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ORIGINAL ARTICLE

Prevalence, clinical correlates and maternal psychopathology of deliberate self-harm in children and early adolescents: results from a large community study

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Objectives: Little is known about the prevalence and correlates of deliberate self-harm (DSH) in children from low- and middle-income countries. We investigated the prevalence of DSH and its clinical and maternal psychopathological associations in Brazilian children (n=2,508, ages 6-14y) in a community-based study.
Methods: Participants of the High Risk Cohort Study for the Development of Childhood Psychiatric Disorders (HRC) and their mothers were assessed in structured interviews. Current (last month) and lifetime DSH were estimated, including analysis stratified by age groups. Logistic regressions were performed to investigate the role of the children's clinical diagnoses and maternal psychopathology on DSH prevalence estimates, adjusting for potential confounding factors.
Results: The prevalence of current DSH was 0.8% (children 0.6%, adolescents 1%) and lifetime DSH was 1.6% (1.8% and 1.5%, respectively). Current and lifetime DSH were more frequent in children with depression, attention-deficit/hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD), even in multiple models accounting for demographic variables and co-occurring psychiatric disorders. Maternal anxiety disorder was strongly associated with current and lifetime DSH in offspring; whereas current DSH, specifically in young children, was associated with maternal mood disorder.
Conclusion: Diagnoses of depression, ADHD and ODD were consistently associated with DSH, as was having a mother with anxiety disorder.

Keywords: Deliberate self-harm; self-injurious behavior; suicide attempt; community survey; family health; psychopathology

Introduction

Deliberate self-harm (DSH) is defined as any act of self-poisoning or self-injury carried out by an individual, regardless of motivation or desire to die.[1] DSH is one of the strongest predictors of completed suicide,[2-4] which is the second leading cause of death among 10- to 24-year-olds worldwide, accounting for 6.3% of all deaths.[5] Suicide is the third leading cause of death among youth in low- and middle-income countries (LMIC), accounting for 8% of all deaths among 15- to 29-year-olds.[6] According to the World Health Organization, 75% of suicide deaths worldwide occur in LMIC, which have limited resources to address the issue.[6] This personal tragedy also has devastating consequences for families and the community.[7]

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Community studies have demonstrated that DSH is a set of increasingly common behaviors beginning at age 12 and peaking at around age 15, which then decline by young adulthood.[8-10] Adolescents who deliberately self-harm are at increased risk for developing depression and anxiety disorders later, as well as for repeating DSH by 18 years of age.[11] It was also observed that individuals clustered into overlapping high-risk trajectories of DSH, other suicidal behaviors and substance abuse had high scores for borderline personality disorder criteria.[12] Youth DSH prevalence rates are highly variable, with world lifetime estimates ranging from 4 to 42% and 12-month estimates varying from 3 to 21%, depending on the instruments and methods used to assess suicidal behavior.[13]

In 32 LMIC, the pooled 12-month prevalences of suicide ideation among adolescent females and males, respectively, were 16.2% and 12.2%.[14] The reported prevalence of suicide attempts by adolescents in LMIC ranges from 2.9 to 3.2%.[15-17] In Brazil, the few available studies show a prevalence of suicide ideation in adolescents ranging from 8 to 14%,[18-20] suicide planning from 6 to 10%,[20,21] and suicide attempts from 5.5 to 8.6%.[20,22]

DSH varies substantially according to demographic, clinical and familial factors. Although suicide is more common in young males,[23] DSH is more common in young females.[10,15,20,24-26] High rates of this behavior are also found in adolescents from lower socioeconomic groups.[24,27,28] These findings are not consistent across ethnic groups.[10,24,26,29-32] Furthermore, studies have shown a strong relationship between DSH and mood, anxiety, disruptive, substance use and eating disorders.[9,10,24,27,33,34] Finally, DSH is more common among the offspring of individuals with psychiatric disorders.[35-38]

Despite the seriousness of the problem, little is known about the prevalence of DSH among children and early adolescents in LMIC or its demographic, clinical and familial correlates. No studies adjusted for the co-occurrence of DSH and psychiatric diagnosis have been conducted. More importantly, there is little information worldwide about suicidal behavior in children less than 10 years of age. In the present study, we investigated the prevalence of DSH in Brazilian children and adolescents as part of a large community-based study and explored the role of relevant clinical and familial factors related to DSH.

Methodology

Study design and participants

The High Risk Cohort Study for the Development of Childhood Psychiatric Disorders (HRC) is a large community school-based study of children aged 6 to 14 years from 57 schools in two Brazilian cities: Porto Alegre (n=22) and São Paulo (n=35). During the screening phase, which took place on school enrollment day, 9,937 respondents were interviewed using the Family History Survey.[39] From this pool, two subgroups were recruited using a random selection (n=958) or high-risk selection procedure (n=1,554), which resulted in 2,512 subjects. Four subjects were excluded from the analysis due to missing data for outcome variables, resulting in a total sample of 2,508 subjects with an average age of 9.7 years upon recruitment (standard deviation [SD] = 1.92). Details about the sample and the methodological procedures can be found in Salum et al.[40] This study was approved by the ethics committee of the Universidade de São Paulo (protocol IORG0004884; CONEP no. 15.457; project IRB registration no. 1132/08). Written consent was obtained from all participants' parents, and verbal consent was obtained from all the children. All children with suicidal thoughts were offered consultation with trained psychiatrists and psychologists and were referred to proper services for treatment.

Instruments and measures

Outcomes

Interviews were conducted at home with the biological parents. We collected parental reports about current (last month) and lifetime DSH using the following yes/no questions from the suicidal behavior items of the Brazilian Portuguese version of Development and Well-Being Assessment (DAWBA), a structured interview administered by lay interviewers[41]: "Over the last 4 weeks, has s/he tried to harm or hurt himself/herself?" and "In his/her lifetime, has s/he ever tried to harm or hurt himself/herself?."

Demographic variables

Age, gender, socioeconomic status and ethnicity data were collected. We adopted the 2009 Associação Brasileira de Empresas de Pesquisa (ABEP) criteria for calculating socioeconomic status and then merged classes A and B into a wealthy stratum, C into a middle stratum, and D and E into a poor stratum. Ethnic groups were divided into a majority group, which included Whites, and a minority group, which included Blacks, mixed-race, Asians, Native South Americans, and people of unknown ethnicity.

Child diagnosis

Current child psychiatric diagnoses were assessed using the DAWBA. The responses generated a computerized diagnosis according to DSM-IV-TR criteria. Child psychiatrists evaluated the responses and confirmed, refuted or altered the initial diagnosis proposed by DAWBA algorithms. Diagnoses used for data analysis were: any anxiety disorders (separation, social or generalized anxiety disorder), major depression, attention-deficit/hyperactivity disorder (ADHD), oppositional defiant disorder (ODD) and conduct disorder (CD). A second child psychiatrist rated a total of 200 interviews from the study, which resulted in a high interrater agreement (κ-value = 0.80, expected agreement = 54.6; rater agreement = 90.95).[40] Insufficient power prevented us from performing any analysis with specific diagnostic categories, such as post-traumatic stress disorder, obsessive-compulsive disorder, specific phobia, other depression, mania/bipolar disorder, other hyperactivity, psychosis or eating disorder. However, an 'any mental disorder' variable (present/absent) was created to encompass disorders included or excluded from the specific analysis.

Parental diagnosis

Current parental psychiatric diagnosis was assessed using the Mini International Neuropsychiatric Interview (MINI).[42] Analyses were restricted to mothers, because they represented the vast majority of the respondents (92%). We investigated the following categories: any anxiety disorder (panic, agoraphobia, social or generalized anxiety disorder), any mood diagnosis (the presence of a depressive or manic episode) and psychotic diagnosis. Insufficient power prevented us from performing analyses with specific maternal diagnostic categories, such as substance use disorder and ADHD. An 'any mental disorder' variable (present/absent) was also created to encompass any current anxiety, mood, or substance use disorder, psychosis or ADHD. In eight subjects this variable could not be computed due to missing data regarding psychotic syndrome (n=11) and ADHD (n=16). This discrepancy occurred because the missing data did not impact the 'any mental disorder' value if another maternal

disorder was present, since it would have been tagged as "present" nonetheless. In cases where all other disorders were tagged as "absent," the missing data prevented computation.

Data analysis

DSH prevalence rates were calculated using both unweighted and weighted samples for the oversampling procedure. For details about the HRC's weighting procedure, see Martel et al.[43] Logistic regression models were performed using the survey package from R,[44] taking school clusters into consideration and trimming the weights to fit into an interval between 0.3 and 3 to avoid the inflation of a few cases with too much weight.[45] Associations between DSH and child or parental psychopathology were estimated using three models: 1) bivariate associations (in which each predictor variable was considered individually); 2) multiple associations adjusted for demographic variables; 3) multiple associations adjusted for demographic variables and comorbidity (in which all predictor variables were considered simultaneously). Additional analysis stratified by age was also performed for children (6 to 9y) and early adolescents (10 to 14y). All significance tests were two-sided with a p-level of 0.05.

Results

The sample mainly consisted of white, middle-class boys. The most common diagnoses were ADHD and ODD, and the most common maternal diagnosis was anxiety disorder (Table 1).

Prevalence of deliberate self-harm in children and early adolescents

The lifetime DSH prevalence in the total sample was 1.6% (1.8% for children and 1.5% for adolescents). DSH prevalence in the last month was 0.8% (0.6% for children and 1% for adolescents). There were no significant differences in prevalence rate between the two age groups (odds ratio [OR] = 1.56, 95% confidence interval [95%CI] 0.8-3.05 for current DSH and OR = 0.86, 95%CI 0.47-1.57 for lifetime DSH).

Associations with demographic factors

The prevalence of lifetime and current DSH did not vary with age, gender or race. However, the chance of reporting a lifetime DSH episode was 70% lower among middle-class children than upper-class children. No associations

Table 1 Sample description according to age group and total sample

	6 to 9 years (n=1,172)			10 to 14 years (n=1,336)			Total sample (n=2,508)		
	Unweighted		Weighted	Unweighted		Weighted	Unweighted		Weighted
	n	%	%	n	%	%	n	%	%
Gender									
Male	639	54.5	53.5	694	51.9	52.2	1,333	53.1	52.8
Socioeconomic status									
A/B (the wealthiest)	239	20.4	19.5	287	21.5	21.4	526	21.0	20.5
C	811	69.2	70.9	926	69.3	70.3	1,737	69.3	70.6
D/E (the poorest)	122	10.4	9.5	123	9.2	8.3	245	9.8	8.9
Ethnic group									
Majority (White)	699	59.6	58.3	816	61.1	60.3	1,515	60.4	59.4
Minority (Black, mixed-race, Asian, Native South American or unknown)	473	40.4	41.7	520	38.9	39.7	993	39.6	40.6
Outcomes									
Current DSH	10	0.9	0.6	18	1.3	1.0	28	1.1	0.8
Lifetime DSH	26	2.2	1.8	30	2.2	1.5	56	2.2	1.6
Psychiatric diagnoses (current)									
Any mental disorder	298	25.4	22.2	352	26.3	21.0	650	25.9	21.6
Anxiety disorder	58	4.9	3.8	75	5.6	4.3	133	5.3	4.0
Major depression	23	2.0	1.7	50	3.7	2.4	73	2.9	2.1
ADHD	136	11.6	10.5	137	10.3	8.5	273	10.9	9.4
ODD	71	6.1	5.7	60	4.5	3.8	131	5.2	4.7
Conduct disorder	14	1.2	0.9	26	1.9	1.6	40	1.6	1.2
Maternal psychiatric diagnoses (current)									
Any mental disorder	315	27.0	24.6	435	32.6	28.8	750	30.0	26.8
Anxiety disorder	237	20.2	17.8	347	26.0	23.2	584	23.3	20.6
Any mood disorder	205	17.5	16.2	285	21.3	17.4	490	19.5	16.8
Psychotic syndrome	61	5.2	4.6	58	4.4	3.6	119	4.8	4.1

ADHD = attention-deficit/hyperactivity disorder; CI = confidence interval; DSH = deliberate self-harm; ODD = oppositional defiant disorder. Anxiety disorder includes generalized anxiety disorder, separation anxiety disorder and social anxiety. For children, any mental disorder includes disorders used in specific analysis and post-traumatic stress disorder, including obsessive-compulsive disorder, specific phobia, other depression, mania/bipolar disorder, other hyperactivity, psychosis or eating disorder. For mothers, any mental disorder encompasses any current anxiety, mood, substance abuse, psychotic or attention-deficit/hyperactivity disorders.

were found between current DSH and socioeconomic status. Associations between DSH and demographic factors were similar between child and adolescent subpopulations (Table 2).

Clinical associations

Current and lifetime DSH were more frequent in children with major depression, ADHD and ODD, after controlling for demographic variables and the co-occurrence of psychiatric disorders. For both current and lifetime DSH, there were significant associations with conduct disorders in bivariate and multiple models adjusted for demographic factors, although the associations were fully explained by other diagnoses in multiple models adjusted for comorbidity (Table 3). Stratified analysis according to age-group revealed the same pattern of associations for adolescents (Table 4). For children, current DSH was associated with major depression and ADHD in a fully adjusted model, while associations with ODD and conduct disorder were non-significant. In children, however, lifetime DSH was associated with major depression and conduct disorder, but not with ADHD or ODD (Table 4).

Associations with maternal diagnosis

Mothers with anxiety disorders were three times more likely than those without them to report a current or lifetime episode of DSH in their offspring. Current and lifetime associations between offspring DSH and maternal mood disorders were found in bivariate models and models adjusted for demographic factors, although the associations were fully explained by other diagnoses in multiple models adjusted for the co-occurrence of other psychiatric disorders. No associations were found for mothers with a psychotic syndrome (Table 3). According to the completely adjusted models presented in Table 5, with results stratified by age group, we can confirm that maternal anxiety is associated with lifetime DSH among children, as well as with current DSH among adolescents. On the other hand, maternal mood disorders predict current DSH, specifically in children.

Discussion

This study provides the prevalence rates of DSH, its clinical correlates and association with maternal psychopathology with in children and adolescents from a community sample. The current and lifetime DSH prevalences were 0.6% and 1.8%, respectively, with no significant differences regarding age, gender or race. The chance of reporting a lifetime DSH episode was lower among the middle-class than the upper-class. Major depression, ADHD and ODD were associated with DSH independently of co-occurring psychiatric syndromes. Moreover, maternal anxiety disorder was strongly associated with lifetime DSH in children and with current DSH in adolescents. However, maternal mood disorder was associated with current DSH specifically in younger children.

Our lifetime DSH estimate was lower than that of a recent systematic review, which reported an international

Table 2 Deliberate self-harm (DSH) prevalence in subpopulations and demographic bivariate associations stratified by age

	6 to 9 years (n=1,172)				10 to 14 years (n=1,336)				Total sample (n=2,508)			
	Current DSH (last month)		Lifetime DSH		Current DSH (last month)		Lifetime DSH		Current DSH (last month)		Lifetime DSH	
	%	Bivariate model OR (95%CI)	%	Bivariate model OR (95%CI)	%	Bivariate model OR (95%CI)	%	Bivariate model OR (95%CI)	%	Bivariate model OR (95%CI)	%	Bivariate model OR (95%CI)
Age		1.49 (0.77-2.86)		1.52 (0.86-2.67)		1.03 (0.77-1.38)		0.95 (0.75-1.19)		1.14 (0.95-1.37)		1.00 (0.86-1.17)
Gender												
Male	0.3	1	2.1	1	0.8	1	1.5	1	0.5	1	1.8	1
Female	1	3.82 (0.84-17.29)	1.3	0.61 (0.23-1.63)	1.2	1.48 (0.49-4.45)	1.6	1.07 (0.46-2.50)	1.1	2.05 (0.89-4.75)	1.5	0.81 (0.46-1.43)
Socioeconomic Status												
A/B (the wealthiest)	1.5	1	4.7	1	0.8	1	2.7	1	1.1	1	3.6	1
C	0.4	0.28 (0.06-1.25)	1	0.20 (0.08-0.48)*	0.9	1.18 (0.25-5.44)	1.1	0.42 (0.18-0.96)†	0.7	0.62 (0.28-1.35)	1.1	0.29 (0.18-0.47)*
D/E (the poorest)	0.3	0.20 (0.02-1.95)	1.5	0.31 (0.07-1.35)	1.8	2.27 (0.32-16.05)	1.8	0.67 (0.15-2.90)	1.0	0.92 (0.23-3.63)	1.6	0.45 (0.16-1.25)
Race												
Majority (White)	0.7	1	2	1	1.2	1	1.9	1	1.0	1	2.0	1
Minority (Black, mixed-race, Asian, Native South American or unknown)	0.6	0.85 (0.17-4.16)	1.4	0.73 (0.28-1.88)	0.6	0.50 (0.14-1.75)	0.9	0.45 (0.16-1.29)	0.6	0.61 (0.21-1.77)	1.2	0.59 (0.28-1.22)

* $p < 0.001$; † $p < 0.05$.

Table 3 DSH prevalence and associations with current youth/maternal psychopathology in the total sample

	Current DSH (last month)				Lifetime DSH			
	%	Bivariate model OR (95%CI)	Multiple model 1 OR (95%CI)	Multiple model 2 OR (95%CI)	%	Bivariate model OR (95%CI)	Multiple model 1 OR (95%CI)	Multiple model 2 OR (95%CI)
Youth psychiatric diagnoses (n=2,508)								
Anxiety disorder	1.5	1.90 (0.61-5.89)	1.79 (0.60-5.40)	0.96 (0.19-4.76)	3.0	1.93 (0.77-4.82)	1.90 (0.73-4.91)	1.41 (0.48-4.13)
Major depression	12.7	25.75 (9.29-71.31)*	25.89 (9.39-71.40)*	16.30 (4.98-53.36)*	14.4	12.26 (5.28-28.51)*	15.53 (6.62-36.41)*	9.03 (3.13-26.11)*
ADHD	4.4	10.20 (4.52-23.03)*	12.20 (5.70-26.11)*	6.57 (3.11-13.89)*	6.8	6.56 (3.42-12.59)*	7.24 (3.64-14.40)*	4.43 (2.12-9.24)*
Oppositional defiant	6.2	11.85 (4.10-34.30)*	14.39 (4.99-41.48)*	4.89 (1.61-14.87)†	7.8	6.30 (2.35-16.89)*	6.91 (2.60-18.38)*	2.97 (1.15-7.67)‡
Conduct disorder	5.2	7.16 (1.53-33.50)‡	8.76 (2.46-31.27)†	1.06 (0.09-12.50)	11.5	8.47 (2.84-25.28)*	11.45 (4.00-32.78)*	2.97 (0.56-15.76)
Any mental disorder	3.2	19.57 (5.94 -64.52)*	20.95 (6.40-68.57)*	-	5.3	8.93 (4.30-18.54)*	9.78 (4.50-21.27)*	-
Maternal psychiatric diagnoses (n=2,295)								
Anxiety	2.3	5.13 (2.01-13.09)†	4.95 (1.94-12.58)†	3.08 (1.20-7.87)‡	4.0	3.72 (1.83-7.57)*	3.88 (1.92-7.85)*	2.89 (1.37-6.08)†
Any mood	2.0	3.44 (1.68-7.06)†	3.37 (1.64-6.93)†	1.94 (0.98-3.86)	3.4	2.62 (1.43-4.81)†	2.96 (1.57-5.59)†	1.72 (0.91-3.25)
Psychotic syndrome§	2.0	2.84 (0.73-11.01)	2.77 (0.80-9.57)	1.08 (0.28-4.23)	2.4	1.50 (0.43-5.25)	1.71 (0.52-5.61)	0.74 (0.20-2.73)
Any mental disorder‖	1.7	3.57 (1.40-9.11)†	3.46 (1.39-8.62)‡	-	3.2	2.91 (1.43-5.91)†	3.12 (1.53-6.36)†	-

95%CI = 95% confidence interval; ADHD = attention-deficit/hyperactivity disorder; DSH = deliberate self-harm; OR = odds ratio.
Multiple model 1, controlled for age, gender, socioeconomic status and race; Multiple model 2, controlled for age, gender, socioeconomic status, race and other diagnoses.
Anxiety disorder includes generalized anxiety disorder, separation anxiety disorder and social anxiety. For children, any mental disorder includes disorders used in specific analysis and post-traumatic stress disorder, including obsessive-compulsive disorder, specific phobia, other depression, mania/bipolar disorder, other hyperactivity, psychosis or eating disorder. For mothers, any mental disorder encompasses any current anxiety, mood, substance abuse, psychotic or attention-deficit/hyperactivity disorders.
§ Psychotic syndrome data was missing in 11 cases, which were excluded from analysis using listwise deletion.
‖ In eight subjects this variable couldn't be computed because of missing psychotic syndrome (n=11) and ADHD (n=16) data.
*$p < 0.001$; †$p < 0.01$; ‡$p < 0.05$.

Table 4 DSH prevalence and associations with current child psychopathology, stratified by age

	Current DSH (last month)				Lifetime DSH			
	%	Bivariate model OR (95%CI)	Multiple model 1 OR (95%CI)	Multiple model 2 OR (95%CI)	%	Bivariate model OR (95%CI)	Multiple model 1 OR (95%CI)	Multiple model 2 OR (95%CI)
6 to 9y (n=1,172)								
Anxiety disorder	0.8	1.27 (0.19-8.44)	1.26 (0.20-8.01)	0.89 (0.03-25.61)	2.0	1.13 (0.29-4.39)	1.21 (0.32-4.60)	0.96 (0.30-3.08)
Major depression	13.9	40.31 (8.33-194.95)*	92.28 (15.01-567.13)*	67.02 (6.06-740.87)†	16.5	12.99 (3.63-46.56)*	18.48 (4.15-82.19)*	11.80 (2.15-64.80)†
ADHD	2.9	7.89 (1.69-36.70)‡	9.59 (1.94-47.29)†	6.28 (1.38-28.58)‡	5.6	4.47 (1.48-13.54)‡	4.48 (1.38-14.54)‡	3.03 (0.76-12.11)
Oppositional defiant	4.2	10.40 (2.18-49.69)†	16.48 (3.06-88.88)†	4.85 (0.95-24.63)	4.7	3.07 (0.84-11.21)	3.33 (0.89-12.53)	1.77 (0.56-5.56)
Conduct disorder	3.4	5.78 (0.65-51.49)	21.18 (1.74-258.59)‡	2.70 (0.03-228.89)	21.9	17.46 (3.65-83.57)*	40.57 (8.35-197.04)*	15.14 (1.03-221.51)
Any mental disorder	2.4	18.11 (2.16-152.03)†	22.52 (3.05-166.46)†	-	4.5	4.73 (1.87-11.96)†	5.21 (2.01-13.54)†	-
10 to 14y (n=1,336)								
Anxiety disorder	2.0	2.20 (0.66-7.42)	2.09 (0.63-6.94)	1.02 (0.20-5.27)	3.8	2.77 (0.89-8.64)	2.65 (0.81-8.67)	1.82 (0.41-8.15)
Major depression	12.0	18.89 (4.51-79.24)*	17.01 (4.04-71.62)*	9.44 (1.05-85.20)	13.1	12.11 (3.37-43.52)*	12.98 (3.57-47.21)*	7.13 (1.06-48.10)‡
ADHD	6.1	12.56 (4.01-39.30)*	13.68 (4.44-42.15)*	7.11 (2.21-22.86)†	8.1	9.63 (4.29-21.64)*	10.67 (4.70-24.25)*	5.88 (2.45-14.07)*
Oppositional defiant	8.9	14.47 (3.87-54.13)*	13.72 (3.64-51.73)*	4.66 (1.10-19.74)‡	12.1	12.36 (3.81-40.09)*	12.57 (3.92-40.32)*	5.42 (1.51-19.47)‡
Conduct disorder	6.1	7.17 (0.89-57.53)	7.45 (1.17-47.44)‡	1.32 (0.05-32.53)	6.1	4.47 (0.57-34.89)	5.35 (0.88-32.53)	0.92 (0.04-20.22)
Any mental disorder	3.9	20.81 (4.68-92.44)*	20.79 (4.54-95.23)*	-	6.1	21.50 (6.49-71.19)*	23.09 (6.41-83.23)*	-

95%CI = 95% confidence interval; ADHD = attention-deficit/hyperactivity disorder; DSH = deliberate self-harm; OR = odds ratio.
Multiple model 1, controlled for age, gender, socioeconomic status and race; Multiple model 2, controlled for age, gender, socioeconomic status, race and other diagnoses. Anxiety disorder includes generalized anxiety disorder, separation anxiety disorder and social anxiety. Any mental disorder includes disorders used in specific analysis and post-traumatic stress disorder, including obsessive-compulsive disorder, specific phobia, other depression, mania/bipolar disorder, other hyperactivity, psychosis or eating disorder.
*$p < 0.001$; †$p < 0.01$; ‡$p < 0.05$.

Table 5 Prevalence of DSH in subpopulations and associations with current maternal psychopathology, stratified by age

	Current DSH (last month)				Lifetime DSH			
	%	Bivariate model OR (95%CI)	Multiple model 1 OR (95%CI)	Multiple model 2 OR (95%CI)	%	Bivariate model OR (95%CI)	Multiple model 1 OR (95%CI)	Multiple model 2 OR (95%CI)
6 to 9y (n=1,079)								
Anxiety disorder	1.4	3.59 (0.76-16.93)	4.25 (0.94-19.16)	2.50 (0.83-7.55)	4.7	4.25 (1.43-12.67)*	5.17 (1.76-15.17)†	4.46 (1.24-16.03)*
Any mood disorder	1.5	3.92 (0.79-19.43)	4.83 (1.09-21.34)*	2.96 (1.15-7.59)*	3.8	2.75 (1.07-7.07)*	3.81 (1.58-9.15)†	1.54 (0.61-3.86)
Psychotic syndrome‡	0.7	1.26 (0.14-11.54)	1.42 (0.15-13.57)	0.51 (0.04-6.35)	1.4	0.78 (0.16-3.91)	1.02 (0.19-5.30)	0.39 (0.06-2.47)
Any mental disorder§	1.0	2.34 (0.49-11.21)	2.78 (0.63-12.33)	-	3.7	3.23 (1.11-9.40)*	4.25 (1.44-12.52)*	-
10 to 14y (n=1,216)								
Anxiety disorder	2.9	5.77 (1.81-18.45)†	5.73 (1.79-18.36)†	3.66 (1.15-11.61)*	3.5	3.38 (1.48-7.75)†	3.35 (1.45-7.74)†	2.17 (0.96-4.91)
Any mood disorder	2.4	3.14 (1.04-9.48)*	2.96 (0.95-9.26)	1.56 (0.40-5.98)	3.2	2.52 (1.04-6.09)*	2.51 (1.00-6.31)	1.74 (0.60-5.05)
Psychotic syndrome‡	3.5	4.08 (0.67-24.86)	3.93 (0.77-20.19)	1.57 (0.23-10.89)	3.5	2.45 (0.42-14.16)	2.50 (0.48-13.17)	1.24 (0.18-8.32)
Any mental disorder§	2.3	4.24 (1.33-13.51)*	4.20 (1.32-13.35)*	-	2.9	2.67 (1.19-6.01)*	2.66 (1.17-6.04)*	-

95%CI = 95% confidence interval; ADHD = attention-deficit/hyperactivity disorder; DSH = deliberate self-harm; OR = odds ratio.
Multiple model 1, controlled for age, gender, socioeconomic status and race; Multiple model 2, controlled for age, gender, socioeconomic status, race and other diagnoses. Anxiety disorder includes generalized anxiety disorder, separation anxiety disorder and social anxiety; any mental disorder encompasses any current anxiety, mood, substance abuse, psychotic or attention-deficit/hyperactivity disorders.
‡ Psychotic syndrome data was missing in 11 cases, which were excluded from the analysis using listwise deletion.
§ In eight subjects this variable couldn't be computed because of missing psychotic syndrome (n=11) and ADHD (n=16) data.
* $p < 0.05$; † $p < 0.01$.

lifetime DSH prevalence of 12.2%.[13] It was also lower than rates in other LMIC countries, such as Mexico (3.1% lifetime),[15] China (2.9% lifetime),[16] and South Africa (3.2% in the past-month).[17] In Brazil, estimates of past-year suicide attempts in 12- to 14-year-olds and 15- to 18-year-olds in Greater São Paulo public schools were 6.7% and 10%, respectively.[22] Another study in the state of Sergipe reported a 6% suicide attempt prevalence in adolescents from 13 to 18 years old.[20] The differences between our findings and those of other studies might be related to: 1) our sample, which consisted of a mostly younger age-group; 2) different assessment methods (self-report vs. maternal report). However, like our study, U.S. community studies have reported a suicide attempt prevalence of 1.5% in children from 7 to 12 years old[24] and retrospectively estimated a DSH onset of less than 1% before 12 years of age, although this rate reached 4 to 5% in later adolescence,[10] which was higher than our population.

Although DSH is commonly reported as higher among young girls,[10,15,20,24-26] some authors have reported comparable rates across genders,[9,27] which is consistent with our findings. We found that middle class children have a lower risk than those of higher socioeconomic strata. Despite evidence that the socially disadvantaged are at greater risk of attempting suicide,[27] mixed results have been found in Brazil regarding this factor,[46,47] including a positive association with income inequality.[47] Previous research about neighborhood influence on antisocial behavior found that increased economic distance between a child and his/her neighbors was associated with increased antisocial behavior, not only for poor children growing up among wealthier neighbors but also for wealthier children growing up among poor neighbors.[48] Our study focused on public schools, and it is expected that only a small portion of wealthier students would be enrolled in them. This small number of upper-class individuals, besides being affected by social disintegration, could also have higher levels of psychopathology or cognitive problems. Additionally, it is possible that middle class children have stronger religious affiliations, resulting in more meaning in life, which has been found to be negatively associated with suicide rates in multinational studies. In fact, the higher suicide rates in wealthy nations seem to be associated with less religiosity and meaning in life.[49] Results in the literature regarding ethnicity are inconsistent: some studies have suggested a predominance of DSH in non-Caucasians[26,29,30]; while other suggest a predominance in Caucasians,[10,31,50] and others, like ours, found no racial differences.[24,32]

Very few community studies on DSH have reported clinical correlates and adjusted for the co-occurrence of psychiatric diagnoses. Mood disorders (particularly depression) have been consistently associated with DSH, while anxious and disruptive disorders have shown conflicting results. Gould et al.[24] found associations between adolescent suicide attempts and mood, anxiety and substance abuse/dependence, but not with disruptive disorder. Nock et al.[10] corroborated the association with mood disorders, but found mixed results regarding anxiety and impulse control disorders. In longitudinal studies, DSH incidence

during adolescence was independently associated with depression, anxiety, antisocial behavior and a high risk of substance use.[9,27] In a follow-up study of a clinical sample of individuals with ADHD who were initially assessed at 4 to 6 years old, it was found that they were at increased risk, relative to matched controls, for meeting depression criteria and attempting suicide by age 18.[34] Our results align with previous research indicating that developmental trajectories involving a high level of disruptiveness are more consistently associated with lifetime self-harm than those with a high-level of anxiousness.[51] It is also important to point out that suicidal behavior is a criterion of major depression, which could inflate statistics about its co-occurrence with DSH. Additionally, clinicians are more likely to ask about DSH in patients with other depression symptoms, and our results highlight the importance of actively inquiring about both internalizing and disruptive disorders, especially in children, who are less likely than adults to seek help in the year prior to the onset of suicidal behavior.[1]

Previous studies have found associations between a wide range of parental mental disorders (such as depression, anxiety, substance abuse and antisocial personality disorders) and increased risk of lifetime suicide attempts by offspring.[35] Our results align with those of other LMIC studies, which found parental anxiety as the only familial psychopathology independently associated with offspring lifetime suicide attempts.[36-38] However, reverse causation cannot be excluded: qualitative research indicates that parents can react with anxiety, shame, anger, guilt and depression after discovering DSH in their children.[52]

Some limitations warrant consideration. First, due to its cross-sectional design, it is impossible to determine the direction of the relationship between DSH and maternal psychopathology. Second, evaluating only children who are being enrolled at school by a biological parent overlooks high-risk cases, such as adopted children and those avoiding, or being kept from, school. Finally, parental reports of psychopathology may either overlook covered self-harm behaviors or be influenced by overanxious parents who tend to overestimate symptoms in their children. Nevertheless, this study has certain strengths that should also be noted. First, the inclusion of young children from a large community sample fills a gap in DSH assessment in school-age children. Second, the use of a structured clinical interview to assess psychopathology with both children and mothers allowed us to assess psychopathology in a structured way, which is lacking in the current literature. Finally, our analysis included covariation for both demographic factors and co-occurring psychopathology, investigating both univariate and independent associations between maternal psychopathology and DSH, which fills a gap in the LMIC literature.

We conclude that DSH is an important problem in children and adolescents. Diagnoses of depression, ADHD and ODD are consistently associated with DSH, as is having a mother with anxiety disorder. Our results are relevant for clinicians and policy makers, since they reinforce the importance of a more comprehensive evaluation of DSH in children with the aforementioned mental disorders and since DSH is closely associated with suicide. Future longitudinal studies will be important for investigating the role of DSH as a predictor of psychopathological trajectories, which can facilitate the development of interventions.

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References

1 Turecki G, Brent DA. Suicide and suicidal behaviour. Lancet. 2016;387:1227-39.
2 Cooper J, Kapur N, Webb R, Lawlor M, Guthrie E, Mackway-Jones K, et al. Suicide after deliberate self-harm: A 4-year cohort study. Am J Psychiatry. 2005;162:297-303.
3 Hawton K, Bergen H, Cooper J, Turnbull P, Waters K, Ness J, et al. Suicide following self-harm: findings from the Multicentre Study of self-harm in England, 2000-2012. J Affect Disord. 2015;175:147-51.
4 Yoshimasu K, Kiyohara C, Miyashita K. Stress Research Group of the Japanese Society for Hygiene. Suicidal risk factors and completed suicide: meta-analyses based on psychological autopsy studies. Environ Health Prev Med. 2008;13:243-56.
5 Patton GC, Coffey C, Sawyer SM, Viner RM, Haller DM, Bose K, et al. Global patterns of mortality in young people: a systematic analysis of population health data. Lancet. 2009;374:881-92.
6 Vijayakumar L, Phillips MR, Silverman MM, Gunnell D, Carli V. Suicide. In: Patel V, Chisholm D, Dua T, Laxminarayan R, Medina-Mora

ME, editors. Disease control priorities. 3rd ed. Washington: World Bank; 2016. p. 163-81.
7 Corso PS, Mercy JA, Simon TR, Finkelstein EA, Miller TR. Medical costs and productivity losses due to interpersonal and self-directed violence in the United States. Am J Prev Med. 2007;32:474-82.
8 Plener PL, Schumacher TS, Munz LM, Groschwitz RC. The longitudinal course of non-suicidal self-injury and deliberate self-harm: a systematic review of the literature. Borderline Personal Disord Emot Dysregul. 2015;2:2.
9 Moran P, Coffey C, Romaniuk H, Olsson C, Borschmann R, Carlin JB, et al. The natural history of self-harm from adolescence to young adulthood: a population-based cohort study. Lancet. 2012;379:236-43.
10 Nock MK, Green JG, Hwang I, McLaughlin KA, Sampson NA, Zaslavsky AM, et al. Prevalence, correlates, and treatment of lifetime suicidal behavior among adolescents: results from the National Comorbidity Survey Replication Adolescent Supplement. JAMA Psychiatry. 2013;70:300-10.
11 Mars B, Heron J, Crane C, Hawton K, Lewis G, Macleod J, et al. Clinical and social outcomes of adolescent self harm: population based birth cohort study. BMJ. 2014;349:g5954.
12 Nakar O, Brunner R, Schilling O, Chanen A, Fischer G, Parzer P, et al. Developmental trajectories of self-injurious behavior, suicidal behavior and substance misuse and their association with adolescent borderline personality pathology. J Affect Disord. 2016;197:231-8.
13 Muehlenkamp JJ, Claes L, Havertape L, Plener PL. International prevalence of adolescent non-suicidal self-injury and deliberate self-harm. Child Adolesc Psychiatry Ment Health. 2012;6:10.
14 McKinnon B, Gariépy G, Sentenac M, Elgar FJ. Adolescent suicidal behaviours in 32 low- and middle-income countries. Bull World Health Organ. 2016;94:340-50F.
15 Borges G, Benjet C, Medina-Mora ME, Orozco R, Nock M. Suicide ideation, plan, and attempt in the Mexican adolescent mental health survey. J Am Acad Child Adolesc Psychiatry. 2008;47:41-52.
16 Hu J, Dong Y, Chen X, Liu Y, Ma D, Liu X, et al. Prevalence of suicide attempts among Chinese adolescents: a meta-analysis of cross-sectional studies. Compr Psychiatry. 2015;61:78-89.
17 Cluver L, Orkin M, Boyes ME, Sherr L. Child and adolescent suicide attempts, suicidal behavior, and adverse childhood experiences in South Africa: a prospective study. J Adolesc Health. 2015;57:52-9.
18 Souza LD, Silva RA, Jansen K, Kuhn RP, Horta BL, Pinheiro RT. Suicidal ideation in adolescents aged 11 to 15 years: prevalence and associated factors. Rev Bras Psiquiatr. 2010;32:37-41.
19 Souza LD, Ores L, Oliveira GT, Cruzeiro ALS, Silva RA, Pinheiro RT, et al. Ideação suicida na adolescência: prevalência e fatores associados. J Bras Psiquiatr. 2010;59:286-92.
20 Silva RJ, dos Santos FA, Soares NM, Pardono E. Suicidal ideation and associated factors among adolescents in northeastern Brazil. Sci World J. 2014;2014:450943.
21 Baggio L, Palazzo LS, Aerts DRGC. Planejamento suicida entre adolescentes escolares: prevalência e fatores associados. Cad Saude Publica. 2009;25:142-50.
22 Carlini-Cotrim B, Gazal-Carvalho C, Gouveia N. [Health behavior among students of public and private schools in the metropolitan area of São Paulo, Brazil]. Rev Saude Publica. 2000;34:636-45.
23 Mcloughlin AB, Gould MS, Malone KM. Global trends in teenage suicide: 2003-2014. QJM. 2015;108:765-80.
24 Gould MS, King R, Greenwald S, Fisher P, Schwab-Stone M, Kramer R, et al. Psychopathology associated with suicidal ideation and attempts among children and adolescents. J Am Acad Child Adolesc Psychiatry. 1998;37:915-23.
25 Evans E, Hawton K, Rodham K, Deeks J. The prevalence of suicidal phenomena in adolescents: a systematic review of population-based studies. Suicide Life Threat Behav. 2005;35:239-50.
26 Centers for Disease Control and Prevention (CDC). 1991-2015 high and middle school youth risk behavior survey data [Internet]. [cited 2016 Jun 27]. https://nccd.cdc.gov/youthonline/App/Results.aspx?LID=XX
27 Fergusson DM, Woodward LJ, Horwood LJ. Risk factors and life processes associated with the onset of suicidal behaviour during adolescence and early adulthood. Psychol Med. 2000;30:23-39.
28 Kokkevi A, Rotsika V, Arapaki A, Richardson C. Adolescents' self-reported suicide attempts, self-harm thoughts and their correlates across 17 European countries. J Child Psychol Psychiatry. 2012;53:381-9.
29 Gratz KL, Latzman RD, Young J, Heiden LJ, Damon J, Hight T, et al. Deliberate self-harm among underserved adolescents: the moderating roles of gender, race, and school-level and association with borderline personality features. Personal Disord. 2012;3:39-54.
30 Yates TM, Tracy AJ, Luthar SS. Nonsuicidal self-injury among "privileged" youths: longitudinal and cross-sectional approaches to developmental process. J Consult Clin Psychol. 2008;76:52-62.
31 Lloyd-Richardson EE, Perrine N, Dierker L, Kelley ML. Characteristics and functions of non-suicidal self-injury in a community sample of adolescents. Psychol Med. 2007;37:1183-92.
32 Hilt LM, Nock MK, Lloyd-Richardson EE, Prinstein MJ. Longitudinal study of nonsuicidal self-injury among young adolescents: rates, correlates, and preliminary test of an interpersonal model. J Early Adolesc. 2008;28:455-69.
33 Brezo J, Paris J, Vitaro F, Hébert M, Tremblay RE, Turecki G. Predicting suicide attempts in young adults with histories of childhood abuse. Br J Psychiatry. 2008;193:134-9.
34 Chronis-Tuscano A, Molina BS, Pelham WE, Applegate B, Dahlke A, Overmyer M, et al. Very early predictors of adolescent depression and suicide attempts in children with attention-deficit/hyperactivity disorder. Arch Gen Psychiatry. 2010;67:1044-51.
35 Gureje O, Oladeji B, Hwang I, Chiu WT, Kessler RC, Sampson NA, et al. Parental psychopathology and the risk of suicidal behavior in their offspring: results from the World Mental Health surveys. Mol Psychiatry. 2011;16:1221-33.
36 Santana GL, Coelho BM, Borges G, Viana MC, Wang YP, Andrade LH. The influence of parental psychopathology on offspring suicidal behavior across the lifespan. PLoS One. 2015;10:e0134970.
37 Atwoli L, Nock MK, Williams DR, Stein DJ. Association between parental psychopathology and suicidal behavior among adult offspring: results from the cross-sectional South African Stress and Health survey. BMC Psychiatry. 2014;14:65.
38 Oladeji BD, Gureje O. Parental mental disorders and suicidal behavior in the Nigerian survey of mental health and well-being. Arch Suicide Res. 2011;15:372-83.
39 Weissman MM, Wickramaratne P, Adams P, Wolk S, Verdeli H, Olfson M. Brief screening for family psychiatric history: the family history screen. Arch Gen Psychiatry. 2000;57:675-82.
40 Salum GA, Gadelha A, Pan PM, Moriyama TS, Graeff-Martins AS, Tamanaha AC, et al. High risk cohort study for psychiatric disorders in childhood: rationale, design, methods and preliminary results. Int J Methods Psychiatr Res. 2015;24:58-73.
41 Fleitlich-Bilyk B, Goodman R. Prevalence of child and adolescent psychiatric disorders in southeast Brazil. J Am Acad Child Adolesc Psychiatry. 2004;43:727-34.
42 Amorim P. Mini International Neuropsychiatric Interview (MINI): validação de entrevista breve para diagnóstico de transtornos mentais. Rev Bras Psiquiatr. 2000;22:106-15.
43 Martel MM, Pan PM, Hoffman MS, Gadelha A, Rosario MC, Mari J, et al. A general psychopathology factor (p-factor) in children: Structural model analysis and external validation through familial risk and child executive function. J Abnorm Psychol. 2017;126:137-48.
44 Lumley T. Complex surveys: a guide to analysis using R. Hoboken: John Wiley & Sons Inc.; 2010.
45 Waldhauser C. Survey: computing your own post-stratification weights in R [Internet]. 2014 Apr 13 [cited 2016 Jun 5]. www.r-bloggers.com/survey-computing-your-own-post-stratification-weights-in-r/
46 Bando DH, Lester D. An ecological study on suicide and homicide in Brazil. Cien Saude Colet. 2014;19:1179-89.
47 Machado DB, Rasella D, Dos Santos DN. Impact of income inequality and other social determinants on suicide rate in Brazil. PLoS One. 2015;10:e0124934.
48 Odgers CL, Donley S, Caspi A, Bates CJ, Moffitt TE. Living alongside more affluent neighbors predicts greater involvement in antisocial behavior among low-income boys. J Child Psychol Psychiatry. 2015;56:1055-64.
49 Oishi S, Diener E. Residents of poor nations have a greater sense of meaning in life than residents of wealthy nations. Psychol Sci. 2014;25:422-30.
50 Muehlenkamp JJ, Gutierrez PM. Risk for suicide attempts among adolescents who engage in non-suicidal self-injury. Arch Suicide Res. 2007;11:69-82.
51 Brezo J, Barker ED, Paris J, Hébert M, Vitaro F, Tremblay RE, et al. Childhood trajectories of anxiousness and disruptiveness as predictors of suicide attempts. Arch Pediatr Adolesc Med. 2008;162:1015-21.
52 Ferrey AE, Hughes ND, Simkin S, Locock L, Stewart A, Kapur N, et al. The impact of self-harm by young people on parents and families: a qualitative study. BMJ Open. 2016;6:e009631.