ns): ADHD, CD, ODD, lifetime cigarette smoking, lifetime excessive drinking, ANX, PD	SA > non SA: p = 0.01	SA > non SA: past SI (p = 0.004); past SA (p = 0.002)	SA > non-SA: ns	SA = non-SA: *Negative events*: Child and parent rated: ns *Positive events*: Child and parent rated: ns	SA >non-SA: Parental depression (p = 0.002) SA = non-SA: Mania/ hypomania: ns ADHD: ns CD: ns ANX: ns SUD: ns	SA > non-SA (p = 0.04)	NR
Totals	SA: CS: PD, SUD, ADHD (1/1 study, 100%), ODD features (1/1 study, 100%) LT: SUD (1/1 study, 100%)	SA: self Injurious behavior (2/2 studies, 100%) CS and LT (1/1 study, 100%)	SA: past SI and SA (1/1 study, 100%)	SA: physical/sexual abuse CS and LT (1/1 study, 100%)	SA: no correlation LT (1/1 study, 100%)	SA: parental depression LT (1/1 study, 100%)	SA: family history of suicidality LT (1/1 study, 100%)	SI: higher QoL of the family than SA (1/1 study, 100%) SA versus non-SA: lower functioning and QoL in the family (1/1 study, 100%)

ADHD = attention-deficit hyperactivity disorder; ANX = anxiety disorder; CD = conduct disorder, CS = cross-sectional; d/o = disorder; FAD = Family Assessment Device; LT = longitudinal; NR = not reported; ns = not significant, ODD = oppositional defiant disorder; PD = panic disorder; QoL = quality of life; SA = suicide attempt; SI = suicidal ideation; SUD = substance use disorder.