The Relationship between Self-harm and Bullying Behavior: Results from a Population based-study of Adolescents

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Abstract

**Background:** This study aims to better understand the association between bullying behaviour (the bullied, the bullies and the bully-victims) and self-harm, and which protective factors moderate this association.

**Methods:** A total of 16,182 adolescents, aged 12 to 19 years, were invited to participate in the cross-sectional Ung-data survey. The response rate was 87%. To assess the relationship between self-harm and bullying behaviour, and risk- and protective factors, we conducted logistic regression analyses. In addition, we tested for potential interaction effects between protective factors and the three bullying groups on self-harm.

**Results:** Fifteen percent of participating adolescents reported engaging in self-harm during the last year. The risk of self-harm was six times higher for the “bully-victims”, five times higher for the bullied, and three times higher for the bullies, compared to the “neither-bullied nor bullies”. The risk of self-harm in the face of being bullied was significantly greater for girls than boys. Depression, anxiety and parental conflict accounted for some of the association between being bullied and self-harm, and between bully-victims and self-harm. School behavioural problems accounted for some of the association between the bullies and self-harm and the bully-victims and self-harm. The relationship between the bullied and self-harm was significantly moderated by parental support and school well-being, while the relationship between “bully-victims” and self-harm was moderated by school well-being.

**Conclusion:** There is a strong link between bullying and self-harm. Interventions to address bullying may reduce self-harm. Our findings also suggest that high levels of parental support and school well-being may buffer the harmful relationship between bullying behaviour and self-harm. Addressing these factors may be important in reducing the risk of self-harm among those experiencing bullying.

**Background**

Self-harm is a major public health problem (1) and adolescents are particularly at risk (e.g., (2)). In a review of 52 studies on self-harm, the international lifetime estimate of self-harm among adolescents was 17% (3), and the 12-month prevalence was 10-19% (4). A recent Norwegian study from 2020 showed that the 12-month prevalence among young adolescents (13-15 years) was 16.2% and that the prevalence had increased 4-fold over a 15-year period (5). Girls engage in self-harm more than boys (3, 5, 6). A study from seven different countries showed that both the lifetime and the 12-month prevalence of self-harm was three times larger among adolescent girls compared to adolescent boys (7).

Previous research suggests that bullying victimisation is a risk factor for self-harm (8-10). Yet, not all adolescents who experience bullying harm themselves. This study aims to better understand the link between bullying and self-harm.
Consensus on the definition of self-harm is lacking in the literature. Common definitions include deliberate self-harm (DSH), that refers to intentional self-poisoning or self-injury, and non-suicidal self-injury (NSSI) that refers to the deliberate and direct injury of one’s own body tissue without suicidal intent, such as scratching, cutting, hitting and burning oneself (11, 12). However, the suicidal intention of self-harm is often unknown, and we do not know how individuals, particularly adolescents, understand the term self-harm. In this study, we therefore use the NICE Clinical Guidelines (14) definition of self-harm: ‘self-poisoning or self-injury, irrespective of the apparent purpose of the act’, that is a shorter and broader definition of the World Health Organization WHO/EURO multicentre study (13).

Risk factors for self-harm include a complex interplay of mental disorders and genetic-, biological-, psychological- and environmental factors (1). Psychological factors include depression, anxiety, emotional dysregulation, personality disorders, aggression, and low self-esteem (16), and exposure to life stress events such as sexual abuse, violence, early parental separation loss, bullying, family/parental conflicts, and school academic problems (17, 18). Fewer studies have however explored protective factors for self-harm, though social support from community, family and friends, and personal factors (social competency, problem-solving skills and positive temperament) may protect against self-harm (19). Studies among adolescents indicate that social support and connectedness to family, peers, and school, and personal factors such as high self-control are associated with reduced risk of self-harm (20, 21).

Many studies confirm that bullying victimisation, which refers to being a victim of aggressive behaviour or intentional harm, repeatedly over time, and which involves an imbalance in power (22), is associated with self-harm (6, 9). Verbal bullying by peers, in particular, seems to have a strong association with self-harm among adolescents (23). O’Conner (6) found that girls who were bullied were three times as likely to engage in self-harm as others, while bullied boys were twice as likely. Cyberbullying, that is bullying through electronic forms of contact such as mobile phones and the internet, have emerged in recent years (24). A review article (25) examining the relationship between bullying victimisation and self-harm showed a significant association between self-harm and both victims of cyber-bullying and traditional bullying face-to-face. The co-occurrence of traditional- and cyber-bullying victimisation also showed a strong association with self-harm.

One explanation for the strong association between bullying victimisation and self-harm may be that both are associated with emotional problems such as anxiety, and depression (26). Bully victimisation is linked to increased feelings of anxiety and depression, and several studies have shown that self-harm can, among other functions, work as an affect-regulation function by decreasing negative emotions (27-29). Thus, negative emotions may mediate the relationship between bullying victimisation and self-harm (29, 30). In addition, a large study of Irish adolescent boys showed that school-related problems, physical abuse, worries about sexual orientation and serious conflicts with parents heighten the risk of self-harm among those who were bullied (10).
Few studies, however, appear to have investigated possible protective factors for self-harm in the face of bullying. Studies that have, found that family- and parental support and an authoritative parental style (9) moderate the relationship between self-harm and bullying victimisation (10, 21) and one study found that parental support also moderated the relationship between self-harm and bulling aggressors (21). There appears to be a lack of research investigating protective factors outside of the family such as support from friends, and school well-being (including teacher support). These protective variables could potentially have a moderating effect on the relationship between self-harm and the different types of bullying behaviours.

In this study, we investigated the relationship between self-harm and 1) being bullied (“bullied”), 2) bullying aggressors (“bullies”) and 3) both being bullied and bullying others (“bully-victims”), and which factors might account for these relationships. Furthermore, we aimed to identify which protective factors may moderate the relationship between these bullying behaviours and self-harm.

**Hypotheses**

We hypothesised that:

1. The three bullying behaviours: 1) being bullied (“bullied”), 2) bullying others (“bullies”) and 3) both being bullied and bullying others (“bully-victims”) would be associated with higher odds of self-harm compared to those who were neither bullied nor bullies.

2. Gender (being a girl), socioeconomic differences (having a poor socioeconomic background), having school behavioural problems, experiencing parental conflict and having emotional problems (depression and anxiety) would be risk factors for self-harm. Controlling for these variables would account for some of the association between self-harm and the three bullying groups.

3. Social support from parents, an authoritative parental style/parental monitoring, social support from friends, friendship and school well-being (including teacher support) would protect against self-harm. Controlling for these factors would account for some of the association between self-harm and the three bullying groups.

4. The protective factors would moderate the relationships between the three bulling groups and self-harm (interaction effects).

**Methods**

**Study design and participants**

“Ungdata” is a cross-sectional, large, national survey, designed for adolescents and conducted at the municipal level in Norway (33). “Ungdata” covers various aspects of young people’s lives, such as
relationships with parents and friends, leisure activities, health issues, local environment, well-being, and school issues. The survey also includes questions about tobacco and drug use, and participation in violence, bullying and self-harm. We were granted access to the “Ungdata” from The Norwegian Social Research Institute (NOVA). NOVA is responsible for the national coordination of the project, while the regional Drug and Alcohol Competence Centres are responsible for conducting the municipal surveys.

Participants in the “Ungdata” study were high-school pupils and students (grades 8th–13th, 50% girls) from 85 different municipalities in Norway, conducted in “the Ungdata” survey in 2014 (N = 47 450) (33, 34). The response rate was 84% among the younger high school pupils (grades 8th-10th) and 66% among the older high school students (grades 11th-13th) (34). All participants filled in an online questionnaire during school hours. The questionnaire consisted of both a core part, which is identical for all municipalities, and an elective part, with questions that municipalities could choose, based on interest and need. Questions on self-harm were in the elective part of the questionnaire. Thus, only adolescents living in the 23 municipalities that had chosen to include this part of the questionnaire could respond (N=16 182). A total of 14 093 adolescents answered the questions relating to self-harm, yielding a response rate of 87%.

A public health coordinator in each municipality administered the survey, and local contacts in each school approached the adolescents together with teachers. The local contacts and teachers ensured that survey procedures were followed and that adolescents did not collaborate while responding to the survey. All of the municipal surveys were conducted anonymously. Participation was voluntarily. Parents were informed about the surveys and given the opportunity to withdraw their children from participation (35). The data were cleaned by NOVA Ungdata according to their criteria to remove non-serious responses prior to issuing the data. Details of the criteria can be found in the UngData report (33). Because the dataset was conducted without personal identifiable information, specific ethical approval was not required for this study and was waved by the Norwegian Centre for Research data (NSD). We conducted the analyses in accordance with the NSD’s data protection regulations.

**Measures**

**Self-harm**

Self-harm was the dependent variable. To measure self-harm, participants were asked: (1) “Have you ever tried to harm yourself?” Those who responded yes, were then asked: (2) “Have you tried to harm yourself in the past 12 months?”. We wanted specifically to study those who had been self-harming the last year. This was because those who have self-harmed in the last twelve months are most at risk in the future, and also because the time line was more aligned with the bullying measure (see below for the bullying measure). Thus, we grouped adolescents into two categories: Those who had self-harmed in the past 12 months (value 1) and those who had not self-harmed in the last 12 months (regardless of if they had harmed themselves prior to this) (value 0).
Bullying behaviour

Bullying behaviour was a categorical independent variable. Bullied by peers was measured by combining two questions: “Are you sometimes teased, threaten, or frozen out by other young people in school or in your free time?” and “Are you sometimes teased, or threaten, by other young people online or on your mobile phone?” Response options for both questions were: (1) Yes, several times a week, (2) Yes, around once a week, (3) Yes, around once a fortnight, (4) Yes, once a month, (5) Almost never (6) Never. Those who responded with 1 to 4, on both, or one of the questions, were categorised as: “Bullied by peers” and valued 1, and those who responded with 5 or 6 on both questions were categorised as “Not bullied by peers” and valued 0. Bullying other peers was measured by combining the following two questions: “Do you sometimes take part in teasing, threatening or freezing out other young people at school or in your free time?” and “Do you sometimes take part in teasing, and/or threatening other young people online or by mobile phone?” Response options for both questions were: (1) Yes, several times a week, (2) Yes, around once a week, (3) Yes, around once a fortnight, (4) Yes, once a month, (5) Almost never (6) Never. Adolescents who responded with 1 to 4, on both, or one of the questions, were categorised as “Bullying other peers” and valued 1, and adolescents who responded with 5 or 6 on both questions were categorised as “Have not bullied other peers” and valued 0. We then created a new variable combining the variables “Bullied by peers” and “Bullying other peers”. First, those who were neither “Bullied by peers” nor “Bullying other peers” were coded with 0. Those who had been “Bullying other peers” but were not “Bullied by peers” were coded with 1 (“bullies”). Those who were both “Bullied by peers” and “Bullying other peers” were coded with 2 (“bully-victims”). Finally, those who were “Bullied by peers”, but not “Bullying other peers” were coded with 3 (“bullied”).

Gender

Gender was a dichotomous variable with Boys (0) and Girls (1).

Social Support of Parents and Social Support of Friends

The measure “willingness to seek social support” was based on Sarason’s social support measure (36). We used two separate questions, one referring to parents and one to friends. Participants were asked: “Imagine that you have a personal problem. You feel sad and need someone to talk to. Who would you talk to, or ask for help? A) Parents? B) Friends? Response options were: (1) Definitely, (2) Maybe and (3) No. For each support person, we combined response options (1) “Definitely” and (2) “Maybe”, with “Yes” (coded with two), while No was coded with 1.

Best friend

Best friend/friendship was measured with the question: Do you have at least one friend who you trust completely and can tell absolutely anything to?

1) Yes, I am sure, 2) Yes, I think so, 3) I do not think so, and 4) I have no one I could call a friend now a days”.
**Father- and Mother Education**

Father/Mother education was measured by responses to the questions: a) “Does your father have university or college level education?” (1) Yes (2) No and b) “Does your mother have university or college level education?” (1) Yes (2) No.

**Psychological Distress: Symptoms of Depression and Anxiety**

The measures of symptoms of depression and anxiety were short versions of the scales: “Hopkins Symptom Checklist” (HSCL) (37, 38) and “Depressive Mood Inventory” (39). Earlier studies have shown that short version of HSCL has good validity (40, 41). Participants were asked: «During the past week, have you been affected by any of the following issues: 1) "Felt that everything is a struggle"; 2) "Had sleep problems"; 3) "Felt unhappy, sad or depressed"; 4) "Felt hopelessness about the future"; 5) "Felt stiff or tense"; 6) "Worried too much about things"; 7) "Suddenly felt scared for no reason"; 8) "Felt constant fear or anxiety"; 9) "Felt exhausted or dizzy"; 10) "Been nervous or felt uneasy"; 11) "Been easily moved to tears" and 12) "Tended to blame yourself for things". Each question had four response categories: (1) Not at all, (2) Not much; (3) Quite a lot; and (4) A great deal. We then conducted a Principal components factors analysis (PCA) with oblique rotation. Based on eigenvalues and scree-plots, we found two factors: questions 1-6 (Depression) and questions 7-12 (Anxiety). A mean score index was then calculated for depression and anxiety. Cronbach’s alpha was 0.9 for each of the factors, indicating a satisfactory reliability of each measure.

**Family’s Financial Situation**

Family’s financial situation was based on responses to the question: “Financially, has your family been well off or badly off, over the past two years? The response categories were: (1) “We have been well off the whole time”, (2) “We have generally been well off”, (3) “We have neither been well off or badly off” (4) “We have generally been badly off” and (5) “We have been badly off the whole time”.

**School Behavioural Problems**

The School behavioural problems (SBP) was measured by four items from the conceptual domain of the “School-related problem behaviour” in the “Bergen Questionnaire on Antisocial behaviour” (42, 43). This measure has been used in earlier UngData-studies (Young in Norway studies) in 1992, 2002, and 2010, and the scale was shortened down when the questionnaire was revised in 2013 (33). The measure included: “Have you done or experienced any of the following things during the past 12 months?": “Had a big argument with a teacher”; “The school have contacted your parents for something bad you did”, “Skipped school” and “Been in a fight (without weapon)”. The response options were: (1) “Never”; (2) “Once” (3) “2 – 5 times”; (4) “6 – 10 times” and 5)“11 times or more”. PCA with oblique rotation was conducted for the four questions. Based on eigenvalues and scree-plots, the items loaded on one factor. A mean score was calculated for the four items. Cronbach’s alpha was 0.7, indicating a satisfactory level of reliability for school problems.
**Relationship with Parents: Parental Monitoring and Parental Conflict**

This measure is based on elements of the concept of parenting style (45), particularly authoritative parenting (46, 47), from the “strictness-supervision scale”, which assesses parental monitoring and limit setting. In addition, some of the items measured the concept “conflicts with or between parents” (33). The adolescents responded to the following questions: “Below are some statements that may describe your relationship with your parents”: a) “My parents usually know where I am, and who I am with, in my free time”; b) “My parents know most of the friends I hang out with in my free time”, c) “I try to hide what I do in my free time from my parents”; d) “My parents know my friends’ parents”; e) “I often argue with my parents”, f) “The adults in my family often argue” and g) “My parents know who I am in touch with on the internet”. Response were given on a 4-point scale from: (1) Very true; (2) Quite true; (3) Not very true, and (4) Not at all true. We conducted a PCA with oblique rotation on the seven statements. Based on eigenvalues and scree plots, two factors were extracted: “Parental monitoring” (items a, b, d and g) and “Parental conflict” (items c, e and f). A mean score index was calculated for each and Cronbach’s alpha showed a satisfactory level of reliability (0.7) for both concepts; (“Parental monitoring”, α = 0.7 and “Parental conflict”, α = 0.7) (48).

**School Well-being**

The questions measuring school well-being have previously been used in studies of young people in Norway (33), and include the following: “Do you agree or disagree with the following statements about your situation at school,” “I enjoy school”, “I feel that I fit in with the students at my school”, “I often do not want to go to school”, “My teachers care about me”, and “I am bored at school”. Evaluation of the statements was on a 4-point scale from: (1) “Totally agree”, (2) “Somewhat agree”, (3) “Somewhat disagree” to (4) “Totally disagree”. To measure how the items correlated with each other and if they fitted together, a PCA with oblique rotation of the five statements was conducted. Based on eigen-values and screeplots, only one factor was extracted. A mean index score was calculated for the five items after reversing responses in the first, second and forth items so a high score represented good school well-being. Cronbach’s alpha was 0.72, indicating a satisfactory level of reliability.

**Statistical Analyses**

To test significant differences between those who had self-harmed during the last 12 months and those who had not self-harmed during the last 12 months, we used chi-square tests for all categorical variables. Independent-samples t-tests were conducted to compare the continuous variables. To assess the relationship between the dichotomous dependent variable/the outcome variable: “self-harmed last 12 months”, (yes/no), and the independent variable (bullying behaviour) and the covariates (gender, depression, anxiety, family’s financial situation, mother/father education, school problems, parental conflict, parental monitoring, school well-being, parental support, friend support and friendship), we conducted logistic regression analyses. Gender, bullying behaviour, parental support, friend support and friendship were treated as categorical variables. We conducted bivariate logistic regression analyses for the dichotomous dependent variable “self-harmed last 12 months”, and the independent variable (bullying
behaviour) and each covariate separately. Then we ran various logistic regression models, with the addition of the covariates in order to evaluate which factors would reduce the strength of the association between bullying behaviour and self-harm. We did this first for all potential risk factors and then for all potential protective factors. To determine whether the potential protective factors moderated the relationship between bullying behaviour and self-harm, we performed separate regression analyses, adding one interaction term at a time. All continuous variables in the interaction terms were first standardised (49). We then plotted the values of the unstandardised regression coefficients (including intercept) and means and standard deviations of the independent variables, moderators and the interaction terms in the cells indicated in the Jeremy Dawson’s excel sheet, http://www.jeremydawson.com/slopes.htm (49-51). This was to aid interpretation and to visualise the significant interaction effects.

Results

Descriptive Statistic

Of the 14,093 adolescents who responded to the questions on self-harm, 15.3% (n=2,149) had engaged in self-harm during the last 12 months, with more girls (22.5%) than boys (8.0%). Around 11% of the sample reported that they had experienced being bullied by their peers (the “bullied”), at least once a month. Three percent had been both victims of bullying and bullied others (the “bully-victims”) and 2% had bullied others but not been bullied themselves (the “bullies”).

Table 1 shows significant differences in self-harm for the categorical variables in the study (gender, bullying behaviour, best friend, social support and parental education). We also found significant differences between those who had self-harmed and those who had not in scores for all continuous variables (depression, anxiety, family’s financial situation, school behavioural problems (SBP), parental conflict, parental monitoring, and school well-being).

Risk Factors

Table 2, Model 1 shows that the odds of self-harm was highest among the “bully-victims”. The odds ratio (OR) was 6.0 times higher for this group compared with those who were neither bullied nor bullies themselves. Additionally, the odds of self-harm was 5.0 times higher among “bullied” adolescents and 3.2 times higher among the “bullies”, compared with those who were neither bullied nor bullies themselves.

The bivariate analysis (Table 2, Model 1), showed that low socioeconomic background (poor family financial situation and low parental education), depression, anxiety, parental conflict, and school behavioural problems (SBP) were significantly related to self-harm. Those whose parents did not have higher education, who had a poorer family financial situation and higher scores on depression, anxiety, parental conflict, and school behavioural problems (SBP) had higher odds of self-harm. The odds of self-
harm among girls was 3.34 times higher than for boys. The OR for gender remained stable and increased a little when controlling for bullying behaviour (OR=3.73) (model 2).

In Model 3, we controlled for socioeconomic background, gender and bullying behaviour. There were small reductions in OR for the three groups of bullying behaviour from model 2 to model 3. Thus, socioeconomic status accounted for little of the relationship between bullying behaviour and self-harm.

Adding depression to the model reduced the odds of self-harm more than 10% from model 3 to model 4 for all three types of bullying behaviours. Thus, depression accounted for part of the relationship between bullying behaviours and self-harm for all three types of bulling behaviour (52). Adding anxiety to model 5, the odds ratio of self-harm reduces less than 10% from model 4 to model 5 for the bullies and thus anxiety do not account for the relationship between the bullies and self-harm.

In the final model (Model 6), we controlled for all predictors. The OR for self-harm was significant for depression, anxiety, parental conflict, SPB, all three types of bullying behaviours and gender. The socioeconomic background variables were no longer significant.

SBP and parental conflict accounted for part of the relationship between “bullies”, “bully-victims”, and self-harm, as the odds ratio for self-harm decreased more than 10% from model 5 to model 6 for “bully-victims” and “bullies”. Parental conflict also accounted for part of the relationship between the “bullied” and self-harm, as the OR decreased from 2.2 (CI 1.9-2.6) to 2.0 (CI 1.7-2.4) when only parental conflict was included in the model.

**Protective Factors**

Table 3, Model 1 displays the OR for self-harm for the various possible protective factors in bivariate analyses. Parental support and having a best friend were the strongest protective factors for self-harm. The odds ratio for gender, again, remained quite stable after controlling for different predictors (models 1-6), We controlled for mother- and father’s education and family’s financial situation in models 3-6. The mother’s education and family’s financial situation was still significantly related to self-harm after controlling for gender and bullying behaviour (Model 3). Conversely, father’s education was not significant.

In model 4, we found that both parental support and parental monitoring had a strong protective effect on self-harm after controlling for bullying behaviour, gender and socioeconomic background. The odds ratio for two of the groups (“bully-victims” and “bullies”) was reduced more than 10% from Model 3 to Model 4, indicating that parental support and parental monitoring accounted for part of the relationship between self-harm and bullying behaviour. Mother’s education was not significantly related to self-harm in Model 4 to 6, but good family financial situation was significant in Model 3 to 6.
When friend support and best friend were included in the Model 5, the changes in OR for all bullying groups from Model 4 to 5 were minimal. However, when we added school well-being in Model 6, the OR for the “bullied” and “bully-victims” decreased by more than 10%. This indicates that school well-being accounted for part of the relationship between self-harm and the groups “bullied” and “bully-victims”.

Parental support was the strongest protective factor for self-harm after controlling for all factors (Model 6). Additionally, parental monitoring, school well-being and a good family financial situation was significant in the final model.

**Interaction Effects**

The odds of self-harm among girls was 3.3 times greater (OR=3.34) than among boys (see Table 4, Model 1). In Model 3, we tested for interaction effects between gender and bullying behaviour. There was a positive significant interaction effect ($p=0.04$) between gender and the “bullied” group (see Table 4, Model 3). This indicates that the risk of self-harm for the “bullied” compared with those who were “neither bullied nor bullies” was significantly greater for girls than for boys, as shown in Table 4 and Figure 1.

Furthermore, we tested for interaction effects between the three bullying behaviours and all protective factors on self-harm (see Table 4). The interactions between parental support and the “bullied”, and between school well-being and the “bullied” and the “bully-victims” were significant (see Table 4, Model 3).

We then plotted the unstandardised regression beta-coefficients of the bulling behaviours and the protective factors and the interactions in order to aid interpretation (see Figure 1-5 for the results). In Figure 2, the regression line for parental support is steeper for the “bullied” than for the “neither bullied nor bullies” group. Thus, parental support was more protective of self-harm among the “bullied” compared to the “neither bullied nor bullies” group. Similarly, the regression line for school-well-being is steeper for the “bullied” (Figure 3) and for the “bully-victims” (Figure 4) than for “neither bullied nor bullies”. Thus, school well-being was more protective of self-harm among the “bullied” and the “bully-victims” than for those who were not bullied nor bullies.

Lastly, we found a significant interaction effect between “friend support” and the “bullied” (see Table 4 and Figure 5). The result (see Figure 5) shows that friend support was slightly less protective of self-harm among the “bullied” compared to the “neither bullied nor bullies”.

**Discussion**

The aim of the study was to examine the relationship between self-harm and bullying, both being bullied and bullying others, and factors that may contribute to this relationship. The odds of self-harm were six times higher for the “bully-victims”, five times higher among the “bullied” and three times higher among the “bullies”, compared to adolescents who were neither bullied nor bullies. The increased risk of self-
harm among these groups is previously documented in studies (8, 9, 21, 31, 32). Our study also confirms that bully-victims are especially vulnerable (31). They are considered to have the broadest range of adjustment problems, presenting difficulties common to both bullies and victims (31, 53), and are high in both externalizing- and internalizing problems. Barker (31) found that many of the bully-victims first have a history of being bullied, and then begin to bully peers later in adolescence. Thus, they suffer from both emotional problems and aggression.

Risk Factors

As hypothesised, the odds of self-harm were higher among adolescent girls compared to boys. This is consistent with earlier studies (3, 6, 7). The gender difference remained after controlling for the three types of bullying behaviour. Additionally, we found a significant interaction effect between gender and “being bullied”, meaning that the odds of self-harm in the face of being bullied was significantly greater for girls than boys, compared with their “neither being bullied nor bullying” counterparts. We are not aware of any previous research which shows this and thus, the reasons for this should be investigated in future research. However, one explanation may be that girls have a greater susceptibility to stress in social relationships than boys (54, 55). Another reason could be that girls are twice as likely as boys to experience depression during adolescence (56) and depression is associated with both being bullied and self-harm (26).

Symptoms of depression and anxiety accounted for the largest part of the relationship between self-harm and being bullied, and some of the relationship between self-harm and the “bully-victims”, and the bullies. Thus, the association between being bullied and self-harm appears to be confounded by depression and anxiety. This is consistent with earlier studies (9, 20, 21, 28-30). Although our data are cross-sectional and we cannot be sure about causality, earlier longitudinal studies suggest that depressive symptoms mediate the relationship between being bullied and self-harm (30).

Parental conflict was associated with an increase in the odds of self-harm for all three bullying groups. This may be because negative relationships with parents, or ongoing inter-parental conflicts, might lead to deficits in emotion regulation and thus increase the likelihood of self-harm (57, 58). The present study is one of a few considering parental conflict as an explanation of the relationship between bullying behaviour and self-harm. An exception was a large study of McMahon (10) among adolescent boys. This study showed that conflicts with parents and school-related problems heightens the risk of self-harm among boys who were bullied. This study did not, however include girls, and did not include the link between bullies and self-harm, and bully-victims and self-harm, as the present study did.

Interestingly, low socioeconomic background had a significant association with self-harm when controlling for bullying behaviour, but that it ceased to be significant after controlling for parental conflict. Thus, conflicts both with, and between, parents may be more important for self-harm than one's socioeconomic background.
School behavioural problems was an important risk factor for self-harm and accounted for some of the relationship between self-harm and the bullies, and self-harm and bully-victims in the present study. It is possible that bullying is part of a broader concept of externalizing behaviour that includes conduct behavioural problems with aggressive and delinquent behaviours, school failure, and drop out (53).

**Protective Factors**

Parental monitoring was a significant protective variable of self-harm, also after controlling for bullying behaviours and all covariates. However, there was no significant interaction effect between parental monitoring and bullying behaviour. Thus, our study suggests that parental monitoring does not buffer against self-harm when being bullied. This is in contrast to an earlier study by Hay and Meldrum (9). This mismatch in findings could be due to the way authoritative parenting was measured. Hay & Meldrum (9) included three dimensions of authoritative parenting: supervision/parental monitoring, fair discipline, and parent–child involvement, while our measure mostly included the supervision/monitoring part of the measure. Another explanation may be due to cultural differences in parenting style. Garcia and Garcia for instance, found that the most optimal parenting style for adolescent mental health may be cultural specific (59).

Parental support had a significant protective effect on self-harm among boys and girls, even after controlling for the three types of bullying behaviour. Furthermore, we found a significant interaction effect between parental support and the “bullied” group. Thus, parental support appears more protective of self-harm for those who are bullied compared to those who are not. This is in line with some earlier studies (9, 21).

Friendship and friend support had a significant protective bivariate association with self-harm in the present study. However, friend support was no longer significant associated with self-harm after controlling for bullying behaviour and parental support. In addition, friendship and friend support accounted for very little of the relationship between self-harm and the three types of bullying behaviour. Friend support was even less protective of self-harm among those who were bullied, compared to the “neither bullied nor bullies”. A review study examining the impact of social modelling on self-harm, showed that exposure to self-harm through peers may for some adolescents, contribute to onset and maintenance of self-harm (60). A possible explanation for the finding that friend support was less protective of self-harm among those who were bullied, compared to those who were not bullied or bullying, could be that adolescents do not receive adequate support from friends when dealing with difficult emotional issues related to self-harm and bullying. Those adolescents who are both being bullied and who self-harm may be extra vulnerable and will need support from adults such as parents or adults at school.

The present study found a significant interaction effect between school well-being and the “bullied”, and school well-being and the “bully-victims”. Thus, school well-being (including support from teacher) was
more protective of self-harm for the bullied and the bully-victims, than it was for the “neither bullied nor bullies”. Previous research suggests that related measures of school well-being (school connectedness, teacher support, liking school) was protective of self-harm among adolescents (20). However, the present study appears to be the first investigating the buffering effect of school well-being on bullying behaviour and self-harm among adolescents. Thus, this might be an important result for the prevention of self-harm. Schools, parents, and health care professionals should be aware of the importance of school well-being for adolescents who are being bullied in terms of identifying those at risk of self-harm.

Strengths and limitations

The present study has some limitations. Firstly, our data were cross-sectional, which does not allow causal interpretations to be drawn. Thus, the relationships between our predictor variables (such as bulling) and self-harm are associations and cannot demonstrate cause-effect. However, previous longitudinal studies found that bullying increases the risk of self-harm and not the other way around (30). Secondly, the measures in our study are based on self-report, which may be biased because people tend to give socially desirable answers. However, earlier studies have shown that self-report measures are usually reliable (61).

Thirdly, our measures of self-harm and bullying are not standardised, since the survey was not specifically designed for assessing self-harm. Consensus of the definition of self-harm is however lacking in the literature and adolescents may have different understandings of what is meant by self-harm. Nonetheless, 15% reported having engaged in self-harm in the previous 12 months, which is consistent with earlier studies finding the 12-month prevalence rate to be between 10 to 19% around the world (3-5). This lends support to the validity of the findings.

Fourthly, a limitation could be that we included cyber-bulling and traditional bulling in the same measure. However, we conducted a sensitivity test, to test if the result of the logistic regression analysis were different if cyber bulling was excluded from the measure of bulling. Results showed very small differences, most likely because only cyber-bullying (without traditional bulling) was not common (e.g less than 7% of those reporting been bullied). This supports earlier studies that found that over 85% of those involved in cyberbullying are also involved in traditional bullying (62), and two studies of bulling found that only 1% of adolescents reported being only cyber victims (63, 64).

Practical Implications

Based on our findings, we see some practical implications. First, it is important to focus on both the bullied, the bullies and the bully-victims when developing interventions. Second, it also seems necessary...
to teach both those who are bullied and those who bully how to cope with depression and anxiety, such as learning adequate emotion-regulation skills, to prevent self-harming behaviour. Third, it may be helpful to include family communication in possible interventions that target bullying, as these factors seem to protect both the bullied, the bullies and bully-victims from engaging in self-harm. Fourth, school-based strategies such as improving school well-being and relationships at school may be an important element in the prevention of youth self-harm behaviours and bullying. Finally, interventions that foster nurturing environments, both at school and at home, may be effective for preventing the development of psychological problems and bullying behaviour (65). Prevention efforts should also be aware of peer networks that could have a negative influence on adolescents who self-harm. This is because strategies simply focusing on promoting friend support may not benefit youth with respect to self-harm and bullying, unless friends have the ability and maturity necessary to function as a positive influence.

Conclusion

Self-harm is not uncommon among adolescents and bullying is an important risk factor. Our study shows that it may have a greater effect on girls than on boys. Depression, anxiety and parental conflict accounted for some of the relationship between being bullied and self-harm, indicating the importance of family environment and emotion regulation. School-behavioural problems on the other hand is an important risk factor for self-harm for bullies and bully-victims. Our study highlights that parental support and school well-being may moderate the harmful consequences of bullying behaviour on self-harm among adolescents.

Abbreviations

HSCL: Hopkins Symptom Checklist
PCA: Principal components factors analysis
SBP: School behavioural problems
OR: Odds ratio
DSH: Deliberate self-harm
NSSI: Non-suicidal self-injury
NOVA: The Norwegian Social Research Institute
NSD: Norwegian Social Science Data Services

Declarations

Ethics approval and consent of participate
We used a secondary anonymized dataset collected by The Norwegian Social Research Institute (NOVA) and the regional Drug and Alcohol Competence Centers. Because the dataset was without collection of personal identifiable data, specific ethical approval was not required for this study and was waved by the Norwegian Centre for Research data (NSD). We conducted the analyses in accordance with the NSD’s data protection regulations. Participation was voluntarily. Parents of all participants were informed about the survey in advance, and were given the opportunity to withdraw their children from participation. No formal verbal or written consent was obtained.

**Consent for publication**

Not applicable as this was an anonymized secondary data source.

**Availability of data**

The dataset used (Ungdata) during the current study are available upon reasonable request from The Norwegian Social Research Institute (NOVA), ([http://www.ungdata.no/English](http://www.ungdata.no/English)).

**Competing interests**

The authors declare that they have no competing interests in this section.

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**Authors' contributions**

MS developed the major ideas of the study. IM conducted the analyses, while both authors contributed to interpreting the results. IM drafted the manuscript and MS commented and helped revise the manuscript. Both authors read and approved the final manuscript.
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References

1. Hawton K, Saunders KEA, O'Connor RC. Self-harm and suicide in adolescents. The Lancet. 2012;379(9834):2373-82.
2. Nock MK, Prinstein, Mitchell J. A Functional Approach to the Assessment of Self-Mutilative Behavior. Journal of Consulting and Clinical Psychology. 2004;72(5):885-90.
3. Swannell SV, Martin GE, Page A, Hasking P, St John NJ. Prevalence of Nonsuicidal Self-Injury in Nonclinical Samples: Systematic Review, Meta-Analysis and Meta-Regression. Suicide and Life-Threatening Behavior. 2014;44(3):273-303.
4. Muehlenkamp JJ, Claes L, Havertape L, Plener PL. International prevalence of adolescent nonsuicidal self-injury and deliberate self-harm. Child and Adolescent Psychiatry and Mental Health. 2012;6(1):10.
5. Tørmoen AJ, Myhre M, Walby FA, Grøholt B, Rossow I. Change in prevalence of self-harm from 2002 to 2018 among Norwegian adolescents. Eur J Public Health. 2020;30(4):688-92.
6. O'Connor RC, Rasmussen S, Miles J, Hawton K. Self-harm in adolescents: self-report survey in schools in Scotland. British Journal of Psychiatry. 2009;194(1):68-72.
7. Madge N, Hewitt A, Hawton K, Wilde EJd, Corcoran P, Fekete S, et al. Deliberate self-harm within an international community sample of young people: comparative findings from the Child & Adolescent Self-harm in Europe (CASE) Study. Journal of Child Psychology and Psychiatry. 2008;49(6):667-77.
8. Fisher HL, Moffitt TE, Houts RM, Belsky DW, Arsenault L, Caspi A. Bullying victimisation and risk of self harm in early adolescence: longitudinal cohort study. BMJ : British Medical Journal. 2012;344:e2683.
9. Hay C, Meldrum R. Bullying Victimization and Adolescent Self-Harm: Testing Hypotheses from General Strain Theory. J Youth Adolesc. 2010;39(5):446-59.

10. McMahon EM, Reulbach U, Keeley H, Perry IJ, Arensman E. Reprint of: Bullying victimisation, self harm and associated factors in Irish adolescent boys. Soc Sci Med. 2012;74(4):490-7.

11. Claes L, Vandereycken W. Self-injurious behavior: differential diagnosis and functional differentiation. Comprehensive Psychiatry. 2007;48(2):137-44.

12. Nock MK, Favazza AR. Nonsuicidal self-injury: Definition and classification. Washington, DC, US: American Psychological Association; 2009. 9-18 p.

13. Schmidtke A, Bille Brahe, U., De Leo, D., & Kerkhof, A. J. F. M. The WHO/EURO Multicentre Study on Suicidal Behaviour: History and Aims of the Study In A Schmidtke, U Bille Brahe, D De Leo, & A J F M Kerkhof (Eds), Suicidal Behaviour in Europe Results from the WHO/EURO Multicentre Study on SuicidalBehaviour. Göttingen,: Hogrefe and Huber. ; 2004. p. 7-10.

14. National Collaborating Centre for Mental H. National Institute for Health and Clinical Excellence: Guidance. Self-Harm: The Short-Term Physical and Psychological Management and Secondary Prevention of Self-Harm in Primary and Secondary Care. Leicester (UK): British Psychological Society Copyright © 2004, The British Psychological Society & The Royal College of Psychiatrists.; 2004.

15. Platt S, Bille-Brahe U, Kerkhof A, Schmidtke A, Bjerke T, Crepet P, et al. Parasiticide in Europe: the WHO/EURO multicentre study on parasuicide. I. Introduction and preliminary analysis for 1989. Acta Psychiatr Scand. 1992;85(2):97-104.

16. Valencia-Agudo F, Burcher GC, Ezpeleta L, Kramer T. Nonsuicidal self-injury in community adolescents: A systematic review of prospective predictors, mediators and moderators. Journal of Adolescence. 2018;65:25-38.

17. Fliege H, Lee J-R, Grimm A, Klapp BF. Risk factors and correlates of deliberate self-harm behavior: A systematic review. Journal of Psychosomatic Research. 2009;66(6):477-93.

18. Madge N, Hawton K, McMahon EM, Corcoran P, De Leo D, de Wilde EJ, et al. Psychological characteristics, stressful life events and deliberate self-harm: findings from the Child & Adolescent Self-harm in Europe (CASE) Study. European Child & Adolescent Psychiatry. 2011;20(10):499.

19. Williamson AK, Riendeau RP, Stolzmann K, Silverman AF, Kim B, Miller CJ, et al. An Exploratory Analysis of Self-Reported Protective Factors against Self-Harm in an Enrolled Veteran General Mental Health Population. Military Medicine. 2019;184(11-12):e738-e44.

20. Kaminski JW, Puddy RW, Hall DM, Cashman SY, Crosby AE, Ortega LAG. The Relative Influence of Different Domains of Social Connectedness on Self-Directed Violence in Adolescence. Journal of Youth and Adolescence. 2010;39(5):460-73.

21. Claes L, Luyckx K, Baetens I, Van de Ven M, Witteman C. Bullying and Victimization, Depressive Mood, and Non-Suicidal Self-Injury in Adolescents: The Moderating Role of Parental Support. Journal of Child and Family Studies. 2015;24(11):3363-71.
22. Luukkonen AH, Räsänen P, Hakko H, Riala K. Bullying Behavior Is Related to Suicide Attempts but Not to Self-Mutilation among Psychiatric Inpatient Adolescents. Psychopathology. 2009;42(2):131-8.
23. Mossige S, Huang L, Straiton M, Roen K. Suicidal ideation and self-harm among youths in Norway: associations with verbal, physical and sexual abuse. Child & Family Social Work. 2016;21(2):166-75.
24. Smith P, Mahdavi J, Carvalho M, Fisher S, Russell S, Tippett N. Cyberbullying: Its nature and impact in secondary school pupils. Journal of child psychology and psychiatry, and allied disciplines. 2008;49:376-85.
25. Heerde JA, Hemphill SA. Are Bullying Perpetration and Victimization Associated with Adolescent Deliberate Self-Harm? A Meta-Analysis. Archives of Suicide Research. 2019;23(3):353-81.
26. Arseneault L, Bowes, L., & Shakoor, S. Bullying victimization in youths and mental health problems: 'Much ado about nothing? Psychological Medicine. 2010;40(5), 717-729.
27. Claes L, Houben A, Vandereycken W, Bijttebier P, Muehlenkamp J. Brief report: The association between non-suicidal self-injury, self-concept and acquaintance with self-injurious peers in a sample of adolescents. Journal of Adolescence. 2010;33(5):775-8.
28. Klonsky ED. The functions of deliberate self-injury: a review of the evidence. Clin Psychol Rev. 2007;27(2):226-39.
29. Klonsky ED. The functions of self-injury in young adults who cut themselves: Clarifying the evidence for affect-regulation. Psychiatry Research. 2009;166(2):260-8.
30. Lereya ST, Winsper C, Heron J, Lewis G, Gunnell D, Fisher HL, et al. Being Bullied During Childhood and the Prospective Pathways to Self-Harm in Late Adolescence. J Am Acad Child Adolesc Psychiatry. 2013;52(6):608-18.e2.
31. Barker ED, Arseneault L, Brendgen M, Fontaine N, Maughan B. Joint Development of Bullying and Victimization in Adolescence: Relations to Delinquency and Self-Harm. Journal of the American Academy of Child & Adolescent Psychiatry. 2008;47(9):1030-8.
32. Brunstein Klomek A, Marrocco F, Kleinman M, Schonfeld IS, Gould MS. Bullying, Depression, and Suicidality in Adolescents. Journal of the American Academy of Child & Adolescent Psychiatry. 2007;46(1):40-9.
33. Froyland LR. Ungdata- Lokale ungdomsundersøkelser: Dokumentasjon av variablene i spørreskjemaet. (Youngdata – Local adolescents’ health surveys Documentation of the variables in the questionnaire). 2015 [Available from: https://nsd.no/data/individ/publikasjoner/NSD2360/NSD2360DokumentasjonsrapportUngdata.pdf.
34. NOVA. Ungdata. Nasjonale resultatater 2014. (Youngdata. National results 2014). Report. Oslo: NOVA; 2015. Report No.: 7.
35. Abebe DS, Froyland LR, Bakken A, von Soest T. Municipal-level differences in depressive symptoms among adolescents in Norway: Results from the cross-national Ungdata study. Scand J Public Health. 2016;44(1):47-54.
36. Sarason IG, Sarason BR, Shearin EN, Pierce GR. A Brief Measure of Social Support: Practical and Theoretical Implications. Journal of Social and Personal Relationships. 1987;4(4):497-510.
37. Derogatis LR. SCL-90-R, Administration, scoring and procedures manual. 2nd. ed: Baltimore, MD: Procedures Psychometric Research.; 1983.

38. Derogatis LR, Lipman RS, Rickels K, Uhlenhuth EH, Covi L. The Hopkins Symptom Checklist (HSCL): A self-report symptom inventory. Behavioral Science. 1974;19(1):1-15.

39. Kandel DB, Davies M. Epidemiology of Depressive Mood in Adolescents: An Empirical Study. Archives of General Psychiatry. 1982;39(10):1205-12.

40. Strand BH, Dalgard OS, Tambs K, Rognerud M. Measuring the mental health status of the Norwegian population: A comparison of the instruments SCL-25, SCL-10, SCL-5 and MHI-5 (SF-36). Nordic Journal of Psychiatry. 2003;57(2):113-8.

41. Tambs K, Moum T. How well can a few questionnaire items indicate anxiety and depression? Acta Psychiatrica Scandinavica. 1993;87(5):364-7.

42. Olweus D. Prevalence and incidence in the study of antisocial behavior: Definitions and measurements. In MW Klein (red): Crossnational research in self-reported crime and delinquency: Dordrecht: Kluwer Academic Publishers.; 1989.

43. Bendixen M, Olweus D. Measurement of antisocial behaviour in early adolescence and adolescence: psychometric properties and substantive findings. Criminal Behaviour and Mental Health. 1999;9(4):323-54.

44. Windle M. A longitudinal study of antisocial behaviors in early adolescence as predictors of late adolescent substance use: Gender and ethnic group differences. Journal of Abnormal Psychology. 1990;99(1):86-91.

45. Baumrind D. Child care practices anteceding three patterns of preschool behavior. Genetic Psychology Monographs. 1967;75(1):43-88.

46. Baumrind D. The Influence of Parenting Style on Adolescent Competence and Substance Use. The Journal of Early Adolescence. 1991;11(1):56-95.

47. Gray MR, Steinberg L. Unpacking Authoritative Parenting: Reassessing a Multidimensional Construct. Journal of Marriage and Family. 1999;61(3):574-87.

48. Nunnally JC. Psychometric theory.: New York: McGraw-Hill.; 1978.

49. Aiken LS, West SG. Multiple regression: Testing and interpreting interactions. Thousand Oaks, CA, US: Sage Publications, Inc; 1991. xi, 212-xi, p.

50. Dawson JF. Moderation in Management Research: What, Why, When, and How. Journal of Business and Psychology. 2014;29(1):1-19.

51. Dawson J, Richter A. Probing Three-Way Interactions in Moderated Multiple Regression: Development and Application of a Slope Difference Test. The Journal of applied psychology. 2006;91:917-26.

52. Hernán MA, Hernández-Díaz S, Werler MM, Mitchell AA. Causal Knowledge as a Prerequisite for Confounding Evaluation: An Application to Birth Defects Epidemiology. American Journal of Epidemiology. 2002;155(2):176-84.
53. Kim YS, Leventhal BL, Koh Y-J, Hubbard A, Boyce WT. School Bullying and Youth Violence: Causes or Consequences of Psychopathologic Behavior? Archives of General Psychiatry. 2006;63(9):1035-41.

54. Sandanger I, Nygård JF, Sørensen T, Moum T. Is women’s mental health more susceptible than men’s to the influence of surrounding stress? Social Psychiatry and Psychiatric Epidemiology. 2004;39(3):177-84.

55. Sund AM, Larsson B, Wichstrøm L. Psychosocial correlates of depressive symptoms among 12–14-year-old Norwegian adolescents. Journal of Child Psychology and Psychiatry. 2003;44(4):588-97.

56. Nolen-Hoeksema S. Gender Differences in Depression. Current Directions in Psychological Science. 2001;10(5):173-6.

57. Baetens I, CL, Martin G., Onghena P., Grietens H., Van Leeuwen K., et al. Is nonsuicidal self-injury associated with parenting and family factors? Journal of Early Adolescence. 2014;34, (3):387–405.

58. Tschan T, Schmid M, In-Albon T. Parenting behavior in families of female adolescents with nonsuicidal self-injury in comparison to a clinical and a nonclinical control group. Child and Adolescent Psychiatry and Mental Health. 2015;9(1):17.

59. García F, Gracia E. Is always authoritative the optimum parenting style? Evidence from Spanish families. Adolescence. 2009;44:101-31.

60. Jarvi S, Jackson B, Swenson L, Crawford H. The Impact of Social Contagion on Non-Suicidal Self-Injury: A Review of the Literature. Archives of Suicide Research. 2013;17(1):1-19.

61. Dolcini MM, Adler NE, Lee P, Bauman KE. An assessment of the validity of adolescent self-reported smoking using three biological indicators. Nicotine & Tobacco Research. 2003;5(4):473-83.

62. Juvonen J, Gross EF. Extending the school grounds?–Bullying experiences in cyberspace. J Sch Health. 2008;78(9):496-505.

63. Przybylski AK, Bowes L. Cyberbullying and adolescent well-being in England: a population-based cross-sectional study. The Lancet Child & Adolescent Health. 2017;1(1):19-26.

64. Wolke D, Lee K, Guy A. Cyberbullying: a storm in a teacup? European Child & Adolescent Psychiatry. 2017;26(8):899-908.

65. Ttofi MM, Farrington DP, Lösel F. Interrupting the Continuity From School Bullying to Later Internalizing and Externalizing Problems: Findings From Cross-National Comparative Studies. Journal of School Violence. 2014;13(1):1-4.

Tables

Table 1

| Significant Differences between Risk- and Protective Factors among adolescents who Self-harmed and not Self-harmed (N=14 093) |  |  |
| Variables                          | Frequencies | Self-harm | Chi-square $\chi^2$ | df |
|-----------------------------------|-------------|-----------|---------------------|----|
|                                   | $n$ | Yes (%) | No (%)             |    |
| Self-harm                         | 14 093 | 15.3     | 84.8               |    |
| Categorical variables             |           |          |                    |    |
| Gender                            |           |          |                    |    |
| Female                            | 7 026 | 22.5     | 77.5               |    |
| Male                              | 6 970 | 8.0      | 92.0               | 569.7*** |
| Bullying behaviour                |           |          |                    |    |
| Neither bullied nor bullies      | 11 528 | 10.9     | 89.1               |    |
| Bullied                           | 1 526  | 38.1     | 61.9               |    |
| Bullies                           | 318   | 28.0     | 72.0               |    |
| Bully-victims                     | 401   | 42.1     | 57.9               | 1054.0*** |
| Best friend                       |           |          |                    |    |
| Yes                               | 12 465 | 14.0     | 86.0               |    |
| No                                | 1 437  | 26.0     | 74.0               | 142.9*** |
| Social support friends            |           |          |                    |    |
| Yes                               | 11 878 | 14.5     | 85.5               |    |
| No                                | 1 699  | 21.2     | 78.8               | 52.0*** |
| Social support parents            |           |          |                    |    |
| Yes                               | 11 027 | 10.3     | 89.7               |    |
| No                                | 2 527  | 36.3     | 63.7               | 1086.6*** |
| Education, Mother                 |           |          |                    |    |
| High                              | 8 990  | 65.7     | 75.0               |    |
| Low                               | 3 220  | 34.3     | 25.0               | 67.9*** |
| Education, Father                 |           |          |                    |    |
| High                              | 7 896  | 59.9     | 67.6               |    |
| Low                               | 3 988  | 40.1     | 32.4               | 38.9*** |
| Continuous variables              | M (SD)          | t-test     | Range |
|----------------------------------|-----------------|------------|-------|
| Depression                       | 21.7 (6.3)      | -56.9***   | 8-32  |
| Anxiety                          | 13.6 (5.2)      | -49.4***   | 6-24  |
| SBP                              | 5.1 (2.7)       | -23.0***   | 3-15  |
| Parental conflict                | 6.5 (2.3)       | -30.3***   | 3-12  |
| Family’s financial situation     | 2.4 (1.1)       | -20.0***   | 1-5   |
| School well-being                | 13.5 (3.2)      | 38.7***    | 5-20  |
| Parental monitoring              | 11.0 (2.8)      | 24.1***    | 4-16  |

Note. Significant result= *p < 0.05, **p < 0.01, and ***p < 0.001. Not significant=n.s. Mean=M. Standard Deviation=SD. Self-harm= Self harmed last 12 months. Bullying behaviour=Being bullied by peers at least one time a month last 12 months or bullying other peers at least one time a month last 12 months, or both bullying others and being bullied by peers at least one time a month last 12 months. SBP=School behavioural problems. Chi-square test was used to test significant differences for categorical variables, and independent sample t-test was used to test significant differences for the continuous variables.

**Table 2**

Odds ratio (OR) of self-harm last 12 months on bullying behaviour and risk variables.
|                      | Model 1                  | Model 2                  | Model 3                  | Model 4                  | Model 5                  | Model 6                  |
|----------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
|                      | OR                       | OR                       | OR                       | OR                       | OR                       | OR                       |
|                      | (95% CI)                 | (95% CI)                 | (95% CI)                 | (95% CI)                 | (95% CI)                 | (95% CI)                 |
| Neither bullied nor bullies | 1.0 (ref.)               |                          |                          |                          |                          |                          |
| Bullied              | 5.04 (4.47-5.68)***      | 4.94 (4.36-5.59)***      | 4.26 (3.69-5.0)***       | 2.30 (1.95-2.71)***      | 2.18 (1.85-2.58)***      | 1.97 (1.66-2.34)***      |
| Bullies              | 3.19 (2.48-4.09)***      | 4.43 (3.40-5.77)***      | 3.52 (2.56-4.84)***      | 2.12 (1.47-3.05)**       | 2.16 (1.48-3.14)**       | 1.49 (1.01-2.22)*        |
| Bully-victims        | 5.97 (4.86-7.35)***      | 8.28 (6.65-10.34)***     | 7.32 (5.60-9.56)***      | 3.24 (2.39-4.38)***      | 2.80 (2.04-3.85)***      | 1.82 (1.29-2.55)***      |
| Gender               | 3.34 (3.02-3.71)***      | 3.73 (3.34-4.17)***      | 3.55 (3.12-4.04)***      | 2.16 (1.88-2.49)***      | 1.72 (1.49-2.00)***      | 1.94 (1.66-2.34)***      |
| Family's financial sit. | 1.60 (1.53-1.68)***      | 1.39 (1.31-1.47)***      | 1.12 (1.05-1.19)***      | 1.12 (1.04-1.19)***      | 1.04 (0.97-1.12)         |                          |
| Education mother     | 1.56 (1.41-1.74)***      | 1.25 (1.08-1.44)***      | 1.21 (1.03-1.41)***      | 1.22 (1.04-1.43)***      | 1.18 (1.00-1.38)         |                          |
| Education father     | 1.39 (1.26-1.55)***      | 1.04 (0.91-1.19)         | 0.99 (0.85-1.15)         | 0.99 (0.85-1.15)         | 0.97 (0.83-1.13)         |                          |
| Depression           | 1.23 (1.22-1.24)***      |                          | 1.20 (1.18-1.21)***      | 1.12 (1.10-1.13)***      | 1.1 (1.08-1.11)***       |                          |
| Anxiety              | 1.33 (1.31-1.34)***      |                          | 1.14 (1.12-1.17)***      | 1.14 (1.12-1.17)***      | 1.1 (1.12-1.16)***       |                          |
| Parental conflict    | 1.44 (1.41-1.48)***      |                          |                          |                          |                          | 1.15 (1.11-1.19)***      |
| School problem       | 1.37 (1.34-1.40)***      |                          |                          |                          |                          | 1.15 (1.11-1.19)***      |

Note. *p<0.05 **p<0.01 ***p<0.001, not significant=n.s. Family's financial sit.=Family's financial situation. Model 1 shows crude/unadjusted OR, bivariate associations with no controls, Model 2 shows adjusted OR with control for bullying behaviour and gender, Model 3 shows adjusted OR with control for bullying behaviour, gender and socioeconomic background. Model 4 shows adjusted OR with control for bullying behaviour, gender, socioeconomic background and depression. Model 5 shows adjusted OR with control for bullying behaviour, gender, socioeconomic background, depression, and anxiety, Model 6 shows adjusted OR with control for all risk variables.
Table 3

Odds ratio (OR) of self-harm last 12 months on bullying behaviour and protective variables

| Variable                  | Odds Ratio (OR) |
|---------------------------|-----------------|
| Protection factor         | 2.5             |
| Social support            | 1.8             |
| Peer support              | 1.5             |
| School support            | 1.2             |
| Family support            | 1.0             |
| Individual support        | 0.8             |
|                | Model 1          | Model 2          | Model 3          | Model 4          | Model 5          | Model 6          |
|----------------|------------------|------------------|------------------|------------------|------------------|------------------|
|                | OR (95% CI)      | OR (95% CI)      | OR (95% CI)      | OR (95% CI)      | OR (95% CI)      | OR (95% CI)      |
| Neither bullied nor bullies | 1.0 (ref.)      |                  |                  |                  |                  |                  |
| Bullied        | 5.04 (4.48-5.68)*** | 4.94 (4.36-5.59)*** | 4.27 (3.68-4.95)*** | 3.69 (3.16-4.24)*** | 3.62 (3.10-4.24)*** | 2.42 (2.05-2.86)*** |
| Bullies        | 3.19 (2.48-4.10)*** | 4.43 (3.40-5.77)*** | 3.60 (2.60-4.98)*** | 2.40 (1.70-3.41)*** | 2.37 (1.6-3.37)*** | 1.89 (1.31-2.73)*** |
| Bully-victims  | 5.97 (4.86-7.35)*** | 8.29 (6.65-10.34)*** | 7.90 (6.02-10.37)*** | 5.60 (3.9-7.0)*** | 5.44 (4.057.29)*** | 3.48 (2.56-4.73)*** |
| Gender         | 3.34 (3.02-3.71)*** | 3.73 (3.34-4.17)*** | 3.51 (3.08-4.01)*** | 3.94 (3.43-4.53)*** | 3.94 (3.42-4.54)*** | 3.71 (3.22-4.28)*** |
| Family's financial sit. | 0.62 (0.60-0.65)*** | 0.72 (0.68-0.76)*** | 0.82 (0.77-0.87)*** | 0.82 (0.76-0.87)*** | 0.89 (0.83-.95)*** |                  |
| Education mother | 0.69 (0.61-0.78)*** | 0.78 (0.68-0.90)** | 0.88 (0.75-1.02)  | 0.87 (0.75-1.02)  | 0.88 (0.76-1.03)  |                  |
| Education father | 0.84 (0.74-0.94)*** | 0.99 (0.86-1.14)  | 1.04 (0.89-1.20)  | 1.04 (0.90-1.20)  | 1.05 (0.91-1.22)  |                  |
| Parental support | 0.20 (0.18-0.20)*** | 0.30 (0.26-0.34)*** | 0.31 (0.26-0.35)*** | 0.37 (0.32-0.42)*** |                  |                  |
| Parental monitoring | 0.81 (0.79-0.82)*** | 0.88 (0.86-0.90)*** | 0.88 (0.86-0.91)*** | 0.91 (0.89-0.94)*** |                  |                  |
| Friend support | 0.63 (0.55-0.71)*** |                  | 1.09 (0.90-1.33)  | 1.22 (1.00-1.50)* |                  |                  |
| Best friend    | 0.46 (0.41-0.53)*** |                  | 0.74 (0.61-0.90)*** | 0.89 (0.73-1.08)  |                  |                  |
| School well-being | 0.73 (0.72-0.74)*** |                  |                  | 0.82 (0.80-0.84)*** |                  |                  |
Note: *p<0.05 **p<0.01 ***p<0.001, n.s.=not significant. Model 1 shows crude OR, bivariate associations with no controls, Model 2 shows adjusted OR with control for bullying behaviour and gender, Model 3 shows adjusted OR with control for bullying behaviour, gender, high family financial situation and high mother and father education. Model 4 shows adjusted OR with control for bullying behaviour, gender, high family financial situation, high mother and father education, parental support, and parental monitoring, Model 5 shows adjusted OR with control for bullying behaviour, gender, high family financial situation, high mother and father education, parental support, parental monitoring, best friend and friend support, Model 6 shows adjusted OR with control for all protective variables.

**Table 4**

*Interaction effects of self-harm on bullying behaviour times gender, and bullying behaviour times protective variables.*
|                                | Model 1 OR (95% CI) | Model 2 OR (95% CI) | Model 3 OR (b) |
|--------------------------------|---------------------|---------------------|---------------|
|                                | Bivariate effect    | Multivariate effect | Interaction effects |
| Neither bullied nor bullies    | 1.0 (ref.)          |                     | Gender*       |
| Bullied                        | 5.04 (4.48-5.68)**  | 4.94 (4.36-5.59)**  | 1.32 (0.28)*  |
| Bullies                        | 3.19 (2.48-4.10)**  | 4.43 (3.40-5.77)**  | 0.84 (-0.18)  |
| Bully-victims                  | 5.97 (4.86-7.35)**  | 8.29 (6.65-10.34)** | 0.68 (-0.39)  |
| Gender                         | 3.34 (3.02-3.71)**  | 3.73 (3.34-4.17)**  |               |
| Neither bullied nor bullies    | 1.0 (ref.)          |                     | Parental support* |
| Bullied                        | 5.04 (4.48-5.68)**  | 4.38 (3.85-4.97)**  | 1.35 (0.30)*  |
| Bullies                        | 3.19 (2.48-4.10)**  | 2.40 (1.83-3.15)**  | 1.24 (0.22)   |
| Bully-victims                  | 5.97 (4.86-7.35)**  | 4.83 (3.85-6.07)**  | 1.08 (0.08)   |
| Parental support               | 0.20 (0.18-0.22)**  | 0.23 (0.21-0.26)**  |               |
| Neither bullied nor bullies    | 1.0 (ref.)          |                     | School well-being* |
| Bullied                        | 5.04 (4.48-5.68)**  | 2.60 (2.28-2.97)**  | 1.06 (0.06)** |
| Bullies                        | 3.19 (2.48-4.10)**  | 1.98 (1.50-2.62)**  | 1.01 (0.01)   |
| Bully-victims                  | 5.97 (4.86-7.35)**  | 2.63 (2.08-3.32)**  | 1.09 (0.09)** |
| School well-being              | 0.73 (0.72-0.74)**  | 0.76 (0.75-0.78)**  |               |
| Neither bullied nor bullies    | 1.0 (ref.)          |                     | Friend support* |
| Bullied                        | 5.04 (4.47-5.68)**  | 4.93 (4.36-5.56)**  | 1.68 (0.52)** |
| Bullies                        | 3.19 (2.48-4.09)**  | 3.10 (2.40-4.01)**  | 0.78 (-0.25)  |
| Bully-victims                  | 5.97 (4.86-7.35)**  | 6.13 (4.96-7.59)**  | 0.70 (-0.35)  |
| Friend support                 | 0.63 (0.55-0.71)**  | 0.80 (0.70-0.92)**  |               |

Note. *p<0.05 **p<0.01 ***p<0.001, not significant=n.s. Self-harm= Self harmed last 12 months. Model 1 shows the crude OR, the bivariate associations with no controls, Model 2 shows adjusted OR with control for gender or the protective variables: parental support, school well-being and friend support. Model 3 shows the regression analysis with the interaction terms: bullying behaviour times gender, and bullying behaviour times the protective variables. Only significant results reported.

Figures
Figure 2

The figure shows the interaction effect between “Bullied” times “Parental support” on self-harm.
Figure 4

Interaction effect between school well-being and the “bully-victims” on self-harm