

# Trajectories of Suicidal Thoughts and Behaviors From Preschool Through Late Adolescence

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**Objective:** Suicidal thoughts and behaviors (STBs) represent a significant and escalating public health concern in youth. Evidence that STBs can emerge in the preschool years suggests that some pathways leading to clinically significant STBs begin early in life.

**Method:** This prospective longitudinal study examined the developmental trajectories of STBs in children from ages 3 to 17, oversampled for preschool-onset depression.

**Results:** Three unique trajectories of STBs across childhood and adolescence were identified: low class ( $n = 273$ ) characterized by low rates of STBs, early-persistent class ( $n = 21$ ) characterized by steadily increasing STBs, and late-onset class ( $n = 21$ ) characterized by low rates of STBs through age 10 followed by a dramatic increase from ages 11 to 14 years. Preschool measures of depression symptoms, externalizing symptoms, impulsivity, and lower income relative to needs were associated with both high-risk STB classes. Both high-risk STB classes reported greater functional impairment, more externalizing symptoms, and more cumulative stressful life events in adolescence relative to the low class; the late-onset class also reported poorer academic functioning relative to both the early-persistent and low classes.

**Conclusion:** A significant minority of this prospectively followed group of preschool children evidenced STBs by and/or after age 10. Although relatively rare before age 10, approximately half of the children who experienced STBs in adolescence first exhibited STBs in early childhood and comprised a trajectory suggesting increasing STBs. In contrast, approximately half of children first exhibited STBs in early adolescence. Early screening and identification of at-risk youth during both preschool and late childhood is important for early intervention regarding STBs.

**Key words:** longitudinal, preschool, suicidal ideation, suicide behavior, youth

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**B**etween 2006 and 2016, rates of suicide in youth ages 10 to 19 years increased by 30%, and youth presenting to hospitals with suicidal thoughts or attempts nearly doubled between 2008 and 2015.<sup>1</sup> Suicide is now the third leading cause of death in children younger than 14 years old.<sup>2</sup> A recent meta-analysis found few accurate predictors of suicidal thoughts and behaviors (STBs),<sup>3</sup> highlighting the need for greater knowledge about developmental trajectories of STBs. Increased understanding of predictors of risk trajectories has the potential to uncover how suicide risk unfolds over time.

STBs, defined as suicidal ideation, plans, or attempts, typically increase over the course of development in at-risk groups. It is often assumed that young children are too developmentally immature to engage in STBs; however, long-standing evidence refutes these assumptions.<sup>4</sup> For example, children as young as 3 years report persistent thoughts about death, suicide behaviors, and even attempts.<sup>5</sup> Suicidal depression has also been documented in

preschool-age children (3–7 years) and is characterized by increased anhedonia, feelings of worthlessness, guilt feelings, nonsuicidal self-injurious behavior, and recurrent thoughts about death.<sup>6</sup> Importantly, recent work found that depressed 4- to 6-year-olds with STBs have a better understanding of death—including the notion that death is permanent—than depressed children without STBs and healthy peers.<sup>7</sup> Thus, some of the pathways that lead to STBs begin early in life, suggesting that studies of STBs may benefit from starting earlier in development to identify antecedents.

Whereas preschool-onset STBs are rare and understudied, more is known about the onset and trajectories of STBs during late childhood and adolescence. A US population-based study of 9- and 10-year-olds found rates of suicidal ideation, self-harm, and suicide attempts were 6.4%, 9.1%, and 1.3%, respectively.<sup>8</sup> Moreover, suicidal ideation tends to increase from 11 to 17 years<sup>9</sup> with some evidence of a peak in incidence at 15–16 years in girls and

a steady increase over those years in boys.<sup>10</sup> Prospective studies indicate that suicidal ideation and self-harm predict later suicide attempts, and suicide attempts predict suicide in adolescents.<sup>11</sup> There is also a sharp increase in suicide in early adolescence and young adulthood.<sup>12</sup>

Alongside onset and prevalence rates, trajectories of STBs throughout adolescence have been identified. For example, in one study that followed African American youth from 11 to 19 years, suicidal ideation peaked around 12 to 13 years.<sup>13</sup> Another longitudinal study of adolescents from 14 to 17 years identified 3 STB trajectories: increasing, decreasing, and not present.<sup>14</sup> Finally, a nationally representative study that followed participants over 20 years (age range, 11-32) also found 3 STB trajectories: low and slightly decreasing, low and slightly increasing, and high and slightly decreasing.<sup>15</sup> These trajectory studies began and assessed STBs during adolescence. However, no longitudinal studies began and assessed STBs during preschool and continued through adolescence. Given the evidence for increasing rates of STBs throughout childhood and adolescence and research documenting the emergence of STBs in early childhood, additional work assessing longitudinal trajectories of STBs is needed.

Established risk factors for STBs include family history of suicide and/or suicide attempts, early environmental factors, and psychological factors related to psychopathology and social relationships.<sup>16</sup> Much of the literature on youth risk factors assesses independent factors and has been primarily cross-sectional, which limits the ability to make any type of causal inferences. Less work has focused on identifying classes or subgroups of children with suicidality by incorporating multiple risk factors that may differentiate onset, severity, and/or course.<sup>17</sup> In this article, we briefly review evidence supporting established risk factors of STBs in youth.

Family history of suicide and/or suicide attempts is considered a biological and psychological risk for STBs.<sup>18,19</sup> Moreover, the heritability of suicide risk is independent of risk for psychiatric disorders broadly.<sup>20</sup> However, family history of suicide attempts or suicide does not appear to be associated with early childhood STBs,<sup>5,21</sup> suggesting developmental differences in family history as a risk factor.

Environmental factors associated with STBs in youth include low socioeconomic status (SES),<sup>22</sup> experiencing stressful life events, and childhood maltreatment.<sup>23</sup> There is a substantial literature linking STBs with exposure to stress and early adversity,<sup>24</sup> and longitudinal prospective studies have demonstrated that physical and sexual abuse in childhood is linked with later suicide attempts and death in youth.<sup>22,23</sup>

Psychological factors associated with STBs in youth include internalizing and externalizing psychopathology and poor social functioning. Depression, in particular, has been consistently associated with STBs.<sup>16</sup> Guilt, a prominent feature of depression, is also independently associated with suicide.<sup>25</sup> Externalizing problems and impulsivity have been linked with STBs in youth<sup>16,24,26</sup> and may have particular relevance for STBs in younger children. Specifically, one study found that compared with adolescents, 5- to 11-year-olds who died by suicide were more likely to have externalizing symptoms and less likely to have depression/dysthymia.<sup>27</sup> The impact of poor social functioning on STBs, especially social rejection and bullying, has also received attention. Several longitudinal studies have demonstrated that childhood social problems are related to later STBs<sup>28-31</sup> with recent work suggesting that increased social media use may play a role in risk of STBs.<sup>32,33</sup>

Given the increasing public health crisis regarding STBs in childhood and new data on early onset,<sup>1,5</sup> understanding how suicide risk unfolds across development and how specific factors predict risk trajectories has the potential to identify earlier windows for prevention and intervention. The current prospective longitudinal study examined trajectories of STBs from preschool to adolescence in children oversampled for depression during the preschool period. Based on previous work examining trajectories of STBs in adolescents,<sup>13-15</sup> it was broadly hypothesized that there would be 3 unique trajectory groups: increasing, decreasing, and stable low STBs. Based on the previously detailed evidence, several family, environmental, and psychological factors were hypothesized to predict STBs over time: family history of suicide and/or suicide attempts; lower SES; experiencing more stressful life events; poor peer relationships; and psychopathology including high levels of depression, high impulsivity, and externalizing symptoms. Finally, it was hypothesized that children with increasing STBs would evidence greater functional and academic impairment in adolescence relative to children with decreasing or stable low STBs.

## METHOD

### Participants

Participants were 348 children and their primary caregivers enrolled in the Preschool Depression Study, an ongoing study of children and their families designed to investigate the longitudinal outcomes of early-onset depression at the Washington University School of Medicine in St. Louis.<sup>34,35</sup> Children between ages 3.0 and 5.9 years were recruited between 2003 and 2005 from pediatrician's offices, day care centers, and preschools in the St. Louis

metropolitan area. Children were screened with the Preschool Feelings Checklist<sup>36</sup> and oversampled for depression and externalizing symptoms. Exclusion criteria were chronic medical illnesses, neurological disorders, pervasive developmental disorders, or language and/or cognitive delays (see Luby *et al.*<sup>34</sup> for additional details). All study procedures were approved by the Washington University School of Medicine in St. Louis Institutional Review Board before data collection.

There were 306 children enrolled at preschool age (between ages 3.0 and 5.9 years). Approximately 65% ( $n = 197$ ) of children had a psychiatric diagnosis during time points 1-3. Of those children, 25% ( $n = 75$ ) had depression and 32% ( $n = 99$ ) had an externalizing disorder. Eight additional follow-up assessments occurred approximately 1 year apart, with longer intervals between time points 3 and 4 (approximately 2.5 years) and time points 8 and 9 (approximately 3 years), owing to grant funding cycles (Figure S1, available online). Beginning at time point 6 (ages 8-13.6 years), 42 new healthy children, age-matched to children with psychiatric disorders, were recruited and followed to increase the number of children without psychopathology.<sup>37</sup> The number of children with an assessment at each age is detailed in Supplement 1, available online. Of these 348 participants, 315 completed at least 3 assessments (mean [SD] = 6.1 [1.9]; range, 3-9 assessments) and were included in quadratic growth mixture models (described below).

## Measures

**Trajectories of STBs.** STBs were assessed via the Preschool Age Psychiatric Assessment (PAPA),<sup>38</sup> Child and Adolescent Psychiatric Assessment (CAPA),<sup>39</sup> or Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS)<sup>40</sup> at each time point, including baseline and up to 8 follow-up assessments, using the age-appropriate diagnostic interview. When participants were 3.0 to 7.9 years, the PAPA was administered to parents. When participants were 8.0 to 8.9 years, the CAPA was administered to parents only, and when participants were 9.0 years and older, the CAPA was administered separately to parents and children. When participants were 16 years or older, the K-SADS was administered separately to parents and adolescents. Parent and child report on the CAPA and K-SADS were combined by taking the most severe rating. Raters were trained to reliability and blinded to the child's previous diagnostic status.<sup>34,35</sup> All interviews were audiotaped, and methods to maintain reliability and prevent drift, including ongoing calibration of interviews by master raters for 20% of each interviewer's cases, were implemented in consultation with an experienced clinician at each time

point. A dichotomous STB variable was calculated at each time point as the endorsement of any of the following symptoms: suicidal themes in play (PAPA), suicidal thoughts, suicide plan (PAPA, CAPA), suicidal behavior, or suicide attempt (PAPA, CAPA, K-SADS) (see Table S1, available online).

**Preschool Predictors of STB Trajectories.** Depression severity was calculated by summing the number of major depressive disorder symptoms endorsed on the PAPA at baseline, excluding STBs. These included depressed/irritable mood, anhedonia, insomnia/hypersomnia, fatigue, decreased concentration, weight/appetite change, psychomotor agitation/retardation, and worthlessness/guilt.

Externalizing symptoms were assessed with the MacArthur Health and Behavior Questionnaire-Parent (HBQ-P<sup>41</sup>) at baseline. The HBQ-P includes 4 externalizing subscales: Oppositional Defiant (9 items), Conduct Problems (12 items), Overt Hostility (4 items), and Relational Aggression (6 items). Items are rated from 0 ("never/not true") to 2 ("often or very true").

Impulsivity was assessed with the 9-item Impulsivity subscale of the HBQ-P<sup>41</sup> at baseline. Items are rated from 0 ("never/not true") to 2 ("often or very true").

Guilt feelings and reparation was assessed with the My Child: Version 2<sup>42</sup> at baseline. The My Child scale is a 100-item parent-report measure of children's self-conscious emotions. Items are rated from 1 ("extremely untrue") to 7 ("extremely true"), and subscale means are computed.

The PAPA assessed how often children experienced any of 18 early stressful life events (eg, change in day care/school, birth of sibling).<sup>38</sup> Frequency of these events experienced before age 7 was summed to create a measure of early stressful life events.

Peer relationships were assessed with the Peer Relations subscale of the HBQ-P<sup>41</sup> at baseline, a composite of the Peer Acceptance/Rejection (8 items) and Bullied by Peers (3 items) subscales. The composite assesses friendship quality, the extent to which the child is liked by peers, and how frequently the child is teased or picked on. Items are rated from 1 ("not at all like") to 4 ("very much like").

Social withdrawal was assessed using the mean of the Asocial With Peers (6 items) and Social Inhibition (3 items) subscales of the HBQ-P<sup>41</sup> at baseline. Items are rated from 0 ("never or not true") to 2 ("often or very true").

The Family Interview for Genetic Studies (FIGS),<sup>43</sup> a structured measure designed to assess diagnostic information about relatives, was used to assess family history of suicide and/or suicide attempts in first- and second-degree relatives at each time point. A senior psychiatrist, blinded to the child's diagnostic status, reviewed questions about the

diagnostic status of family members (J.L.L.). Family history of suicide and/or suicide attempts was coded dichotomously (present or absent).

An income-to-needs ratio was computed as the total family income at baseline divided by the federal poverty level, based on family size, at the time of data collection.<sup>44</sup>

*Preschool to Middle Childhood Predictors of STB Trajectories.* Depression, externalizing symptoms, impulsivity, guilt, early stressful life events, peer relationships, social withdrawal, family history of suicide and/or attempts, and income-to-needs (all detailed above) were assessed at each time point between 3 and 10 years and used as early to middle childhood predictors of STB trajectories. Because participants had several assessments before age 10, individual participants' estimated intercepts and slopes were extracted from multilevel models of each subscale (see "Results" for further details).

*Adolescent Outcomes of STB Trajectories.* Adolescent outcomes were taken from the final assessment time point for each participant 14 years or older. Participants who completed their final assessment before age 14 were not included in the analyses of adolescent outcomes.

Scores on the HBQ-P externalizing subscales at the final assessment assessed adolescent externalizing symptoms.

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The frequency of stressful life events reported on the PAPA/CAPA/K-SADS were summed to create a cumulative stressful life events score indicating the frequency of stressful life events experienced through the final assessment.

The Functional Impairment scale (7 items) of the HBQ-P<sup>41</sup> administered at the final assessment was used to quantify the amount of impairment exhibited across several domains of functioning, including school, home/family, and social. Items are rated from 0 ("none") to 2 ("a lot").

The Academic Functioning scale of the HBQ-P<sup>41</sup> is a composite of the School Engagement (8 items) and Academic Competence (8 items) subscales. Items are rated from 1 ("not at all") to 4 ("quite a bit").

## Data Analytic Plan

*Growth Mixture Models.* Growth mixture models were used to identify groups with similar courses of STBs. Age at assessment was the time variable and ranged from 3 to 19 years; however, the model could not be run including data from ages 18 and 19 because no participants with an assessment at age 18 ( $n = 4$ ) or 19 ( $n = 1$ ) endorsed STBs at that age and thus effectively covered ages 3–17 years. We

selected an optimal number of class trajectories by following an iterative sequence.<sup>45</sup> Consistent with best practices<sup>46,47</sup> for class selection, as part of this sequence, model fit was evaluated through comparisons of the Lo-Mendell-Rubin adjusted likelihood ratio test  $p$  value, Bayesian information criterion, entropy, and group size. Model fit of a  $k$  class model (eg, a 4-class model) was compared with the model fit of a  $k - 1$  class model (eg, a 3-class model). This process concluded and the optimal number of classes was determined when the likelihood ratio tests were no longer significant, when overextraction was evident, or when a class model failed to converge.<sup>46,48</sup> The 3-class model was selected because it had the lowest sample size adjusted Bayesian information criterion and because the Lo-Mendell-Rubin adjusted likelihood ratio was no longer significant for the 4-class model. See Table S2, available online, for all selection criteria.

Growth mixture model analyses were fit using Mplus Version 8.6.<sup>49</sup> Given the longitudinal nature of the data, some cases were missing owing to attrition, and thus a full-information maximum-likelihood estimator was used because these models assume the data are missing at random and produce estimates based on all available data. Even subjects with no missing assessments had missing data because the time variable was age, not wave, and there were more possible ages than waves.

*Preschool and Middle Childhood Predictors of STB Latent Classes.* Baseline depression, externalizing symptoms, impulsivity, guilt, early stressful life events, peer relationships, social withdrawal, family history of suicide and/or attempts, and income-to-needs were each tested as potential predictors of membership in each latent class. Multinomial logistic regression models with latent class as the dependent variable were used to assess differences in preschool and middle childhood variables by class. When omnibus tests were significant, odds ratios with 95% CI comparing each pair of latent classes were calculated.

*Adolescent Outcomes of STB Latent Classes.* Adolescent externalizing symptoms, internalizing symptoms, cumulative stressful life events, functional impairment, and academic functioning were included as outcome measures of latent class membership. Linear regressions with outcome as the dependent variable and latent class as the independent variable were conducted. Contrast statements were added to the model for pairwise class comparisons when omnibus tests were significant.

Covariates included child sex (all analyses), age at baseline (preschool predictors), and age at last assessment (adolescent outcomes). To account for multiple

comparisons, false discovery rate (FDR)  $p$  values were calculated within each set of analyses (demographics, preschool-age predictors, adolescent outcomes, and post hoc analyses). The FDR uses a rank-order approach to control for the proportion of false discoveries across multiple analyses.

## RESULTS

### STB Trajectories

As described above, the 3-class model was selected as the best-fitting model. Intercept, slope, and quadratic estimates from this model are presented in Table 1. As can be seen in Figure 1, each of the 3 trajectories shows a distinct pattern over time (see Table S3, available online for rates of endorsement of STBs by age). The largest class ( $n = 273$ ) is characterized by low rates of STBs at all points between 3 and 17 years (termed low). The low class reported overall low levels of STBs, although given that children were originally oversampled for depressive symptoms, as might be expected, some children in this class did transiently exhibit STBs at ages 3 through 9 years. The second class ( $n = 21$ ) is characterized by a steady, linear increase in the proportion of STBs endorsed over the study period (termed early-persistent). The third class ( $n = 21$ ) shows a unique trajectory characterized by a very low proportion of STBs early in development (ages 3–9 years), followed by a sharp increase after age 10, which peaks around age 15 and then begins to decrease (termed late-onset). Classes did not differ in IQ ( $\chi^2 = 3.70$ ,  $p = .16$ ), proportion of males and females ( $\chi^2 = 3.37$ ,  $p =$

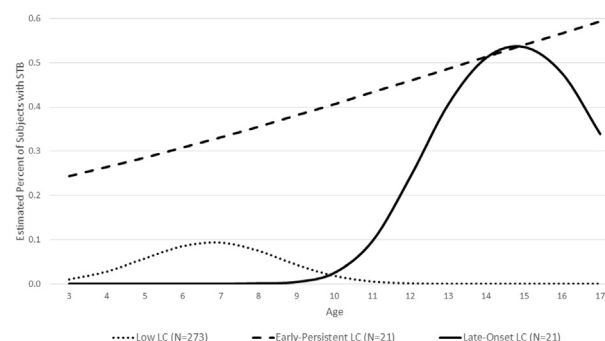
**TABLE 1** Intercept, Slope, and Quadratic Estimates From the 3-Latent Class Growth Mixture Model of Suicidal Thoughts and Behaviors by Age

|                                  | Estimate | SE    | Estimate/SE | $p$    |
|----------------------------------|----------|-------|-------------|--------|
| Low LC ( $n = 273$ )             |          |       |             |        |
| Intercept                        | −2.079   | 0.923 | −2.252      | .024   |
| Slope                            | 1.265    | 0.472 | 2.678       | .007   |
| Quadratic                        | −0.168   | 0.056 | −3.002      | .003   |
| Early-persistent LC ( $n = 21$ ) |          |       |             |        |
| Intercept                        | 1.435    | 0.362 | 3.965       | < .001 |
| Slope                            | 0.108    | 0.054 | 2.007       | .045   |
| Quadratic <sup>a</sup>           |          |       |             |        |
| Late-onset LC ( $n = 21$ )       |          |       |             |        |
| Intercept                        | −20.395  | 4.694 | −4.345      | < .001 |
| Slope                            | 3.922    | 0.898 | 4.369       | < .001 |
| Quadratic                        | −0.166   | 0.043 | −3.913      | < .001 |

Note: LC = latent class.

<sup>a</sup>Nonsignificant, removed from model.

**FIGURE 1** Estimated Latent Class Trajectories From the 3-Latent Class Growth Mixture Model of Suicidal Thoughts and Behaviors by Age



Note: LC = latent class; STB = suicidal thoughts and behaviors

.19), or race ( $\chi^2 = 1.28$ ,  $p = .86$ ), as detailed in Table 2. Overall, 42 of 315 (approximately 13%) children exhibited STBs in later childhood and adolescence, with about half having persistent and increasing STBs (early-persistent) and the other half developing STBs later in childhood and adolescence (late-onset). The low and early-persistent classes align with the study predictions for expected trajectories. Contrary to predictions, there was no evidence for a decreasing class. The emergence of the late-onset class was unexpected and further explored in post hoc analyses.

### Preschool Age Predictors of STB Trajectories

Differences in preschool-age predictors across STB trajectories are presented in Table 3. Relative to the low class, both the early-persistent and the late-onset classes reported more preschool externalizing and depression symptoms and impulsivity ( $ps < .05$ ); a similar pattern for peer relationships did not survive FDR correction. Moreover, relative to the low class, the late-onset class reported lower income-to-needs ( $p < .01$ ). Classes did not differ on family history of suicide and/or attempts, early stressful life events, social withdrawal, or guilt. These findings are broadly in line with study hypotheses, as when differences emerged between the classes, they were driven by increases in risk factors for both of the increasing STB classes (externalizing, depression, impulsivity) or the late-onset class (income-to-needs) relative to the low class.

### Adolescent Outcomes of STB Trajectories

Outcomes during adolescence were examined as a function of STB latent class (Table 4). Relative to the low class, both the late-onset and the early-persistent classes reported greater functional impairment, more externalizing



TABLE 2 Demographic and Descriptive Characteristics

| Characteristic           | Total<br>(N = 315) |        | Low<br>(n = 273) |        | Early-<br>persistent<br>(n = 21) |        | Late-onset<br>(n = 21) |        | Omnibus test |       | Low vs late-<br>onset |          | Early-<br>persistent vs<br>late-onset |          | Low vs early-<br>persistent |          |
|--------------------------|--------------------|--------|------------------|--------|----------------------------------|--------|------------------------|--------|--------------|-------|-----------------------|----------|---------------------------------------|----------|-----------------------------|----------|
|                          | Mean               | (SD)   | Mean             | (SD)   | Mean                             | (SD)   | Mean                   | (SD)   | $\chi^2$     | p     | OR                    | (95% CI) | OR                                    | (95% CI) | OR                          | (95% CI) |
|                          | n                  | (%)    | n                | (%)    | n                                | (%)    | n                      | (%)    | $\chi^2$     | p     | FDR p                 |          | FDR p                                 |          | FDR p                       |          |
| Baseline age, y          | 5.12               | (2.03) | 5.21             | (2.15) | 4.85                             | (0.68) | 4.34                   | (0.85) | 3.70         | .1575 | .2230                 |          |                                       |          |                             |          |
| Last assessment age, y   | 13.76              | (3.11) | 13.53            | (3.13) | 14.28                            | (2.79) | 16.30                  | (1.61) | 13.10        | .0014 | .0084                 |          |                                       |          |                             |          |
| Baseline income-to-needs | 2.09               | (1.13) | 2.16             | (1.12) | 1.82                             | (1.07) | 1.46                   | (1.12) | 8.13         | .0171 | .0513                 |          |                                       |          |                             |          |
| IQ score                 | 105.0              | (14.6) | 105.8            | (14.5) | 101.9                            | (14.3) | 100.1                  | (15.6) | 3.70         | .1574 | .2230                 |          |                                       |          |                             |          |
| Sex, male                | 163                | (51.8) | 138              | (50.6) | 15                               | (71.4) | 10                     | (47.6) | 3.37         | .1858 | .2230                 |          |                                       |          |                             |          |
| Race                     |                    |        |                  |        |                                  |        |                        |        | 1.28         | .8642 | .8642                 |          |                                       |          |                             |          |
| White                    | 168                | (53.3) | 148              | (54.2) | 10                               | (47.6) | 10                     | (47.6) |              |       |                       |          |                                       |          |                             |          |
| Black                    | 108                | (34.3) | 93               | (34.1) | 7                                | (33.3) | 8                      | (38.1) |              |       |                       |          |                                       |          |                             |          |
| Other                    | 39                 | (12.4) | 32               | (11.7) | 4                                | (19.1) | 3                      | (14.3) |              |       |                       |          |                                       |          |                             |          |

Note: FDR = false discovery rate; OR = odds ratio.

symptoms, and more cumulative stressful life events. The late-onset class also reported poorer academic functioning relative to both the low and the early-persistent classes and more internalizing symptoms relative to the low class. Moreover, STB latent class continued to predict stressful life events, functional impairment, academic functioning, and externalizing when each of the preschool predictors are included in the model (except preschool externalizing in the model of adolescent externalizing), suggesting that latent class explains unique variance in functional impairment not accounted for by other predictors.

### Post Hoc Analyses Exploring Preschool-to-Middle Childhood Predictors of Late-Onset Trajectory

Factors that may explain the rapid increase in STBs after age 10 for the late-onset class were examined in post hoc analyses (Table S4, available online). Repeatedly assessed measures from ages 3 through 9.11 years included depression, externalizing symptoms, impulsivity, guilt, peer relationships, and social withdrawal. Multilevel linear models, including random intercept and slope components, generated individual participants' estimated intercepts and slopes for each of the above potential risk factors. Changes (eg, slopes) from ages 3 through 9.11 years were estimated for depression, externalizing, impulsivity, guilt, peer relationships, and social withdrawal. Cumulative stressful life events, family history of suicide and/or attempts, and income-to-needs just at age 10 were also examined as potential risk factors. Differences in pubertal status at age 10 were also analyzed, given the increased risk for STBs that emerges after puberty.<sup>50</sup>

Relative to the early-persistent class, the low class had a shallower negative slope in externalizing symptoms ( $p < .001$ ). Furthermore, the omnibus test revealed significant effects of income-to-needs and social withdrawal slopes that suggested that children in the late-onset class experienced lower income-to-needs and did not have an age-appropriate decline in social withdrawal in early to middle childhood relative to the early-persistent and low classes; however, these effects did not survive FDR corrections. The classes did not differ in changes in depression, impulsivity, peer relationships, guilt, family history of suicide and/or attempts, cumulative stressful life events through age 9, or puberty status at age 10.

## DISCUSSION

This study identified 3 unique developmental trajectories of STBs that emerge during preschool and extend through adolescence (ages 3-17 years): low, early-persistent, and late-

**TABLE 3** Preschool Predictors (Baseline Measures) of Latent Class Membership Covarying for Sex and Age at Baseline

| Predictor                   | Low (n = 237) |        |  | Early-persistent (n = 21) |        |  | Late-onset (n = 21) |        |  | Omnibus test |         | Low vs late-onset |             | Early-persistent vs late-onset |              | Low vs early-persistent |             |
|-----------------------------|---------------|--------|--|---------------------------|--------|--|---------------------|--------|--|--------------|---------|-------------------|-------------|--------------------------------|--------------|-------------------------|-------------|
|                             | Mean          | (SD)   |  | Mean                      | (SD)   |  | Mean                | (SD)   |  | $\chi^2$     | P       | OR                | (95% CI)    | OR                             | (95% CI)     | OR                      | (95% CI)    |
|                             | n             | (%)    |  | n                         | (%)    |  | n                   | (%)    |  |              |         |                   |             |                                |              |                         |             |
| Income-to-needs             | 2.19          | (1.17) |  | 1.82                      | (1.07) |  | 1.46                | (1.12) |  | 8.27         | .0160   | 1.70              | (1.15-2.52) | 1.29                           | (0.76-2.20)  | 1.31                    | (0.89-1.95) |
| Depression                  | 1.89          | (1.57) |  | 3.38                      | (1.53) |  | 2.81                | (1.50) |  | 16.66        | .0002   | 0.70              | (0.54-0.92) | 1.14                           | (0.81-1.62)  | 0.62                    | (0.47-0.81) |
| Early stressful life events | 4.80          | (5.02) |  | 5.10                      | (3.67) |  | 5.29                | (2.92) |  | 0.25         | .8809   |                   |             |                                |              |                         |             |
| Externalizing symptoms      | 0.43          | (0.31) |  | 0.82                      | (0.34) |  | 0.56                | (0.35) |  | 18.46        | < .0001 | 0.24              | (0.06-0.95) | 3.47                           | (0.62-19.50) | 0.07                    | (0.02-0.25) |
| Impulsivity                 | 0.81          | (0.41) |  | 1.20                      | (0.44) |  | 0.99                | (0.43) |  | 13.62        | .0011   | 0.31              | (0.10-0.93) | 1.99                           | (0.45-8.72)  | 0.15                    | (0.05-0.47) |
| Peer relationships          | 3.52          | (0.51) |  | 3.19                      | (0.68) |  | 3.32                | (0.71) |  | 6.91         | .0316   |                   |             |                                |              |                         |             |
| Social withdrawal           | 0.67          | (0.39) |  | 0.65                      | (0.37) |  | 0.65                | (0.39) |  | 0.10         | .9510   |                   |             |                                |              |                         |             |
| Guilt reparation            | 26.71         | (4.29) |  | 25.24                     | (4.96) |  | 25.44               | (4.47) |  | 2.96         | .2282   |                   |             |                                |              |                         |             |
| Guilt feelings              | 17.82         | (2.63) |  | 18.30                     | (2.66) |  | 17.94               | (3.03) |  | 1.21         | .5465   |                   |             |                                |              |                         |             |
| Family history of suicide   | 46            | (20.2) |  | 3                         | (14.3) |  | 3                   | (15.0) |  | 0.88         | 0.6448  |                   |             |                                |              |                         |             |
|                             |               |        |  |                           |        |  |                     |        |  | 0.88         | 0.6448  |                   |             |                                |              |                         |             |

Note: FDR = false discovery rate; OR = odds ratio.

onset. Of the 42 children in the high-risk groups (approximately 13% of the sample), about half exhibited persistent and increasing STBs starting as early as preschool (early-persistent), and half first exhibited STBs in early adolescence (late-onset). The low and early-persistent classes were consistent with study hypotheses and extend our knowledge of trajectories of STBs earlier into development, highlighting their emergence as early as the preschool period. The finding of a third late-onset class was not hypothesized but was of interest. This class reported low rates of STBs through age 10 followed by a dramatic increase in STBs after age 10.

Several preschool-age risk factors distinguished the low- from high-risk STB classes, including depression, externalizing symptoms, impulsivity, and lower income-to-needs. There was also some indication that children in the high-risk STB classes might struggle with peer relationships, although these did not survive FDR correction. These findings are largely in line with previous studies of correlates and risk factors for STBs in school age and adolescent youth,<sup>16</sup> providing further evidence for their association with STBs and extending evidence for their relevance to preschool-age children. However, no preschool-age risk factors uniquely predicted the early-persistent from the late-onset class. Contrary to hypotheses, family history of suicide and/or suicide attempts, early stressful life events, social withdrawal, and guilt did not differ by class. As most research on these risk factors for STBs has focused on adolescents, a downward extension of these specific factors may not be applicable. For example, some risk factors may not have been experienced or may not have accumulated to a significant degree to have an effect during the preschool period.

In our prior work, we found evidence of continuation in STBs from preschool to school age.<sup>5</sup> The current study extends these findings by creating latent classes that span from preschool to adolescence and showing that children in the high-risk STB classes had worse adolescent outcomes than children in the low class, including greater functional impairment, more externalizing symptoms, and more experiences of stressful life events (early-persistent and late-onset) and more internalizing symptoms and poorer academic functioning (late-onset only). These findings suggest that trajectories of increasing STBs have widespread implications for mental health and functioning across several domains.

During adolescence, participants in the late-onset class had poorer academic functioning relative to those in the early-persistent class, and this was the only variable that distinguished the 2 high-risk STB classes. This finding is not surprising given the precipitous change in STBs in the late-

**TABLE 4** Adolescent Outcomes Covarying for Sex and Age at Last Assessment

| Outcome                           | Low (n = 133) |        | Early-persistent (n = 13) |        | Late-onset (n = 20) |        | Omnibus test |         | Low vs late-onset |         | Early-persistent vs late-onset |       | Low vs early-persistent |       |
|-----------------------------------|---------------|--------|---------------------------|--------|---------------------|--------|--------------|---------|-------------------|---------|--------------------------------|-------|-------------------------|-------|
|                                   |               |        |                           |        |                     |        |              |         |                   |         |                                |       |                         |       |
|                                   | Mean          | (SD)   | Mean                      | (SD)   | Mean                | (SD)   | F            | p       | F                 | p       | F                              | p     | F                       | p     |
| Cumulative stressful life events  | 39.3          | (34.3) | 65.5                      | (80.3) | 98.0                | (82.7) | 14.06        | < .0001 | 25.97             | < .0001 | 3.20                           | .0753 | 3.99                    | .0474 |
| Functional impairment             | 0.22          | (0.32) | 0.45                      | (0.52) | 0.62                | (0.48) | 12.04        | < .0001 | 21.28             | < .0001 | 1.80                           | .1818 | 4.62                    | .0330 |
| Academic functioning              | 4.02          | (0.63) | 3.87                      | (0.63) | 3.40                | (0.92) | 7.16         | .0011   | 14.27             | .0002   | 4.12                           | .0440 | 0.38                    | .5371 |
| Adolescent externalizing symptoms | 0.16          | (0.19) | 0.34                      | (0.30) | 0.26                | (0.31) | 5.38         | .0055   | 3.96              | .0483   | 0.90                           | .3430 | 7.85                    | .0057 |
| Adolescent internalizing symptoms | 0.23          | (0.20) | 0.33                      | (0.20) | 0.51                | (0.42) | 12.15        | < .0001 | 23.17             | < .0001 | 3.83                           | .0522 | 2.44                    | .1204 |

Note: FDR = false discovery rate.

onset class before this measurement and is consistent with other poor outcomes. In addition, this may also suggest that during adolescence, participants in the early-persistent class who have continual and increasing STBs have acquired a coping mechanism within the academic context.

Post hoc analyses explored predictors of the unexpected late-onset class, pointing to externalizing symptoms, social withdrawal, and income-to-needs as factors that should be investigated in future studies. Relative to the early-persistent class, the low class had a shallower negative slope in externalizing symptoms. This is likely a result of the early-persistent class regressing toward more developmentally normative levels of externalizing behavior, whereas the low class started off with low levels and maintained those low levels across the study. Alternatively, 49 children in the low class expressed STBs between ages 3 and 10. Thus, the STBs in this class may be an extreme form of frustration expression associated with persistent externalizing symptoms. Future research exploring this possibility is needed.

Interestingly, while all 3 classes showed age-appropriate decreases in social withdrawal from ages 3 through 9, the late-onset class decreased at a slower rate. Consistent with previous literature,<sup>23</sup> the late-onset class also reported lower income-to-needs at age 10 compared with the low class. However, these effects did not survive FDR correction. Nonetheless, when combined with the preschool-onset risk factors described above, these exploratory findings hint that the late-onset group might be facing more social deprivation and failing to increase engagement with peers. There were no group differences in peer relationships broadly, suggesting that the effect is unique to social withdrawal. A potential picture emerges of the late-onset class as a group of children without early STBs and who experienced low SES throughout early childhood. Over time, children in this class may not increase engagement in social situations or develop relationships that might buffer the negative impact of accumulating stressful life events.<sup>51</sup> Moreover, the social effects of low SES might become highly salient around age 10 as peer pressure and peer comparison increase, driving social withdrawal and STBs as maladaptive coping mechanisms. The effects of accumulating stressful life events may also represent an independent risk for STBs<sup>24</sup> and contribute to social withdrawal.

The findings from the current study are limited in several ways. First, because the children were oversampled for depression, the findings may not generalize to other populations. Second, the findings may be limited by the use of a composite score that combined suicidal thoughts and suicidal behaviors. There is some evidence that predictors of ideation may differ from predictors of the



transition from ideation to plans and attempts.<sup>9</sup> These issues require additional study in samples with higher rates of suicidal behaviors. While several of the predictors of the late-onset class are intriguing and fit with prior literature, the differences did not survive FDR correction and should be taken as hypotheses to be examined in future work.

Clinically, it may be helpful for parents, teachers, and pediatricians to pay additional attention to children at ages 10 and 11 for signs of emerging STBs. Children who experience higher levels of stressful life events and lower income and who fail to engage with other children may be at particular risk for a rapid increase in STBs at this time. Monitoring social engagement both in person and on social media may provide important information about a child's internal emotional state. Second, similar to what has been observed in school-aged children and adolescents, preschool children displaying symptoms of depression, externalizing disorders, and impulsivity from families with lower income-to-needs may be at risk for increasing rates of STBs across childhood and into adolescence. Because these factors can be reliably assessed by preschool age, the potential for early intervention is significant. Intervening on such symptoms in preschool children has the potential to not only treat existing difficulties but also alter a child's overall trajectory away from developing or maintaining STBs.

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Informed written consent (and verbal assent) was obtained from all individual participants included in the study.

Ms. Tillman served as the statistical expert for this research.

### Author Contributions

All authors contributed to the study conception and design. Material preparation and data analysis were performed by B.T., D.J.W., L.H., and N.M.E. The first draft of the manuscript was written by D.J.W., and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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