



Dampened positive emotion and a PTSD diagnosis are related to suicidal thoughts and behavior in young children receiving intensive psychiatric care

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STRUCTURED ABSTRACT

Objective: This study examined the prevalence of suicidal thoughts and behavior (STB), as well as clinical characteristics, emotional responsiveness, as well as executive functioning and death understanding, in young children receiving intensive psychiatric treatment.

Method: Ninety children, 4 to 7 years of age in a Pediatric Partial Hospital Program (PPHP), were studied. A diagnosis of autism or a significant language delay were exclusion criteria. Most children were male (74 %) and White (63 %); 8 % were Black, and 26 % were multiracial or endorsed other races; 18 % were Latine. Caregivers completed diagnostic interviews about their child as well as psychiatric history screening and measures of their own depression and STB. Children were administered lab tasks tapping cognitive and emotional risk factors as well as a death understanding interview.

Results: Approximately 44 % of children had a history of STB, as reported by a caregiver. Both MDD and PTSD were associated with increased rates of STB in univariate analyses but neither ODD or ADHD differentiated the groups. Preschoolers with a history of STB demonstrated a greater understanding of death and dampened positive emotion in interactive play compared to those without a history of STB. In multivariate analyses, older age, a PTSD diagnosis, and dampened positive emotion differentiated children with a history of STB from those without a history of STB.

Conclusion: Continued refinement of the clinical assessment of STB in young children referred for mental health care is important given the high rates of STB found in this study. A PTSD diagnosis appears especially important to consider in understanding STB in this age group as is the child's ability to experience positive emotion.

1. Introduction

Suicidal thoughts and suicidal behaviors (STB) in children accounted for an increasing proportion of Emergency Department visits from 2011 to 2020, with an almost 35-fold increase for 5- to 9-year-olds (Bommersbach et al., 2023). Psychiatric inpatient admissions for children also increased significantly over the past decade (Arakelyan et al., 2023) suggesting that STB is occurring with greater frequency in younger children. Although the clinical characteristics of STB in children have been described for decades (e.g., Pfeffer, 1986), empirical

research on STB in early childhood is limited, despite increasing empirical attention to preschool psychopathology and depression (Luby, Gaffrey, Tillman, April, and Belden, 2014). Addressing this gap in the literature is important as early childhood may be a key developmental period with respect to the onset of STB, given significant changes in emotion and cognition development, including children's emerging understanding of death. Identification of unique clinical, emotional, and cognitive risk factors associated with early STB is also essential to the development of prevention and early intervention strategies.

There are only a few studies of STB that include preschool-aged

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children. In a large sample of 306 3- to 7-year-old children, oversampled for depressive symptoms (Whalen, Dixon-Gordon, Belden, Barch, and Luby, 2015), 34 children (11 %) were classified as suicidal by parent report. These children were more likely to be male and be diagnosed with major depressive disorder (MDD) and externalizing behavioral disorders compared to children with no history of STB. After controlling for maternal psychopathology and co-occurring psychiatric diagnoses, only attention-deficit/hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), and conduct disorder (CD) significantly differentiated the groups. Suicidal ideation at this early age also predicted suicidal ideation, as well as poor mental health outcomes, in later childhood through adolescence (Whalen, Hennefield, Elsayed, Tillman, Barch, and Luby, 2022).

There are even fewer studies of STB focusing on very young children receiving psychiatric care. This population is particularly important to understand given that mental health professionals working with young children must make clinical decisions regarding STB risk. Pfeffer (1978) conducted some of the first studies with psychiatrically hospitalized children but very few of these patients were 7 years-old or younger. Martin et al. (2016) found that 13 % of young children (ages 3 to 7 years) in a psychiatric partial hospitalization program had STB, with suicidal plans or behavior endorsed by approximately 3 %. Results differed from the Whalen et al. (2015) study of preschool depression in that concurrent MDD, ODD, and PTSD were predictors of STB in univariate analyses, but only age and MDD remained as significant predictors in multivariate analyses. In a study of 288 depressed children (3 to 7 years) recruited for a psychotherapy treatment study, rates of suicidal ideation (SI) and suicidal behavior were 19.1 % and 3.5 %, respectively (Luby, Whalen, Tillman, and Barch, 2019). More recently, Hennefield et al. (2024) found that in a sample of young children who received treatment for preschool-onset MDD, almost half (47.4 %) had a history of preschool STB.

1.1. Cognitive, emotional, and parental predictors of early childhood STB

To date, the literature on correlates of STB in young children has focused primarily on clinical (e.g., diagnostic) and demographic (e.g., age, sex) risk factors. It is equally, if not more, important to examine cognitive and emotion processes underlying STBs in this age group. Deficits in neurocognitive functioning are presumed to be a mechanism underlying psychopathology in young children (Groves et al., 2022) that may help distinguish children who do or do not experience STB. (Whalen, Luby, and Barch, 2018). For example, executive functioning processes, such as problem solving and planning skill deficits, poor inhibitory control, and cognitive inflexibility may lead to suicidal behavior in children with SI. Indeed, there are some studies demonstrating such deficits in school-aged children with SI compared to children without SI (Keilp et al., 2013). However, other studies have found no differences between children with and without a history of STB with respect to working memory, cognitive control, or reward processing (Giannetta et al., 2012). A more recent study examined baseline data on the NIH Toolbox cognition measures in 9- and 10-year-old children participating in the Adolescent Brain Cognitive Development study. Children identified with SI (classified by parent interview) performed worse on a task of episodic memory, compared to children without SI (Huber, Sheth, Renshaw, Yurgelun-Todd, and McGlade, 2022). Another study found that elementary school-aged children (6–9 years) with STB performed worse on the NIH Toolbox tasks of inhibitory control and cognitive flexibility, as compared to children without a history of STB (Chen et al., 2023). Weaker working memory has also been found to statistically mediate SI in children with ADHD (Bauer, Gustafsson, Nigg, & Karalunas (2018). With the exception of a study using parent ratings of executive functioning and impulsivity (Luby et al., 2018), studies of the relation between neurocognitive functioning and STB in early childhood are rare.

Cognitive development also affects young children's understanding

of death, which, in turn, complicates interpretation of studies on STB. Early research posited that young children did not die by suicide because they were not developmentally able to grasp the concept of suicide (Cuddy-Casey and Orvaschel, 1997). Later studies suggest that children can distinguish between things that can and cannot die by age 4, understand that death is irreversible by age 6, and by age 7, most children have a basic understanding of the biological basis of death (Slaughter, 2005). Studies have also indicated that some children have an elaborate understanding of death, including death by suicide (Bering and Bjorklund, 2004; Poling and Evans, 2004; Slaughter and Lyons, 2003). One study (Hennefield, Whalen, Wood, Chavarria, and Luby, 2019) found that young children (ages 3 to 7 years) with depression and SI demonstrated a more sophisticated understanding of death compared to both healthy children and depressed children with no history of STB. These studies suggest that there is both developmental and individual variation in children's understanding of death and that young children with a more mature understanding of death may be more likely to experience suicidal thoughts.

Emotion processes interact with higher-order executive functioning in order to enable children to control their behavior (Barkley, 1997). Increased negative emotion, such as anger and anxiety, as well as decreased positive emotion, are related to psychopathology in childhood (Beauchaine, 2015; Hayden, Klein, Durbin, Olin, 2006). Emotional processes have also been associated with suicidal behavior in children and adolescents (Preyede et al., 2014). The high rates of emotional reactivity found in children referred for psychiatric care suggest that difficulties in coping with emotion may contribute to emergent STB (Ellehaug, Thoustup, Nielsen, Pagsberg, and Hagström, 2023). However, detailed studies of emotion processes and their relation to STB in early childhood have yet to be reported.

Parental psychopathology, specifically depressed mood and suicidality, has also been implicated in their children's history of STB. For example, Sheftall et al. (2021) found that among 6- to 9-year-olds, children with a lifetime history of suicidal ideation were more likely to have a parental history of suicide attempt, as compared to children with no history of suicidal ideation. Research also suggests that children who have a parent with a history of suicidal behavior may engage in suicidal behavior at a younger age than children without this parental history (Brent et al., 2003).

1.2. Current study

The purpose of the current study was to examine clinical, cognitive, and emotion processes that might differentiate a history of STB in young children receiving care in an intensive day treatment program. Based on the literature, it was hypothesized that young children with a history of STB would be more likely to meet diagnostic criteria for MDD, PTSD, and ODD compared to young children without a history of STB. Based on a recent meta-analysis of risk factors for preadolescent STB (Liu, Walsh, Sheehan, Cheek, and Sanzari, 2022), it was hypothesized that children with a history of STB would demonstrate poorer executive functioning but a more mature understanding of death than those without a history of STB. Children with a history of STB were also hypothesized to display more negative and less positive emotion in response to laboratory tasks, as compared to young children without a history of STB. Finally, caregiver history of depression and suicidal behavior was hypothesized to be more likely in young children with a history of STB than young children without a history of STB.

2. Method

2.1. Participants

Ninety children, 4 to 7 years of age ($M = 74.02$ months, $SD = 10.68$ months), along with a parent/caregiver (hereafter referred to as caregivers), participated in the study between 12/3/2018 - 11/3/2021; 78 %

(n = 115) of the caregivers approached agreed to participate. The most common reasons for refusal were caregiver time constraints and reluctance for children to complete the death understanding interview. The study was temporarily suspended and total enrollment was affected by the COVID lockdown and length of grant funding. Participating children were enrolled in an early childhood, psychiatric partial hospital program in the Northeast, with a wide range of presenting problems, including aggressive behavior, self-injurious behavior, and highly oppositional behavior. Study exclusion criteria included a caregiver who was not proficient in English, a child who had a diagnosis of autism spectrum disorder or a significant language delay, and/or a standard score of < 70 on the NIH Toolbox Picture Vocabulary Test (Akshoomoff et al., 2013); the latter criteria were to ensure that participating children were developmentally able to understand verbal instructions and procedures for the child assessment tasks.

As shown in Table 1, approximately three-quarters of the children were male and about one-quarter were female; the gender identity of all children was consistent with their biological sex. Almost two-thirds of the sample were White; two participating children (2 %) were Asian, seven (8 %) were Black, 13 (14 %) were multiracial, and 11 (12 %) endorsed other races; and 16 (18 %) were Latine. Most children (86 %) were prescribed one or more psychiatric medications, including: stimulants (26 = 29 %), alpha agonists (56 = 62 %), antidepressants (42 = 47 %), and atypical antipsychotics (35 = 39 %). The participating caregivers were largely female (94 %) and biological mothers (87 %), with 7 % adoptive parents, and 4 % biological fathers. About half of the caregivers were single parents; and about half completed high school, with one-quarter having a bachelor's degree or higher.

2.2. Procedure

Caregivers were invited to participate in the study within a few days of their child's admission to the partial hospital program. Written informed consent was obtained from caregivers after the study was explained by research staff. The caregiver then completed diagnostic and psychiatric history screening interviews and study questionnaires, typically over a week's time during the first few weeks of their child's admission. Children were administered a brief, computerized measure of executive functioning, a structured interview for assessment of death understanding, and several laboratory tasks for the assessment of positive and negative emotion. The laboratory tasks were administered in a single session with breaks in-between tasks, with the assessments of executive functioning and death understanding administered separately.

Ethical considerations: The study was approved by the hospital/university Institutional Review Board.

2.3. Measures

2.3.1. Child and family demographic characteristics

Caregivers completed a demographics questionnaire including three indicators of socioeconomic risk (i.e. caregiver education < high school completion, non-employment, and single parenthood) summed to create a family socioeconomic adversity score (Huffhines, Coe, Busuito, Seifer, and Parade, 2022; Tyrka et al., 2015) with possible scores from 0 to 3.

2.3.2. Child psychiatric diagnoses

The MDD and PTSD modules from the *Diagnostic Infant and Preschool Assessment (DIPA; Scheeringa and Haslett, 2010)*, a semi-structured interview with acceptable test-retest reliability and criterion validity for commonly occurring DSM-5 diagnoses in very young children (Scheeringa, 2016), were administered to caregivers by experienced clinicians and trained clinical research assistants, with ongoing supervision provided by a senior study author (J.R.B). The caregiver who participated in this interview was usually the biological mother (n = 70, 78 %) or both biological parents (n = 11, 12 %), although non-maternal caregivers (e.g., biological father only, adoptive parents, other legal

Table 1

Demographics, Psychiatric Diagnoses, Emotion Regulation, Executive Functioning, Understanding of Death, and Caregiver Depression and Suicidality in Children with and without a History of Suicidal Thoughts and Behavior.

	n	Full Sample (n = 90)	History of STB* (n = 40)	No History of STB* (n = 50)	t/chi ²
		Mean (SD) or %	Mean (SD) or %	Mean (SD) or %	
Demographic Variables:					
Child age (in months)	90	74.02 (10.68)	79.22 (8.91)	69.86 (10.22)	p < .001
Child sex (male)	90	67 (74 %)	31 (78 %)	36 (72 %)	p = .55
Child ethnicity (non-Hispanic/Latinx)	90	74 (82 %)	33 (83 %)	41 (82 %)	p = .95
Child race (white)	90	57 (63 %)	28 (70 %)	29 (58 %)	p = .24
Family sociodemographic adversity	77	1.23 (0.92)	1.08 (0.81)	1.37 (0.99)	p = .17
Child Psychiatric Diagnoses (DIPA):					
Major Depressive Disorder (MDD)	88	35 (40 %)	21 (54 %)	14 (29 %)	p = .02
Posttraumatic Stress Disorder (PTSD)	88	15 (17 %)	11 (28 %)	4 (8.2 %)	p = .01
Comorbid MDD and PTSD	88	13 (15 %)	10 (25 %)	3 (6 %)	p = .01
Generalized Anxiety Disorder (GAD)	86	24 (28 %)	14 (37 %)	10 (21 %)	p = .10
Oppositional Defiant Disorder (ODD)	87	67 (77 %)	32 (84 %)	35 (71 %)	p = .16
Attention-Deficit/Hyperactivity Disorder (ADHD)	87	57 (66 %)	22 (58 %)	35 (71 %)	p = .19
Child Emotion Regulation:					
Negative emotion in response to frustration (Lab-TAB Attractive Toy in Transparent Box)	82	6.73 (3.84)	6.11 (4.11)	7.19 (3.60)	p = .22
Negative emotion in response to loss (Lab-TAB Box Empty)	85	7.32 (3.18)	6.62 (3.06)	7.85 (3.20)	p = .08
Positive Emotion in Response to Reward (Lab-TAB Popping Bubbles)	85	8.86 (2.27)	8.24 (2.36)	9.33 (2.10)	p = .03
Child Executive Function and Cognitive Understanding of Death:					
Inhibitory control (NIH Toolbox FIC)	87	91.54 (14.03)	89.16 (15.00)	93.39 (13.09)	p = .17
Cognitive flexibility (NIH Toolbox DCCS)	87	88.35 (14.15)	86.00 (12.84)	90.12 (14.96)	p = .17
Death understanding total score	85	5.62 (2.27)	6.24 (2.37)	5.15 (2.09)	p = .03
Caregiver Depression and Suicidality:					
Current depressive symptoms (CES-D)	83	18.67 (11.61)	18.39 (12.01)	18.89 (11.43)	p = .85
Lifetime history of MDD (MINI)	83	34 (38 %)	19 (48 %)	15 (30 %)	p = .09
Lifetime history of suicidal ideation (CSSRS)	85	32 (38 %)	13 (35 %)	19 (40 %)	p = 0.67
Lifetime history of suicide attempt (CSSRS)	83	17 (20 %)	6 (17 %)	11 (23 %)	p = .52

Note. SD = Standard Deviation *chi*² = Pearson's Chi-squared test; *t* = Welch Two Sample *t*-test.

DIPA = Diagnostic Infant and Preschool Assessment; Lab-TAB = Laboratory Temperament Assessment Battery; MAP-DB = NAME; FIC = Flanker Inhibitory Control Task; DCCS = Dimensional Change Card Sort Task; CES-D = Center for Epidemiological Studies Depression Scale; MINI = Mini International Neuropsychiatric Interview; CSSRS = Columbia Suicide Severity Rating Scale.

† Suicidal thoughts/behavior items were excluded from when determining major depressive disorder diagnosis so as to avoid confounds between the two variables in analyses.

guardians) served as primary interview informants for nine (10 %) of the children. When more than one caregiver participated in the interview, the interviewer worked with the guardians to reach consensus for each interview question. As per the DIPA protocol, interviewers also queried for specific examples of each symptom endorsed, in order to verify caregivers' responses.

2.3.3. Child STB

Child STB was assessed based on information collected during caregiver interviews, including four items in the MDD module of the DIPA (i.e., *Does s/he ever think about ending it all? Has s/he ever drawn pictures about suicide, or play games in which a character kills himself? Has s/he made a plan to kill him/herself? Has s/he ever actually tried to kill him/herself?*). The MDD module of the DIPA also queries for other death-related thoughts (i.e., *Does s/he seem to think or talk about death or dying?*) and death-related play themes (i.e., *Does s/he ever draw pictures about death and dying, or play games in which a character dies?*), however, positive endorsement of these items was not considered to be STB, unless suicide-related themes emerged when parents were queried further. Caregivers also completed the Columbia - Suicide Severity Rating Scale (C-SSRS; Posner et al., 2011) regarding their child's past four weeks and lifetime STB. Responses were coded by trained clinical research assistants, using all available information from both the DIPA and the C-SSRS interviews. STB was coded as present or absent based on responses to these measures. Audiotapes of 39 interviews (43 %) were independently coded by two trained raters, with good inter-rater agreement for lifetime suicidal thinking (percent agreement = 87 %, kappa = 0.71) and lifetime suicidal behavior (percent agreement = 95 %, kappa = 0.80). Discrepancies were resolved by a third experienced clinician in a consensus meeting.

2.3.4. Child executive functioning

The NIH Toolbox Early Childhood Cognition Battery (for children under 7 years old) and NIH Toolbox Cognition Battery (7+ years) (<http://nihtoolbox.org/>) was used to assess cognitive flexibility and inhibition control which are considered, along with working memory, to be the primary subcomponents of executive functioning. Specifically, the *Dimensional Change Card Sort Test (DCCS)*, a widely used task of *attentional flexibility* to the switching of rules, with four phases (i.e., practice, pre-switch, post-switch, and mixed) was scored based on both accuracy and reaction time. *Inhibitory control* was assessed using the *Flanker Inhibitory Control and Attention Test*, which consists of a practice block, a fish block, and an arrows block. Scores are based on both accuracy and reaction time.

Children's understanding of death was assessed by a structured interview (Slaughter and Griffiths, 2007; Slaughter and Lyons, 2003) consisting of five subcomponents of the death concept: 1) inevitability (death happens to everyone), 2) applicability (death is only applicable to living things), 3) irreversibility (death is a permanent state), 4) cessation (all bodily functioning ceases with death), and 5) causality (death is caused by a breakdown of bodily functioning). Each of the subcomponents are scored 0, 1, or 2 with an overall death concept score obtained by summing the five components, yielding a total score from 0 to 10. High interrater reliability for the subscales was reported in the original study and for the total score in this sample (ICC = 0.96; $n = 21$).

2.3.5. Child negative and positive emotion

Child negative and positive emotion was assessed using three observational tasks from the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith, Reilly, Lemery, Longley, and Prescott, 1997) with procedures slightly modified for feasibility of use within a clinical treatment setting; for example, caregivers were not present

during the administration. All tasks were administered in the order listed below and videotaped. Two coders rated each tape and were blind to the child's history of STB. Global ratings were derived for the child's behavior on each task.

2.3.5.1. Attractive toy in transparent box. In this task, the child is provided with an attractive toy, placed in a Plexiglass box that is locked with a small padlock. The child is given a set of keys and told that they can open the box to play with the toy but none of the keys fit the lock. The child is left alone and allowed to attempt to open the box for up to four minutes. The experimenter then returns, apologizes for their mistake, provides the child with the correct key, and allows the child to play with the toys for several minutes. Facial, vocal, and bodily dimensions of child anger and sadness were coded and summed to create a score for *Negative Emotion in Response to Frustration*, with good inter-rater reliability (ICC = 0.84; $n = 15$).

2.3.5.2. Box empty. In this task, the child is told that they are being given a gift and are handed a small, wrapped box. The experimenter tells the child that they can open their gift, however the box is empty. The experimenter leaves the room and returns after one minute, apologizes for their mistake, and provides the child with a small gift. Facial, vocal, and bodily dimensions of child anger and sadness were coded and summed to create a score for *Negative Emotion in Response to Loss*, with good inter-rater reliability (ICC = 0.92; $n = 15$).

2.3.5.3. Popping bubbles. In this task, the child and experimenter play together with a battery-operated bubble blowing toy, during which the child is encouraged to chase and pop the bubbles, preventing them from hitting the floor. Facial, vocal, and bodily dimensions of positive affect were coded, and summed to create a score for *Positive Emotion in Response to Interactive Play*, with good inter-rater reliability (ICC = 0.81; $n = 15$).

2.3.6. Caregiver depression and suicidality

Caregiver current depressive symptoms were assessed using the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977), a 20-item scale rated on a four-point scale from 0 (rarely or none of the time) to 3 (most or all of the time). Symptoms are reported for the prior week with a total score over 16 considered to be clinically elevated. Caregiver current and lifetime history of MDD was assessed using the Mini International Neuropsychiatric Interview (MINI; Sheehan et al., 1998). Caregiver lifetime history of STB was assessed using the C-SSRS (Posner et al., 2011).

2.4. Data analyses

The sample was divided according to the criterion variable of whether a caregiver reported their child had STB in their lifetime. Independent variables were selected *a priori* based on associations with suicidal risk in previous studies with this age group or older children. Independent samples *t*-tests were performed for continuous independent variables, and χ^2 tests for categorical variables. Independent variables significantly associated with STB at the univariate level, $p < .05$, were included in a multivariate logistic regression model. Overall, 4 % of the data were missing, ranging from 0 % missing to 14 % missing depending on the variable. Missing data were handled using multiple imputation to create $m = 10$ datasets that were pooled for analysis (van Buuren and Groothuis-Oudshoorn, 2011).

3. Results

Table 1 presents sociodemographic characteristics of the sample, as well as descriptive information on key study variables. As shown in Table 1, and consistent with the acute clinical setting in which the study

was conducted, the overall sample was characterized by high rates of psychiatric disorders and comorbidity, with ODD (77 %), ADHD (66 %), and MDD (40 %) diagnosed most frequently. In addition, 28 % of children met criteria for generalized anxiety disorder (GAD) and 17 % met criteria for PTSD; of note, 87 % of the participants who had a diagnosis of PTSD also had a diagnosis of MDD.

Forty children (44.4 %) were reported by caregivers to have a history of suicidal thoughts, and for most of these children ($n = 26$), these thoughts had been present in the four weeks prior to their partial hospital admission. Suicidal behavior was endorsed for 17 children (19 %). Examples of suicidal behaviors included attempts to cut themselves (e. g., with a knife, scissors), to choke themselves (e.g., with shirtsleeves, seatbelt), to jump from a moving vehicle or height (e.g., window), and to run into moving traffic, often with adults intervening to prevent harm (e. g., removing sharp objects or ligatures).

3.1. Comparison of children with and without STB on demographic, diagnostic, cognitive, emotion, and parental history variables

Analyses comparing young children with STB ($n = 40$) to young children without STB ($n = 50$) are presented in Table 1. Children with and without a history of STB did not differ with respect to biologic sex, ethnicity (Latine versus non-Latine), race (white versus all other races), or family sociodemographic adversity. Children with a history of STB were older than children without a history of STB. A higher percentage of children with a history of STB were diagnosed with MDD, PTSD, and comorbid MDD/PTSD than children without a history of STB.

With respect to cognitive factors, there were no differences between groups on the NIH Toolbox measures of executive functioning, specifically, inhibitory control or cognitive flexibility. Children with a history of STB received a higher total score (better understanding) on the Death Understanding Interview than children without a history of STB, although both groups of children demonstrated only partial understanding (6.24 and 5.15 out of 10 possible points, respectively). There were only four children in the sample who demonstrated complete understanding of death (i.e., scored the maximum 10 points on the death understanding interview), all of whom had a history of STB and were at least six years old.

With respect to negative and positive emotionality, children with a

Table 2
Correlations among key variables and 95 % confidence intervals.

	Lifetime STB	Child Age in Months	Child PTSD	Child MDD	Box Empty	Popping Bubbles	Death Understanding	Parent MDD
Lifetime STB	-	.43 (0.25, 0.59)	.26 (0.06, 0.44)	.26 (0.05, 0.44)	-0.21 (-0.40, 0.01)	-0.25 (-0.45, -0.03)	.26 (0.06, 0.45)	.18 (-0.03, 0.37)
Child Age in Months		-	.11 (-0.11, 0.31)	.33 (0.13, 0.50)	-0.20 (-0.40, 0.01)	-0.08 (-0.30, 0.14)	.23 (0.02, 0.42)	.04 (-0.17, 0.24)
Child PTSD on DIPA			-	.43 (0.24, 0.58)	-0.04 (-0.24, 0.17)	.10 (-0.11, 0.30)	.01 (-0.20, 0.22)	-0.04 (-0.25, 0.17)
Child MDD on DIPA				-	-0.17 (-0.38, 0.04)	.08 (-0.13, 0.29)	.04 (-0.18, 0.25)	-0.02 (-0.23, 0.20)
Lab-TAB Box Empty					-	.15 (-0.06, 0.35)	.27 (0.06, 0.45)	-0.01 (-0.22, 0.20)
Lab- TAB Popping Bubbles						-	-0.11 (-0.33, 0.11)	-0.11 (-0.33, 0.12)
Death Understanding Interview							-	.11 (-0.11, 0.33)
Parent MDD on MINI								-

Note: STB = History of STB; PTSD = Posttraumatic Stress Disorder diagnosis; Major Depressive Disorder diagnosis; Lab-TAB Laboratory Temperament Assessment Battery; DIPA = Diagnostic Infant and Preschool Assessment; MINI = Mini International Neuropsychiatric Interview; Suicidal thoughts/behavior items on the Diagnostic Infant and Preschool Assessment were excluded when determining Major Depressive Disorder diagnosis.

history of STB demonstrated less positive emotion during interactive play (Lab-TAB Popping Bubbles) as compared to children without a history of STB, but the groups did not differ with respect to negative emotion in response to frustration (Lab-TAB Attractive Toy). There was a statistical trend suggesting that children with a history of STB were less likely to display negative emotion in response to loss (Lab-TAB Box Empty) than children who did not have a history of STB.

There were no differences between groups with respect to caregiver current depressive symptoms or history of STB. There was a statistical trend suggesting that caregivers of children with a history of STB were more likely to have a lifetime history of MDD than caregivers whose children did not have a lifetime history of STB (48 % versus 30 %).

3.2. Multivariate prediction of STB

A correlation matrix amongst the independent variables was calculated prior to conducting the multivariate regression analyses to check for multicollinearity (Table 2). Due to the high degree of comorbidity between MDD and PTSD, these variables were combined into a single MDD/PTSD variable for the multivariate analyses. Age, MDD/PTSD, Lab-Tab Positive Emotion in Response to Interactive Play (Popping Bubbles), and Death Understanding Total score were entered simultaneously into the multivariate logistic regression model. As shown in

Table 3
Multivariate Logistic Regression Analysis for the Prediction of Suicidal Thoughts and Behaviors.

Predictors	OR (95 % CI)	p
Age (months)	1.10 (1.04 - 1.17)	<.01
Comorbid MDD [†] /PTSD	5.65 (1.18 - 27.12)	.03
Response to Reward (Lab-TAB Popping Bubbles)	0.78 (0.62 - 0.997)	.05
Death Understanding	1.18 (0.94 - 1.48)	.15

Note. OR = odds ratio; CI = confidence interval. MDD = Major Depressive Disorder; PTSD = Posttraumatic Stress Disorder When PTSD was entered instead of MDD/PTSD, the results remained the same: OR 5.54 (1.13 - 27.13), $p = .04$.

[†] Suicidal thoughts/behavior items were excluded when determining Major Depressive Disorder diagnosis so as to avoid confounds between the two variables in analyses.

Table 3, positive, significant associations with STB were found for age and MDD/PTSD while Popping Bubbles was negatively related to STB classification. When PTSD alone was entered instead of MDD/PTSD, the results remained the same.

4. Discussion

In this clinical sample of 4- to 7-year-olds, approximately 44 % had a history of STB, as reported by a caregiver. In a study conducted at the same site between 2010 – 2015 (Reference blinded for review), only 13 % of children had a history of STB by caregiver report. The much higher rates in the current study may reflect the increase in childhood STB reported in recent years, as well as the fact that some of the data in this study were collected during COVID restrictions, when suicidality was found to increase for youth in the US (Bridge et al., 2023; Farah, Rege, Cole, and Holstege, 2023). In addition, in the current study, child STB was assessed using two measures, the DIPA and C-SSRS, and a clinical consensus process used to finalize a rating of STB, whereas in the prior study, child STB was assessed by the DIPA only. The current study also was focused on child STB specifically, whereas the prior study (Reference blinded) focused on child psychopathology more broadly; caregivers of children with a history of STB may have been especially inclined to participate in the current, compared to the former, study. However, it is notable that the rate of STB in the current study is comparable to recent research by Hennefield et al. (2024), who found that among 47 % of the children who received treatment for preschool-onset MDD had a history of preschool STB. Hennefield et al. (2024) further found that STB in these depressed preschoolers was robustly predictive of suicidal ideation and behavior in preadolescence. With respect to clinical predictors of STB, both MDD and PTSD were associated with increased rates of STB in univariate analyses, but there was a high degree of comorbidity. Comorbid MDD/PTSD, but not MDD alone, remained significant in multivariate analyses. This finding stands in contrast to our prior study in which depression, as well as older child age, but not PTSD, differentiated young children with a history of STB from those without a history of STB. As noted above, the 7- to 10-year gap between data collection in the two studies, and the increase in the severity in psychiatric symptomatology over that period, might have contributed to this finding. Similarly, much of the data were collected after COVID, a time when increased rates of stress lead to concomitant increases in child psychiatric symptoms (Ng & Ng, 2022). However, the relatively small number of cases of PTSD and MDD/PTSD in the sample affects the stability of the findings.

Neither ODD or ADHD differentiated the groups, in contrast to Whalen et al' (2015). One possibility for the null finding in this study is the severity of the clinical sample; young children requiring partial hospital treatment very often display significant externalizing behaviors that cannot be managed in a typical preschool or childcare setting. In addition, the high rates of externalizing disorders in the sample, about two-thirds diagnosed with ADHD and more than three-quarters with ODD, may have created a ceiling effect.

Young children with a history of STB demonstrated a more advanced understanding of death than children without a history of STB. This finding replicated that of another study that found depressed 4- to 6-year-old children with STB had a better understanding of death than depressed children without STB (Hennefield et al., 2019). In the present study, the link between STB and death understanding was attenuated in multivariate analyses that included child age; that is, advanced understanding of death among children with STB may be partly explained by their older age. Nonetheless, findings contribute to a growing body of research suggesting that STB in early childhood may be accompanied by an advanced awareness and understanding of death and dying. Children who are preoccupied with thoughts of death may come to understand death earlier than their healthy peers, simply due to the amount of time and cognitive energy devoted to considering it. Findings related to death understanding and STB have clinical implications. For example,

clinicians working with young children experiencing suicidal thinking should assess the child's understanding of the concept of death, in addition to working with caregivers to engage in developmentally appropriate conversations about children's thoughts about death and dying, rather than avoiding or dismissing as a topic that young children are unable to comprehend.

Executive functioning, specifically inhibitory control and cognitive inflexibility, did not differentiate young children with or without STB. Some studies have shown that inhibitory control, and other executive functioning subdomains, such as cognitive flexibility, do not appear to be disorder specific, but rather are transdiagnostic correlates of psychiatric symptomatology (Doyle et al., 2018; Kavanaugh, Cancelliere, and Spirito, 2019). This same conclusion regarding lack of specificity might also apply to early childhood STB.

Although negative emotionality has been well-documented with respect to adolescents with STB, there was only a statistical trend for negative emotion to be associated with a history of STB in this age group. Specifically, children with a history of STB demonstrated somewhat less negative emotion in the context of loss, i.e., Box Empty task. This finding was counterintuitive and may suggest that, in some contexts, young children with STB may over-regulate difficult emotions, such as sadness or disappointment. With respect to positive emotion, and consistent with hypotheses, children with STB demonstrated less positive emotion during interactive play (i.e., Popping Bubbles task). This is a novel finding, at least in part due to the fact that positive emotion, in general, is understudied with respect to child psychopathology. One notable exception is a longitudinal study of 302 preschoolers (age 3 to 5 years), enriched for early-onset depression, demonstrating that preschool excitability predicted emotional lability in late childhood and early adolescence (Vogel, Jackson, Barch, Tillman, and Luby, 2019). The authors concluded that preschool emotional responsiveness, both positive and negative, may predict later psychopathology. In the current study, low levels of positive affect during interactive play may be an indicator of emerging anhedonia, which has been shown to predict suicide-related outcomes in school-aged children (Nock and Kazdin, 2002), as well as to be associated with depression severity in preschoolers (Luby, Belden, Pautsch, Si, & Spitznagel, 2009). Alternatively, dampened positive emotion during play may be a separate, but related, construct to anhedonia. Indeed, a 6-month follow-up study of psychiatrically hospitalized adolescents with STB (Yen et al., 2013) found that low positive affect prospectively predicted time to either a suicide attempt or an emergency intervention for an acute suicidal crisis, even after controlling for depression severity and anhedonia. Regardless of its source, interventions to support children and caregivers during interactions to promote positive emotions, such as joy and curiosity, appear indicated in this population.

Finally, it was hypothesized that caregiver history of depression and STB would be more common in children with a history of STB than those without a history of STB, but this hypothesis was not confirmed. A study of young children with suicidal ideation/behavior, nonsuicidal self-injurious behavior, or neither also found that family history of affective disorder (MDD or bipolar disorder) and suicide in parents, siblings, and other household members did not differentiate amongst the three groups (Luby, Whalen, Tillman, and Barch, 2019). In our study, this negative finding might be a function of statistical power, given the relatively small sample size and the low percentage of caregivers with a history of STB. Alternatively, the presence of other extended family caregivers might have dampened some of the risks associated with a maternal history of STB. Nonetheless, a recent meta-analysis found that parental history of STB was a significant predictor of preadolescent STB (Liu et al., 2022). The meta-analysis included studies primarily with older children, as well as those with community, not clinical, samples, e.g. Sheftall et al. (2021), which may also account for the different findings. There was a trend for children with a history of STB to be more likely to have a caregiver with a lifetime history of a diagnosis of MDD, which is consistent with the literature (Liu et al., 2022).

4.1. Limitations

This study is noteworthy for its assessment of STB in such a young clinical sample. Nonetheless, there are limitations to the study. First, a specific model of STB was not tested but rather we relied on a selection of high probability risk factors based on the school-age and adolescent STB literature. Second, the relatively small sample size of this study affected statistical power to detect differences across groups and subgroups within the sample. We chose to not correct significance levels due to multiple comparisons and to discuss statistical trends because of the uniqueness of the sample and the very limited research literature on this topic. Being less conservative in statistical interpretation helped generate potential areas for future investigation in a larger sample. Relatedly, in this age range, males are overrepresented in tertiary care psychiatric settings making the sample representative of the setting but making conclusions about girls tentative. Girls comprised only about one-quarter of the sample and only 12 reported STB. There is also growing recognition that risk factors may also vary by race (Sheftall and Miller, 2021). Racial differences may not have been detected due to sample size limitations; racial categories other than White were collapsed into one category to achieve reasonable cell sizes for a chi-square test. Given that the majority of the children in the sample were White, the risk factors found in this study should be investigated with an adequate sample of young children of color in the future. Similarly, young Hispanic and Asian children should also be adequately sampled in future studies. Third, the sample demonstrated severe externalizing problems and high levels of family stress. Thus, these findings may not generalize to children and families with less severe clinical presentations. While studying high risk samples is important in understanding early childhood STB, the severity of the sample made it challenging to differentiate groups (e.g., children with and without externalizing disorders). In addition, many of the children in the sample were on psychotropic medications which could also have affected performance on tasks of executive functioning, in particular. Fourth, because this was a cross-sectional study, conclusions about the temporal relationship between early childhood STB and the other risk factors assessed in this study cannot be drawn. Longitudinal studies may help point to the timing of preventative interventions.

Finally, given the age of the participating children, assessment of STB relied upon caregivers and it is possible that children may report more STB if interviewed directly. However, it is important to note that there is currently no clinical or research consensus on the lowest age at which young children should be interviewed about STB, nor of the value added in doing so with very young children. For example, a study of young children recruited from the community indicated a high rate of suicidal ideation when 6-year-old children were asked directly (with 44.9 % of children endorsing “I think of killing myself but would not do it” and 2.6 % endorsing “I want to kill myself”) as compared to when caregivers were asked (with only 1.6 % of parents reporting that their child “sometimes” experienced suicidal ideation); however only parent-reported SI predicted later SI and NSSI. The authors recommended against administering SI screening measures to children under the age of 10 in community studies (Silver, Olino, Carlson, Dougherty, and Klein, 2023). In contrast, Miller et al. (2025) found that trauma-exposed children as young as five years of age were able to report on their own STB using developmentally adapted self-report and clinical interview measures, with no significant iatrogenic effects in the week following. The authors did note that some caregivers expressed concern about asking these questions of their children, albeit a minority. Expert guidance and consensus from the field as to at what age, and under what conditions, young children should be interviewed about their own STB would be useful to both clinicians and clinical researchers working with very young, high-risk children. Caregiver concerns regarding asking young children about STB will also need to be thoroughly addressed in both clinical care and in research studies.

5. Conclusions

The findings reported here suggest STB is relatively common in young children presenting for intensive psychiatric care, indicating the need to screen for STB in these children, even if STB is not the primary reason for referral. Equally important will be refinement of the clinical assessment of STB with caregivers of young children presenting for psychiatric care, as well as continued attention to the question of at what age, and under what conditions, children should be interviewed about their own STB. MDD/PTSD comorbidity appears especially important to consider when evaluating suicidal risk in early childhood and a positive screen for PTSD should indicate not only more in-depth assessment of trauma-related symptoms, but also of depression and STB. In addition, given that dampened positive emotion was more frequent in children with a history of STB, approaches to prevention and treatment should focus not only on symptom reduction and safety planning, but also on interventions to promote children’s positive engagement and emotions during play and other interactive activities.

Author statement

The submitted article is original, has been written by the stated authors, has not been published previously, and is not under consideration for publication by another journal. The manuscript’s publication has been approved by all authors and tacitly by the responsible authorities where the work was carried out. The organization, NIMH, that funded the research is listed in the Acknowledgments section of the manuscript, including the grant number. None of the content of the manuscript has been written or edited by anyone other than those individuals listed as an author on the submission. All tables and figures submitted with the manuscript are original.

CRediT authorship contribution statement

John Boekamp: Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Funding acquisition, Data curation, Conceptualization. **Sarah Martin:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization. **Richard Liu:** Writing – review & editing, Funding acquisition, Formal analysis, Conceptualization. **Zachary Kunicki:** Writing – review & editing, Formal analysis, Data curation. **Anjali Gottipay:** Writing – review & editing, Investigation, Data curation. **Lydia Lin:** Writing – review & editing, Investigation, Data curation. **Claudia Paszek:** Investigation, Data curation. **Daniel Klein:** Writing – review & editing, Methodology, Conceptualization. **Anthony Spirito:** Writing – review & editing, Writing – original draft, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors of this manuscript do not have any potential conflicts of interest, financial or otherwise, that might have influence their judgment, decision-making, or actions, with respect to the preparation of this manuscript.

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