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Conflicts of interests

We declare no competing interests.

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Data availability: The data that support the findings of this study are available from Statistics Denmark and from Statens Serum Institut. Data access requires the completion of a detailed application form from the Danish Data Protection Agency, the Danish Health Data Authority and Statistics Denmark and from Statens Serum Institut. For more information on accessing the data, see https://www.dst.dk/en and https://www.dnbc.dk.

Ethics: The DNBC cohort is approved by the Danish Data Protection Agency and the Committee on Health Research Ethics under case no. (KF) 01-471/94. Data handling in the DNBC has been approved by Statens Serum Institut (SSI) under ref. no 18/04608 and is covered by the general approval (Fællesanmeldelse) given to SSI. The 11-year follow-up was approved under ref. no. 2009-41-3339 and the 18-year follow-up was approved under ref. no. 2015-41-3961. The DNBC participants were enrolled by informed consent. Data approval for analyses carried out in this study where DNBC data were linked with register data and accessed at Statistics Denmark's server was obtained from Region Capital (P-2020-305).

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ABSTRACT

Background: Bullying involvement (victim or perpetrator role) in childhood is linked to later suicidality. However, findings are inconsistent, and sex may be a moderator. We investigated whether childhood bullying involvement was associated with suicidality in adolescence, and whether this association varied by sex.

Methods: Childhood bullying involvement was collected from self-reports of children and parents during the 11-year follow-up of the Danish National Birth Cohorts (DNBC). Data on suicidal ideation (SI) and suicide attempts (SA) from the 18-year follow-up was supplemented with hospital-records of SA from the National Patient Register. Associations were estimated using multinomial logistic regressions, while inverse probability weighting accounted for socioeconomic-related selection bias.

Results: 11,705 boys and 17,292 girls were included. Adolescent boys exposed to bullying had increased risks of SI (adjusted Relative Risk Ratio (aRRR): 1.6; 95% CI: 1.4-1.8) and SA (aRRR: 2.8; 95% CI: 2.0-3.8), while no increased risk was found among those who were perpetrators of bullying versus non-involved peers. Girl victims had increased risks (aRRR) of SI and SA of 1.6 (95% CI: 1.5-1.7) and 2.9 (95% CI: 2.5-3.5), respectively. Girl perpetrators had an increased risk of SA (aRRR: 2.3; 95% CI: 1.5-3.6). Sex significantly moderated the association between perpetration role and suicidality.

Conclusion: Childhood bullying was associated with a higher risk of suicidality during adolescence. Girl, but not boy, perpetrators had increased risk of SI and SA. These findings emphasize the importance of preventive interventions targeting bullying in childhood and its long-term effects, including possible differences in policies for boys and girls.

Keywords: Suicidal ideation, suicidal behavior, bullying, perpetration, youth, epidemiology.

Key findings

- **What is already known on this topic:**
  Bullying is linked to adolescent suicidality, but less is known about how these associations differ by sex or vary by type of involvement (victim, perpetrator, or both), and few studies have incorporated both self-report and parent perspectives.
- **What this study adds:**
  This study shows a dose-response relationship between victimization and suicidality, with risks for perpetration differing by sex. Parental-child agreement on bullying involvement was associated with higher risk.
- **How this study might affect research, practice or policy:**
  Findings highlight the importance of considering sex differences and incorporating multiple informants in identifying adolescents at risk of suicidality. School- and family-based interventions should address both victimization and perpetration and be tailored to reflect sex-specific patterns.

INTRODUCTION

Bullying, is defined as repetitive behaviors with the intention to cause harm or intimidation, and involving a physical or psychological power imbalance (e.g. physical strengths or popularity) between bully and victim.[1] Multiple systematic reviews and meta-analyses have established that exposure to bullying has been associated with suicidal behavior, including suicide ideation (SI) and suicide attempts (SA), in adolescents.[2–5] Moore et al. (2017) found strong evidence for a causal link between bullying victimization and adverse mental health outcomes, including SI and SA. Similarly, Holt et al. (2015) and Wilson et al. highlight greater risk among individuals involved as both victims and perpetrators, suggesting additive vulnerability.

Children involved in bullying, whether as victims, perpetrators, or both, have been found to have elevated risks of suicidal and self-injurious behavior.[6] These associations have also been substantiated in longitudinal studies.[6,7] Sourander et al. (2009) found that victimized girls faced increased risk of later psychiatric hospitalization and treatment, even after adjusting for early mental health symptoms.[8] Similarly, Brunstein-Klomek et al. (2008) reported that boys who frequently bullied or were bully-victims were more likely to experience severe depression and SI at age 18.[9]

Findings are limited and conflicting for perpetrators alone, with some studies suggesting neutral effects, while others suggest increased risk.[6,7,10] Although some longitudinal research exists, small sample sizes limit the evidence base.[11] Identifying modifiable risk factors for suicidal behavior is essential to inform effective interventions. Bullying patterns also vary by sex, with boys more often experiencing physical bullying, and girls relational bullying, such as exclusion or gossiping.[12,13] Moreover, distinct sex differences in the causal pathways linking bullying to suicidality.[14] For these reasons, the association should be examined for boys and girls separately, as emphasized in recent systematic reviews.[3,5]

Differences in child and parent reports may reflect variations in awareness or communication, rather than contradictions in experience. Including both perspectives enhances the validity of bullying assessments and provides a more nuanced understanding of the child's social environment. While mechanisms cannot be inferred, examining multiple informants helps qualify the findings.

Linking data from the Danish National Birth Cohorts (DNBC) with national registers, we examined whether past-year childhood bullying involvement (victimization, perpetration, or both) at age 11, was associated with lifetime SI and SA at age 18, compared to non-exposed peers. Additionally, we investigated if the associations differed by sex. Furthermore, we examine both child and parent reports and explore informant agreement.

METHODS

Study design and data sources

A cohort design was applied to prospective population-based data on 96,822 Danish liveborn children from (1996-2003) derived from the DNBC.[15] Mothers were enrolled during pre-natal general practice healthcare visits and followed up during web-based survey waves when children turned 11 years old (DNBC-11P - parent version). Women with insufficient Danish proficiency or who did not intend to carry their pregnancy to term were excluded. Children completed self-administered questionnaires at age 11 (DNBC-11C; July 2010–September 2014) and age 18 (DNBC-18; April 2016–December 2021).[15] Data were linked to national Danish registers using unique personal identification numbers (eTable 1).[16]

Participants

Children aged 11–12 who responded to bullying exposure items in DNBC-11C and suicidality items in DNBC-18 were included (Figure 1), totaling 28,997 participants (11,705 boys and 17,292 girls).

Exposure

In DNBC-11C, children were provided with a definition of bullying ("Bullying is when somebody is kept out, teased, beaten or hurt in an intimidating way again and again") as well as questions with predefined response options (eTable 2). We constructed three exposure measures: 1) *victim*, derived from a question whether children had been bullied within the last year (no, few times, many times); 2) *perpetrator*, derived from a question regarding having bullied others within the last year (no, yes); and 3) *bully roles,* constructed as a composite (victim only, perpetrator only, victim-perpetrator). Victims are compared with those who reported no victimization, perpetrators are compared with those who reported no perpetration and all bully role categories are compared to individuals who reported both no to perpetration and victimization. Parents' reports from DNBC-11 regarding their child's bullying involvement (victim and/or perpetrator status) were also collected. Agreement between responses by parents and children regarding *victim* and/or *perpetrator status* as: yes (agreeing), conflicting (disagreeing), and no (agreeing) were assessed.

Suicidality

The outcome measures, i.e. having experienced lifetime SI and SA lifetime before answering DNBC-18, were determined based on the questions: '*Have you ever thought about taking your own life (even though you would not do it)?*' and '*Have you ever tried to kill yourself?*' from the DNBC-18 (eTable 3). Response options were *yes*, *no*, or *I don't know*; as fewer than 5% responded '*I don't know*,' these were classified as '*no*'. Additionally, information on hospital-recorded SAs prior to the participants' completion of the DNBC-18 was obtained from the National Patient Register[17] and the Psychiatric Central Research Register[18]. Only hospital-recorded SAs by participants aged 10 or older were included. While SAs at younger age are known to occur,[19] many have been deemed erroneous when using the Danish algorithm for identifying hospital-recorded SAs.[20] SI was assessed through self-report, while SA was identified through either self-report or national registers.

A joint outcome was constructed as a hierarchical variable with three mutually exclusive categories: 1) no SI and no SA, 2) SI only, and 3) SA (based on either self-report or register data). Participants were classified in the highest applicable category. If a participant self-reported no SA but had a hospital-recorded SA or vice-versa the participant would be classified in the SA category.

Covariates

Information regarding *parents' income level*, *family structure* (i.e., living with both biological parents or not)*, parents' highest educational level*, *parents' psychiatric diagnosis*, *parents' occupation*, was identified in national register data (eTable 1). This information was recorded when the children were aged 11 years. Additional covariates were drawn from child self-report in DNBC-11C, including frequency of seeing friends, experience with alcohol and cigarette use, and indicators of mental wellbeing (sleep, stress, life satisfaction, and self-harm) (eTable 4). Psychiatric diagnoses recorded in the registers before age 11 were also included (eTable 1).

Statistical Analyses

To improve representativeness, we applied Inverse Probability Weighting (IPW).[21,22] The propensity scores for having participated in the DNBC versus not were calculated using logistic regressions and national population figures on all children born in same period as the DNBC-cohort and still alive at age 18. Differences between the two groups were assessed using the following covariates measured at age 11 years: mother's birth age, parity of mother, family structure, parents' highest educational level, parents' occupation, parent's income level, child's psychiatric diagnosis and parent's psychiatric diagnosis. Propensity scores were converted into weights and stabilized to reduce extreme values (Table 1).[23]

Associations between exposure variables and suicidality were estimated as Relative Risk Ratios (RRR) with their corresponding 95% confidence intervals (CI) using multinomial logistic

regressions. All RRR's represent weighted estimates. Unless otherwise stated, all reported frequencies and percentages are based on unweighted absolute numbers. Covariates in the adjusted models were selected based on theoretical relevance, prior literature linking them to suicidality or bullying, and initial bivariate analyses. Specifically, these included family structure, parental education, occupation, income, psychiatric diagnosis, frequency of visiting friends, and experiences with alcohol and smoking. These variables were chosen to account for key sociodemographic and psychosocial risk factors.

Risks of SI and SA were calculated with respect to *victim, perpetrator,* and *bully roles,* as well as *victim and perpetrator status, according to parent and child.* Having identified an interaction effect with regard to sex and bully roles in preliminary analyses (p= 0.001), we opted to analyze data for boys and girls separately, but also to explore the role of sex jointly in relation to bully roles. In adjusted models, we accounted for family structure, parents' highest educational level, parents' occupation, parents' income level, parents' psychiatric diagnosis, frequency of visiting friends, and experience of drinking alcohol and of smoking. To examine dose-response relationships, we compared the p-values across increasing levels of self-reported bullying victimization (no, a few times, and several times) in the multinomial logistic regressions.

Missing data in covariates was minimal (<5% for all variables) and were handled using complete case analysis. In preliminary analyses missing values were tested as separate categories and found unsubstantial and these responses were therefore added in the most frequent category for each covariate.

In sensitivity analyses, the robustness was assessed by excluding: 1) all individuals with "*do not know*" (n=1,271) answers to the self-reported suicidality questions, and 2) all who reported self-harm (n=2,022) in the DNBC-11. Further, in a third sensitivity analyses we additionally adjusted for

sleep, stress, life satisfaction, self-harm, and psychiatric diagnoses. These measures had been collected at the same time as the examined exposures and could, therefore, represent mediators or confounders, depending on the causal pathway. Consequently, the model including these additional adjustments likely represent an over-adjustment. Lastly, we examined hospital-recorded SA using data from national health registers, in addition to self-reported SI and SA (see eTable 10).

All analyses were carried out in SAS version 9.4.

RESULTS

Descriptive Statistics

In all, 17.2% (n= 2021) of adolescent boys and 17.8% (n=3,078) of adolescent girls self-reported having been bullied. More boys (4.6%, n=537) than girls (1.6%, n=278) reported that they had been perpetrators of bullying. Also, more boys stated that they had been both perpetrators and victims (boys 6.1%, n=717; girls 3.0%, n=515) (eTables 5a and 5b). SI and SA had been experienced by 26.9% (n=3145) and 1.5% (n=178) of boys, respectively, at age 18 years. For girls, 34.5% (n=5967) had experienced SI and 3.5% (n=607) SA. The proportion reporting lower life satisfaction, higher levels of stress, less sleep, and self-harm was higher in all exposed groups for both genders (eTables 5a and 5b).

Victimization and perpetration

Adolescent boys who had been bullied had significantly higher risks of SI (few times: aRRR=1.5, 95% CI: 1.3-1.5 p<.0001 ; many times: aRRR=2.0, 95% CI: 1.7-2.5) and SA (few times: aRRR= 2.1, 95% CI: 1.6-2.9; many times: aRRR= 5.1, 95% CI: 3.4-7.8) versus non-exposed peers (Figure 2 and eTable 6). Girl victims of bullying also had higher risks of SI (few times: aRRR= 1.6, 95% CI: 1.4-1.7; many times: aRRR= 2.3, 95% CI: 1.9-2.8) and SA (few times: aRRR= 2.6, 95% CI: 2.2-3.1; many times: aRRR=5.2, 95% CI:3.9-7.0). A dose-response relationship (i.e., higher risks among boys and girls reporting many times versus few times) was found for SI (boys: p=

0.0011/girls: p <0.0001) and SA (boys: p <0.0001/girls: p <0.0001). While no excess risks were found among boys who reported having been perpetrators of bullying, increased risks of both SI and SA were found for girls (aRRRs of 1.5 (95% CI:1.3-1.7) and 2.2 (95% CI :1.7-2.9, respectively)).

Bully roles

With regards to bullying roles, elevated risks of SA were found for boy victims and those who had both roles (victim: aRRR=2.8, 95% CI: 2.0-3.8; perpetrator: aRRR=1.1, 95% CI: 0.5-2.0; victim-perpetrator: aRRR=2.3, 95% CI: 1.5-3.5) when compared to non-exposed individuals. For girls, all bullying roles were linked to excess risks of SA (victim: aRRR=2.9, 95% CI: 2.5-3.5; perpetrator: aRRR=2.3, 95% CI: 1.5-3.6; victim-perpetrator: aRRR=3.7, 95% CI: 2.7-5.0).

Comparisons by sex

When comparing estimates for boys and girls, a significant interaction between bully roles and sex was found for SA (p= 0.0001). Thus, while the difference in aRRR between non-involved and perpetrators was 1:1.0 in boys, girl perpetrators had a 2.4-fold higher risk of SA than non-involved girls (difference in aRRR: 6.7/2.7) (Table 2). For all bully roles, risk estimates for SI and SA were consistently higher among girls than boys.

Parental reports

Victimization agreement between children and parents was 81.8% agreement for boys and 82.6% for girls. With regard to perpetration, the agreement between children and parents was 88.8% for boys and 94.6% for girls. Agreement between children and parents regarding sons being victims of bullying was associated with an aRRR for SI of 1.8 (95% CI: 1.6-2.1) versus disagreement where the aRRR was 1.4 (95% CI: 1.2-1.6) (Table 3). Concordance regarding victimization in boys was also linked to a higher risk of SA (aRRR= 4.9, 95% CI: 3.4-7.0) versus disagreement (aRRR=2.0, 95% CI: 1.4-2.8) relative to concordance regarding non-involvement. Agreement between statements of boys and parents on the child being a perpetrator was associated with elevated risks of

SA (aRRR=2.7, 95% CI: 1.6-4.8) and for those who disagreed (aRRR=1.5, 95% CI: 1.0-2.2) compared with agreement on non-perpetrator status.

For girls, parent-daughter agreement regarding victimization was linked to a higher risk of SI (aRRR=2.2, 95% CI: 1.9-2.5) versus disagreement (aRRR= 1.6 (95% CI: 1.5-1.8) when compared to agreement regarding non-involvement. The corresponding estimates for SA were 4.5 (95% CI: 3.5-5.6) when there was agreement versus 2.6 (95% CI: 2.1-3.1) for disagreement. Parent-daughter agreement on perpetration resulted in an aRRR of 4.4 (95% CI: 2.5-8.0) for SA versus 1.8 (95% 1.4-2.4) for non-agreement.

Sensitivity analyses

Excluding those who responded '*I do not know'* to questions regarding suicidality (eTable 7). Excluding those who responded 'I do not know' to questions regarding suicidality (eTable 7) or those who had reported self-harm at DNBC-11C (eTable 8) did not alter the main findings (Figure 2 and eTable 6).Overall, lower estimates were obtained when adjusting for measures of childhood mental wellbeing and risks of SI and SA in boys who were victims/perpetrators were no longer statistically significant (eTable 9).

Discussion

Using longitudinal, weighted and population-based data, we found that adolescents who at age 11 years reported being victims of bullying had elevated risks of suicidality by age 18 years, after accounting for potential confounders. A dose-response association was found for both SI and SA. Being a perpetrator of bullying was a significant predictor of SA for girls. When parent and child agreed, excess risks of SA were documented for boys and girls who were perpetrators versus non-perpetrators. Seemingly, any form of involvement in bullying was associated with elevated risks of suicidality.

Despite variations in effect sizes, a consistent association between bullying victimization and suicidality was observed. In our study, the adjusted relative risk ratios (aRRRs) for suicidal ideation ranged from 1.5 to 2.3, and for suicide attempts from 2.1 to 5.7. These findings align with previous research, where effect sizes for suicidal ideation have ranged from 1.57 to 2.83 (Winsper et al., Ahmad et al.) and for suicide attempts from 1.74 to 4.72 (Wen et al., Klomek et al.). Different effect sizes might be explained by different cut-offs and exposure measures (e.g., physical, relational, or verbal bullying). [6,24] Although a dose-response association for victimization has been suggested,[7] this is, to our knowledge, the first prospective study to demonstrate this with respect to SA.

Being a victim of bullying may further exacerbate negative emotions, such as stress, in already vulnerable individuals[25] and lead to suicidal behaviours. [26] We found, for instance, that children who were victims of bullying were more likely to report elevated levels of stress (see eTables 5a and 5b). The existing evidence regarding perpetrators of bullying and suicidality has been meagre.[6,10] Although being a perpetrator was only associated with SI and SA in girls, parent-child concordance regarding perpetrators suggested that boy perpetrators may also be at elevated risk of SA. Perpetrators of bullying are often exposed to familial adversities and have an elevated risk of mental disorders.[27] Individuals who are both victims and perpetrators have been characterized as impulsive, hyperactive, aggressive, and having problems socializing with other children.[25] According to classmates, victim-perpetrators may be more often rejected.[28] Thus, both social exclusion and poor mental health may contribute to the elevated risk of suicidality of this group.

Girls with both roles, i.e., victim and perpetrator, have been suggested to have higher risks than those who are victims only.[7] In our large sample, we found that risks of suicidality for girls who were both victims and perpetrators showed a tendency to be higher than those of victims only, albeit not significantly. Boy victims seemed to have higher risks than those with both roles.[28] Our findings, including the comparative analyses of boys and girls, support the perception that risks of

suicidality in relation to bully roles vary between boys and girls. For instance, SA risks of girl perpetrators were higher than those of their boy counterparts. This is supported by qualitative findings suggesting that gender-stereotypical perceptions among girls and boys are pronounced when it comes to bullying. [13] The qualitative study found that, girls are more open to talking about their experience of bullying victimization than boys; however, they also have a harder time getting over these experiences. On the other hand, boys might be less keen to talk about victimization due to concerns that it would make them appear weak[13]. Such gender differences may stem from a desire to belong and fit with the norm, which may be expressed differently between the two sexes and may have different effects on mental health of the individuals involved.[29]

Implications

A recent meta-analysis of 69 randomized trials found that school-based anti-bullying programs consistently reduced bullying perpetration and victimization among school-aged youth.[30] Further an evaluations of the Olweus Bullying Prevention Program indicate a reduction in both bullying victimization and perpetration as well as a slight reduction in suicidality.[11,31] Bullying behavior[32] and suicidal behaviour[14] have been found to display different patterns based on sex.[7] Further, findings from intervention studies of anti-bullying effects suggest that effects of interventions may vary by sex. [33]

Given the strong association between parent-child agreement on bullying and suicidality and the fact that many parents are unaware of bullying[34], it is possible that such concordance was indicative of more extreme cases of bullying. However, discordant reports were also linked to excess risks of SI and SA. Low levels of parent-child communication, as reported by children, have been linked to increased victimization and subsequent risk of suicidality[35]. Conversely, higher parent-child communication reduces this risk more effectively than parent-teacher communication about the

child's well-being. [36] While the study was based on a socioeconomically diverse sample, it did not adjust for socioeconomic status, unlike our study, which accounted for key sociodemographic factors in the analysis. This underscores the crucial role parents may play in preventing bullying, whether their child is a victim or a perpetrator.

Strengths and limitations

This study has several strengths, including a large sample size that allowed us to stratify analyses by sex and assess associations within sub-groups. Collecting answers from both children and parents helped minimise bias; e.g., having parental reports perhaps increases the confidence in the findings as some children with mental health problems may have been more likely to misjudge their relations with peers as involving bullying due to their own poor mental health.[37] Relying on two data sources for SAs also strengthened the validity of our findings. By combining data on self-reported and hospital records of SA, we ensured a higher validity. The ability to link our sample to Danish registers, which are highly complete however may be vulnerable to residual confounding, also allowed us to control for potential confounders, such as sociodemographic information and psychiatric diagnoses, as well as applying inverse probability weighting procedures.

Limitations include the fact that our measures of bullying were rather general. Also, we could not have examined a specific bullying behaviours, such as cyber-bullying which has been associated with suicidal behaviours [38], but information on these was not available Bullying involvement was assessed using single items developed for this study, rather than validated multi-item scales, which may not fully capture developmental trajectories. Although a definition was provided, single-item measures may increase misclassification. Similarly, parental reports were based on single SDQ items not validated for this specific purpose. Another limitation is that we did not include child well-being and psychiatric diagnoses in the main models, as these were measured alongside bullying exposure and may act as mediators rather than confounders. Including them could lead to

over-adjustment; however, sensitivity analyses adjusting for these still showed significant but attenuated associations. As noted by Cosma et al. (2022), gender inequality shapes bullying patterns across countries, and within the relatively gender-equal Nordic context, this may help explain the comparatively smaller but still observable sex differences reported in Denmark.[32] Furthermore, gendered norms around aggression and stigma related to bullying perpetration may influence both child and parent reports. This may introduce bias in reporting in the measurement of bullying involvement. Furthermore, the prospective design ensures that bullying involvement was assessed prior to outcome measurement, we cannot entirely rule out that some participants may have experienced SI or SA prior to age 11 as children were not asked about suicidality at the DNBC-11. However, suicidality before age 11 years is relatively uncommon.[19] Additionally, while registry-based identification of suicide attempts provides objective outcome data, non-fatal attempts may be underreported in national registers. As both bullying exposure and suicidality were primarily assessed via self-report and by single items, there is a risk of shared method variance, which may inflate associations due to common reporting biases. Although we adjusted for relevant covariates, information on parent-child relationship, social support and also factors known to increase risk of victimization would have been preferred but were not available.[39] Further, stratified analyses exploring other factors often associated with being bullied, such as ethnicity and gender identity, would also have been preferred, as these have been noted as important risk factors in this association and should be considered in future investigations.[40] Additionally, measurement of social connectedness during childhood as well as measures for smoking and drinking, may not be fully representable for peer environment during adolescence, and future studies may benefit from repeated assessments across developmental stages. Some subgroup analyses, such as for boy perpetrators, had small samples, limiting statistical power and precision. In the child parent agreement analyses, there was insufficient power to examine perpetration and victim-perpetration

separately, however, future studies may consider addressing this. Finally, despite adjustment for a wide range of sociodemographic and psychosocial covariates, we cannot exclude the possibility of residual confounding influencing the observed associations.

Conclusion

Being a victim or a perpetrator of bullying when age 11years old was associated with higher risk of adolescent SI and SA. Associations seem to vary by sex in perpetrators. Risks of SI and SA were highest among boy and girl who were victims of bullying and those who were both victims and perpetrators. Girl perpetrators also had an excess risk of SA. Dose response associations were observed for victimization and suicidality. Parental perceptions of children's bullying involvement supported the findings from the child self-reports. The differences between the two sexes in the nature and impacts of bullying suggests that sex-specific interventions may be indicated.

References

1. Olweus D. Bullying at School BT - Aggressive Behavior: Current Perspectives. In: Huesmann LR, ed. Springer US; 1994:97-130. doi:10.1007/978-1-4757-9116-7_5

2. Miranda-Mendizabal A, Castellví P, Parés-Badell O, et al. Gender differences in suicidal behavior in adolescents and young adults: systematic review and meta-analysis of longitudinal studies. *Int J Public Health*. 2019;64(2):265-283. doi:10.1007/s00038-018-1196-1

3. Holt MK, Vivolo-Kantor AM, Polanin JR, et al. Bullying and Suicidal Ideation and Behaviors: A Meta-Analysis. *Pediatrics*. 2015;135(2):e496-e509. doi:10.1542/peds.2014-1864

4. Moore SE, Norman RE, Suetani S, Thomas HJ, Sly PD, Scott JG. Consequences of bullying victimization in childhood and adolescence: A systematic review and meta-analysis. *World J Psychiatry*. 2017;7(1):60. doi:10.5498/wjp.v7.i1.60

5. Wilson E, Crudgington H, Morgan C, Hirsch C, Prina M, Gayer-Anderson C. The longitudinal course of childhood bullying victimization and associations with self-injurious thoughts and behaviors in children and young people: A systematic review of the literature. *J Adolesc*. 2023;95(1):5-33. doi:10.1002/jad.12097

6. Winsper C, Lereya T, Zanarini M, Wolke D. Involvement in bullying and suicide-related behavior at 11 years: A prospective birth cohort study. *J Am Acad Child Adolesc Psychiatry*. 2012;51(3). doi:10.1016/j.jaac.2012.01.001

7. Ahmad K, Beatson A, Campbell M, et al. The impact of gender and age on bullying role, self-harm and suicide: Evidence from a cohort study of Australian children. *PLoS One*. 2023;18(1 January):1-13. doi:10.1371/journal.pone.0278446

8. Sourander A, Ronning J, Brunstein-Klomek A, et al. Childhood Bullying Behavior and Later Psychiatric Hospital and Psychopharmacologic Treatment. *Arch Gen Psychiatry*. 2009;66(9):1005. doi:10.1001/archgenpsychiatry.2009.122

9. Klomek AB, Sourander A, Kumpulainen K, et al. Childhood bullying as a risk for later depression and suicidal ideation among Finnish males. *J Affect Disord*. 2008;109(1-2):47-55. doi:10.1016/j.jad.2007.12.226

10. Wen X, Shu Y, Qu D, et al. Associations of bullying perpetration and peer victimization subtypes with preadolescent's suicidality, non-suicidal self-injury, neurocognition, and brain development. *BMC Med*. 2023;21(1). doi:10.1186/s12916-023-02808-8

11. Jantzer V, Ossa FC, Eppelmann L, Parzer P, Resch F, Kaess M. Under the skin: does psychiatric outcome of bullying victimization in school persist over time? A prospective intervention study. *J Child Psychol Psychiatry*. 2022;63(6):646-654. doi:10.1111/jcpp.13502

12. van der Wal MF, de Wit CAM, Hirasing RA. Psychosocial Health Among Young Victims and Offenders of Direct and Indirect Bullying. *Pediatrics*. 2003;111(6):1312-1317. doi:10.1542/peds.111.6.1312

13. Hellström L, Beckman L. Adolescents' perception of gender differences in bullying. *Scand J Psychol*. 2020;61(1):90-96. doi:10.1111/sjop.12523

14. Canetto SS, Sakinofsky I. The Gender Paradox in Suicide. *Suicide Life Threat*

Behav. 1998;28(1):1-23. doi:10.1111/j.1943-278x.1998.tb00622.x

15. Olsen J, Meder IK. *Better Health for Mother and Child-The Danish National Birth Cohort (DNBC), Its Structure, History and Aims ESTABLISHING THE DANISH NATIONAL BIRTH COHORT*. Vol 24.; 2014. www.dnbc.dk

16. Schmidt M, Pedersen L, Sørensen HT. The Danish Civil Registration System as a tool in epidemiology. *Eur J Epidemiol*. 2014;29(8):541-549. doi:10.1007/s10654-014-9930-3

17. Lynge E, Sandegaard JL, Rebolj M. The Danish national patient register. *Scand J Public Health*. 2011;39(7):30-33. doi:10.1177/1403494811401482

18. Mors O, Perto GP, Mortensen PB. The Danish psychiatric central research register. *Scand J Public Health*. 2011;39(7):54-57. doi:10.1177/1403494810395825

19. Geoffroy MC, Bouchard S, Per M, et al. Prevalence of suicidal ideation and self-harm behaviours in children aged 12 years and younger: a systematic review and meta-analysis. *Lancet Psychiatry*. 2022;9(9):703-714. doi:10.1016/S2215-0366(22)00193-6

20. Reuter Morthorst B, Soegaard B, Nordentoft M, Erlangsen A. Incidence rates of deliberate self-harm in Denmark 1994-2011: A nationwide register study. *Crisis*. 2016;37(4):256-264. doi:10.1027/0227-5910/a000391

21. Debarmore BM. Coding IPW and SMR in SAS and Stata. Published online 2019.

22. Ali M, Altman DG. Inverse probability weighting. 2016;189(January):1-2. doi:10.1136/bmj.i189

23. Xu S, Ross C, Raebel MA, Shetterly S, Blanchette C, Smith D. Use of Stabilized Inverse Propensity Scores as Weights to Directly Estimate Relative Risk and Its Confidence Intervals. 2010;13(2):273-277.

24. Brunstein Klomek A, Barzilay S, Apter A, et al. Bi-directional longitudinal associations between different types of bullying victimization, suicide ideation/attempts, and depression among a large sample of European adolescents. *J Child Psychol Psychiatry*. 2019;60(2):209-215. doi:10.1111/jcpp.12951

25. Colmenero-Navarrete L, García-Sancho E, Salguero JM. Relationship Between Emotion Regulation and Suicide Ideation and Attempt in Adults and Adolescents: A Systematic Review. *Arch Suicide Res*. 2022;26(4):1702-1735. doi:10.1080/13811118.2021.1999872

26. Newman ML, Holden GW, Delville Y. Isolation and the stress of being bullied. *J Adolesc*. 2005;28(3):343-357. doi:10.1016/j.adolescence.2004.08.002

27. Sourander A, Jensen P, Rönning JA, et al. What Is the Early Adulthood Outcome of Boys Who Bully or Are Bullied in Childhood? The Finnish “From a Boy to a Man” Study. *Pediatrics*. 2007;120(2):397-404. doi:10.1542/peds.2006-2704

28. Peeters M, Cillessen AHN, Scholte RHJ. Clueless or Powerful? Identifying Subtypes of Bullies in Adolescence. *J Youth Adolesc*. 2010;39(9):1041-1052. doi:10.1007/s10964-009-9478-9

29. Koenig LR, Blum RW, Shervington D, et al. Unequal Gender Norms Are Related to Symptoms of Depression Among Young Adolescents: A Cross-Sectional, Cross-Cultural Study. *Journal of Adolescent Health*. 2021;69(1):S47-S55. doi:10.1016/j.jadohealth.2021.01.023

30. Fraguas D, Diáz-Caneja CM, Ayora M, et al. Assessment of School Anti-Bullying Interventions: A Meta-analysis of Randomized Clinical Trials. *JAMA Pediatr*. 2021;175(1):44-45. doi:10.1001/jamapediatrics.2020.3541

31. Ossa FC, Jantzer V, Eppelmann L, Parzer P, Resch F, Kaess M. Effects and moderators of the Olweus bullying prevention program (OBPP) in Germany. *Eur Child Adolesc Psychiatry*. 2021;30(11):1745-1754. doi:10.1007/s00787-020-01647-9

32. Cosma A, Bjereld Y, Elgar FJ, et al. Gender Differences in Bullying Reflect Societal Gender Inequality: A Multilevel Study With Adolescents in 46 Countries. *Journal of Adolescent Health*. 2022;71(5):601-608. doi:10.1016/j.jadohealth.2022.05.015

33. Lewis KM, Schure MB, Bavarian N, et al. Problem Behavior and Urban, Low-Income Youth. *Am J Prev Med*. 2013;44(6):622-630. doi:10.1016/j.amepre.2013.01.030

34. Holt MK, Kaufman Kantor G, Finkelhor D. Parent/Child Concordance about Bullying Involvement and Family Characteristics Related to Bullying and Peer Victimization. *J Sch Violence*. 2008;8(1):42-63. doi:10.1080/15388220802067813

35. Mark L, Samm A, Tooding LM, et al. Suicidal Ideation, Risk Factors, and Communication With Parents. *Crisis*. 2013;34(1):3-12. doi:10.1027/0227-5910/a000153

36. Choi B. Parental Coping Strategies as Predictors and Outcomes of Bullying: Longitudinal Relationships Between Child Victimization, Parent-Child Communication, and Parent-Teacher Consultation. *J Youth Adolesc*. Published online 2024. doi:10.1007/s10964-024-02019-1

37. De Los Reyes A, Prinstein MJ. Applying depression-distortion hypotheses to the assessment of peer victimization in adolescents. *Journal of Clinical Child and Adolescent Psychology*. 2004;33(2):325-335. doi:10.1207/s15374424jccp3302_14

38. Perret LC, Orri M, Boivin M, et al. Cybervictimization in adolescence and it's assocaition with subsequent suicidal ideation/attempt beyond face-to-face victimization: a longitudinal population-based study. *Journal of Child Psychology and Psychiatry*. 2020;2507(February):1-9.

39. Mueller AS, James W, Abrutyn S, Levin ML. Suicide ideation and bullying among US adolescents: Examining the intersections of sexual orientation, gender, and race/ethnicity. *Am J Public Health*. 2015;105(5):981-985. doi:10.2105/AJPH.2014.302391

40. Meng H, Real AG, Gower AL, et al. Suicidal ideation among youth: Examining the intersections of multiple social positions and bias-based bullying. *J Affect Disord*. 2025;381:61-68. doi:10.1016/j.jad.2025.03.178

Table 1: Danish National Birth Cohort study population before and after weighting against the reference group of the Danish background population liveborn in the same calendar period (both sexes).

	DNBC population	Background population	Weighted DNBC population
Characteristics at age 11	N (%)[a]	N (%)[a]	%
Total	28,997 (100.0)	449,288 (100.0)	100.0
Mother's birth age			
<26 years	3,286 (11.3)	91,702 (20.4)	17.7
26 to 30 years	9,862 (34.0)	175,562 (39.1)	31.2
30 to 34 years	11,206 (38.6)	115,656 (25.7)	35.6
≥35 years	4,643 (16.0)	66,210 (14.7)	15.6
Missing	0 (0.0)	158 (0.0)	0
Parity of mother			
1 child	13,736 (47.4)	189,332 (42.1)	43
2 children	9,904 (34.2)	162,651 (36.2)	37
≥3 children	5,348 (18.4)	97,251 (21.7)	19.9
Missing	9 (0.0)	54 (0.0)	0.1
Family Structure			
Living with both parents	22,816 (78.7)	292,640 (65.1)	67.5
Not living with (both) parents	6,156 (21.2)	143,135 (31.9)	32.3
Missing	25 (0.1)	13,513 (3)	0.2
Parent's highest educational level			
Elementary school	450 (1.6)	37,527 (8.6)	4.9
Vocational education	6,838 (23.6)	155,343 (34.6)	36
Highschool education	1,496 (5.2)	30,152 (6.7)	6.8
Bachelor's degree or higher	20,185 (69.6)	214,714 (47.8)	52.2
Missing	28 (0.1)	11,552 (2.6)	0.2
Parent's occupation			
Working/studying	26,124 (90.1)	337,643 (75.2)	79
Not working	2,864 (9.9)	106,405 (23.7)	20.9
Missing	9 (0)	5,240 (1.2)	0.1
Parent's income level			
1st quartile (lowest)	2,901 (10)	110,681 (24.6)	21.8
2nd quartile	6324 (21.8)	111,034 (24.7)	25.9
3rd quartile	8989 (31)	111,130 (24.7)	25.9
4th quartile (highest)	10,774 (37.2)	111,217 (24.8)	26.3
Missing	9 (0.0)	5,226 (1.2)	0.1
Sex of child			
Boy	11,705 (40.4)	230,419 (51.3)	49.3
Girl	17,292 (59.6)	218,869 (48.7)	50.7
Child's psychiatric diagnosis			
No	28,317 (97.7)	431,371 (96.0)	96.3
Yes	680 (2.3)	17,917 (4.0)	3.7
Parent's psychiatric diagnosis			
No	26,523 (91.5)	383,312 (85.3)	86.6
Yes	2,465 (8.5)	65,913 (14.7)	13.3
Missing	9 (0.0)	63 (0.0)	0

[a]Absolute numbers represents unweighted figures.

Table 2: Relative risk ratio of lifetime suicidal ideation and suicide attempt from at age 18 years by bully role and sex based on self-reports at age 11.

			Unadjusted[a]		Adjusted[a,b]	
	N	**Cases SI/SA**	SI RRR (95% CI)	SA RRR (95% CI)	SI RRR (95% CI)	SA RRR (95% CI)
Non-involved and boy	8439	2063/93	1	1	1	1
Non-involved and girl	13424	4312/343	1.5 (1.5-1.6)	2.8 (2.3-3.5)	1.6 (1.5-1.7)	2.7 (2.2-3.4)
Perpetrator only and boy	537	143/7	1.1 (0.9-1.3)	1.4 (0.8-2.6)	1.1 (0.9-1.3)	1.0 (0.6-1.9)
Perpetrator only and girl	278	95/16	1.9 (1.4-2.4)	9.0 (5.7-14.4)	1.8 (1.4-2.3)	6.7 (4.2-10.8)
Victim only and boy	2012	709/58	1.7 (1.5-1.9)	3.2 (2.5-4.3)	1.6 (1.4-1.8)	2.7 (2.0-3.6)
Victim only and girl	3075	1322/203	2.6 (2.4-2.9)	10.2 (8.1-12.7)	2.5 (2.3-2.8)	8.1 (6.5-10.2)
Victim-perpetrators and boy	717	230/20	1.5 (1.3-1.7)	3.2 (2.2-4.6)	1.4 (1.2-1.6)	2.2 (1.5-3.2)
Victim-perpetrators and girl	515	238/45	3.3 (2.7-4.0)	15.9 (11.3-22.2)	3.1 (2.6-3.7)	10.6 (7.5-15.0)

[a]All models represent weighted estimates

[b]Adjusted for parent's income level, family structure, parent's highest educational level, parent's psychiatric diagnosis, parent's occupation, child's drinking, child's smoking, and frequency of visiting friends.

Abbreviations: SI= suicidal ideations; SA= Suicide attempt; RRR= Relative risk ratio; 95% CI= 95% confidence intervals

Table 3: Relative risk ratios of suicidal ideation and suicide attempt reported at age 18 years according to parent and child agreement on bullying involvement from 11-year follow-up

	N	Cases SI/SA	Unadjusted Model[a] SI RRR (95% CI)	Unadjusted Model[a] SA RRR (95% CI)	Adjusted Model[a,b] SI RRR (95% CI)	Adjusted Model[a,b] SA RRR (95% CI)
Boys						
Victim status, according to parent and child						
No (agreeing)	7793	1859/77	1	1	1	1
Conflicting (disagreeing)	1963	638/39	1.4 (1.3-1.6)	2.2 (1.5-3.2)	1.4 (1.2-1.6)	2.0 (1.4-2.9)
Yes (agreeing)	985	369/44	2.0 (1.8-2.3)	6.4 (4.6-9.0)	1.8 (1.6-2.1)	4.9 (3.4-7.0)
Perpetrator status, according to parent and child						
No (agreeing)	9359	2458/124	1	1	1	1
Conflicting (disagreeing)	1209	359/26	1.2 (1.0-1.4)	1.8 (1.3-2.7)	1.1 (1.0-1.3)	1.5 (1.0-2.2)
Yes (agreeing)	173	49/10	1.2 (0.9-1.5)	4.7 (2.8-8.0)	1.0 (0.7-1.3)	2.7 (1.6-4.8)
Girls						
Victim status, according to parent and child						
No (agreeing)	11661	3635/275	1	1	1	1
Conflicting (disagreeing)	2684	706/87	1.7 (1.6-1.9)	3.1 (2.6-3.7)	1.6 (1.5-1.8)	2.6 (2.1-3.1)
Yes (agreeing)	1051	515/94	2.4 (2.1-2.7)	5.8 (4.7-7.3)	2.2 (1.9-2.5)	4.5 (3.5-5.6)
Perpetrator status, according to parent and child						
No (agreeing)	14511	4886/458	1	1	1	1
Conflicting (disagreeing)	825	349/53	1.5 (1.3-1.8)	2.4 (1.8-3.1)	1.4 (1.2-1.6)	1.8 (1.4-2.4)
Yes (agreeing)	60	26/9	1.7 (1.1-2.7)	8.4 (4.8-14.5)	1.5 (0.9-2.4)	4.4 (2.4-8.0)

[a]All models represent weighted estimates

[b]Adjusted for parent's income level, family structure, parent's highest educational level, parent's psychiatric diagnosis, parent's occupation, child's drinking, child's smoking, and frequency of visiting friends.

Abbreviations: SI= suicidal ideations; SA= Suicide attempt; RRR= Relative risk ratio; 95% CI= 95% confidence intervals

Figure 1: Flowchart of the study population participating in 11- and 18-year follow-ups in the DNBC cohort

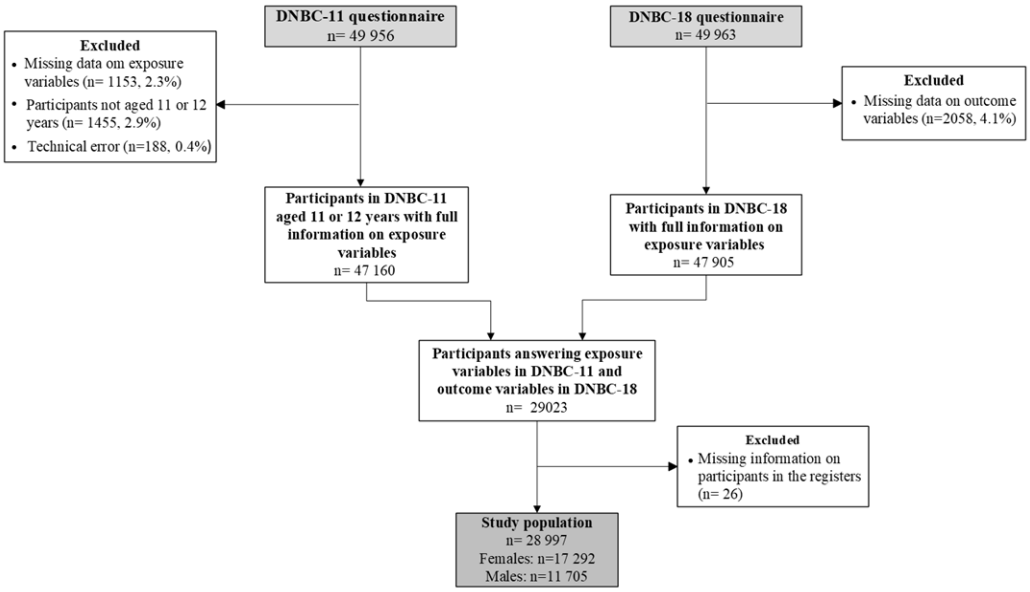
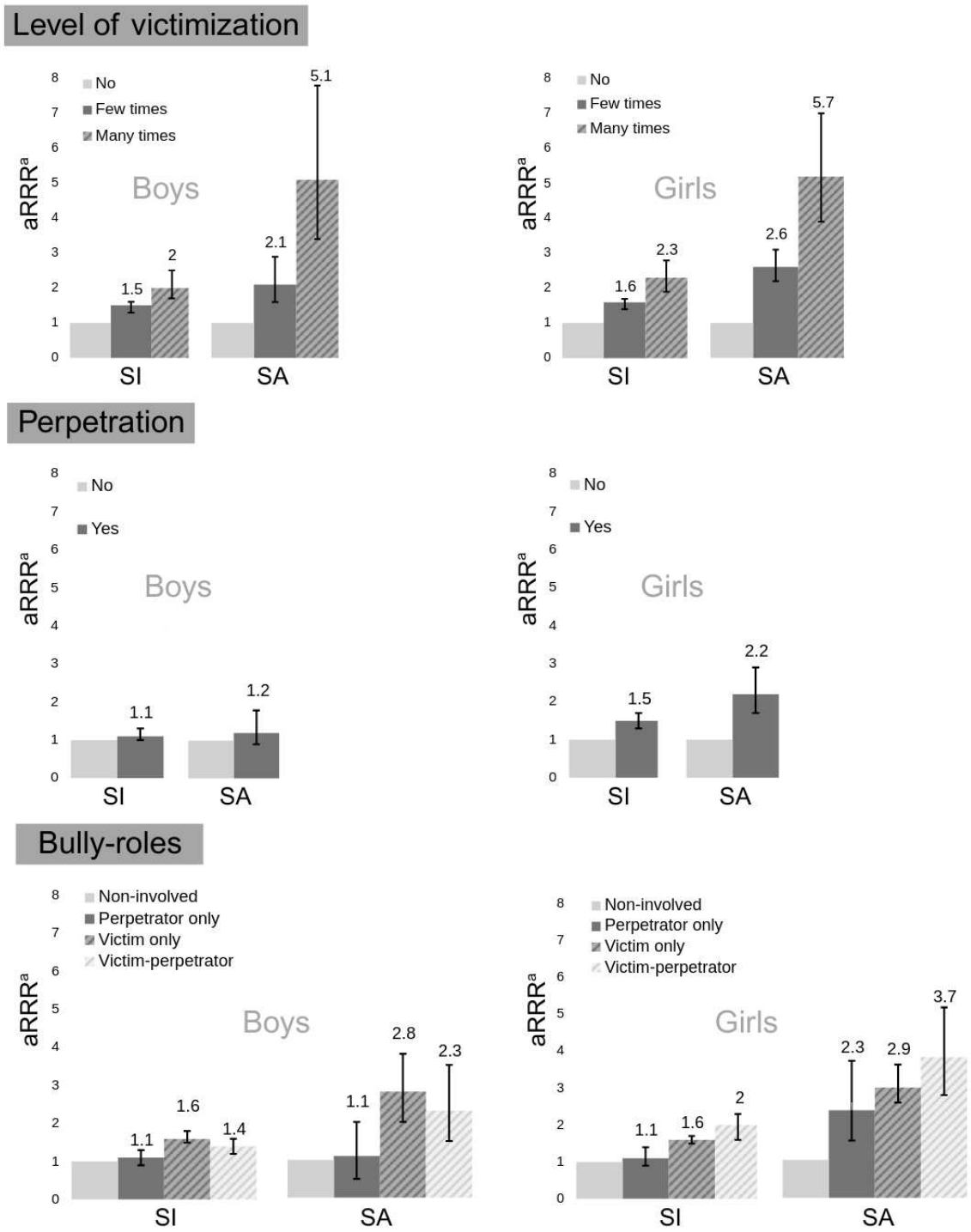


Figure 2: Adjusted relative risk ratios (aRRR)[a] of suicide ideation and suicide attempt at age 18 years according to victimization, perpetration, and bully roles from 11-year follow-up for boys and girls, respectively.



[a] Adjusted for parent's income level, family structure, parent's highest educational level, parent's psychiatric diagnosis, parent's occupation, child's drig, child's smoking, and frequency of visiting friends.
Abbreviations: SI= suicidal ideations; SA= Suicide attempt