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ABSTRACT

Continual conduct problems from adolescence to adulthood comprise a societal concern. Knowledge of school-related triggers and contributors to persistent conduct problems is important but still limited. We explored the role of schoolwork difficulties and being bullied by peers at school in the development of conduct problems, controlling for vulnerability factors of low cognitive competence and low prosociality. The data covered two measuring points on a longitudinal cohort of Finnish students between the ages of 16 and 18 ($N = 5,108$). All measures were self-reported. The regression and moderation modeling were executed using Bayesian estimation. Among 18-year-old adolescents, 14% of conduct problems were explained by conduct problems at the age of 16. Schoolwork difficulties had a direct positive effect on later conduct problems. Being bullied moderated effects of low cognitive competence and earlier conduct problems on later conduct problems. The findings show that we should also focus on school when risk factors for continuity of adolescents' conduct problems are sought out.

Increasing conduct problems, that is, antisocial and defiant activities, during adolescence comprise a societal concern, as some adolescents with antisocial behavior maintain their repetitive behavioral patterns into adulthood, thus facing ever-growing troubles in their adjustment to society. Adolescents who exhibit conduct problems in adolescence have a greater risk for multiple social and health impairments in later life (Colman et al., 2009; Khoddam, Jackson, & Leventhal, 2016). Moreover, conduct disorder in childhood and mid-adolescence predicts the tendency toward dropping out of school, drug use, and delinquency in adulthood (Breslau, Miller, Chung, & Schweitzer, 2011; Cerdá, Tracy, Sánchez, & Galea, 2011; Fergusson, Horwood, & Ridder, 2005; Heron et al., 2013; Moffit, Caspi, Harrington, & Milne, 2002; Mordre, Groholt, Kjelsberg, Sandstad, & Myhre, 2011; Sourander et al., 2005). Therefore, understanding contributors to the persistence of conduct problems throughout adolescence is important, but longitudinal research on the issue is still limited (Hankin, Abela, Auerbach, McWhinnie, & Steven, 2005). Specifically, little research has focused on the long-term risk factors in the school context, as most studies have focused on family or neighborhood settings. The present study explored the longitudinal associations of two school-related stress factors, schoolwork difficulties and being bullied by students at school, with conduct problems in Finnish adolescents between the ages of 16 and 18. The stress factors were studied alongside two vulnerability factors of conduct problems: low prosociality and low cognitive competence.

Conduct problems in adolescence

Conduct problems in adolescence include antisocial and defiant activities such as lying, stealing, physical aggression, disobedience, and coercive behaviors (Goodman, 2001). Conduct problems increase in middle adolescence, decrease toward young adulthood, and occur more commonly among boys than girls (Canino, Polanczyk, Bauermeister, Rohde, & Frick, 2010; Erskine et al., 2013). The increasing conduct problems have been explained, for example, by the developmental turbulence of the transitional period itself, especially among youth who exhibit conduct problems for the first time in adolescence (Barker & Maughan, 2009; Moffitt, 1993). In the transition from childhood to

adulthood, adolescents confront several biological, psychological, and social developmental tasks and challenges, including biological and sexual maturation, the development of personal identity, affirming independence and autonomy in the sociocultural environment, and the development of intimate sexual relationships (Christie & Viner, 2005; Harter, 2012). Due to these challenges, adolescents experience an increasing number of stressors and elevated emotional distress, which increase the probability of psychosocial problems (Ge, Conger, & Elder, 2001).

Vulnerability factors for conduct problems

Our theoretical framework is the stress-vulnerability perspective, which argues that risk for psychological problems is higher among adolescents who are more vulnerable and exposed to stressors (Grant, Compas, Thurm, McMahon, & Gipson, 2004; Grant & McMahon, 2005). The stress-vulnerability framework resembles the diathesis-stress model, which refers to genetic or biological vulnerabilities (Goforth, Pham, & Carlson, 2011) and has been used to explain, for example, the onset of depression or schizophrenia (Bandura, Pastorelli, Barbaranelli, & Caprara, 1999). Moreover, the stress-vulnerability perspective includes such characteristics and individual traits as vulnerability factors, which develop throughout adolescents' life experiences and make adolescents more prone to psychological problems, for example, antisocial behavior (Hankin et al., 2005).

Drawing on evidence from earlier research, one of the most important vulnerability factors of conduct problems is low prosociality. Prosocial behavior is defined as voluntary social actions toward other people, such as being nice and kind, that are intended to help another individual or have positive consequences for others (Eisenberg & Mussen, 1989). Low prosociality refers to limited prosocial emotions and a lack of empathy and has been associated with conduct problems and antisocial behaviors (de Wied, Wied, & van Boxtel, 2010; Euler, Steinlin, & Stadler, 2017; Kimonis, Frick, & McMahon, 2014). The parallel findings have been discovered in longitudinal designs, for example, more concern for other people predicted less behavioral problems among 4- to 10-year-old children (Hastings, Zahn-Waxler, Usher, Robinson, & Bridges, 2000). Moreover, peer ratings on low prosocial behavior at 8 years of age predicted criminal offenses by age 27, although early conduct problems were controlled for (Hämäläinen & Pulkkinen, 1996). Also, *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition (DSM-5) diagnostic criteria for conduct disorder include specifications due to limited prosocial emotions (American Psychiatric Association [APA], 2013).

Considerable research has also detected that low cognitive competence is a vulnerability factor that exposes children to conduct problems (Kimonis et al., 2014). Longitudinal studies have shown that low intelligence and poor verbal ability are antecedents of later conduct problems and delinquency in adulthood (Farrington, 2003; Goodman, Simonoff, & Stevenson, 1995; Manninen et al., 2013). Furthermore, life-course persistent offending has been predicted by poor neuropsychological test scores (Moffitt, 1993; Piquero, 2001).

Stressors in the school context

We define stressors as environmental triggers that cause emotional distress and may prompt adolescents to behave antisocially in the presence of vulnerabilities (Grant et al., 2004; Grant & McMahon, 2005). So far, the majority of the studies on contextual risk factors of conduct problems have been carried out in family settings or high-risk neighborhoods (e.g., Cooley-Strickland et al., 2009; Lorber & Slep, 2015; Murray & Farrington, 2010; Schonberg & Shaw, 2007; Trudeau, Mason, Randall, Spoth, & Ralston, 2012). Much less research has focused on stressors in the school context, although school is an important environment for children's and adolescents' development. Considering the probable origins of stress in school, we suggest that schoolwork and social relationships are the most salient fields where an adolescent's adverse experiences may cause notable stress (see Harter, 2012). Through formal and informal assessments at school, a poorly performing student frequently finds himself or herself to be worse compared to peers, which may evoke abundant feelings of loss, that is, loss of pleasure by competency and loss of the teacher's and parents' appreciation. This causes emotional distress, which could lead vulnerable adolescents to behave antisocially according to the stress-vulnerability perspective (Grant et al., 2004; Grant & McMahon, 2005). Earlier research has found that poor grades and low school attainment are risk factors that predict later conduct problems and delinquency (Farrington, 2003; Hämäläinen & Pulkkinen, 1996; Moffit, Caspi, Dickson, Silva, & Stanton, 1996).

Additionally, poor social relationships at school cause recurrent emotional distress, which has been shown to be a risk factor for many adolescents' psychosocial problems (Harter, 2012). Being bullied by peers at school has been associated with depressive symptoms (Hawker & Boulton, 2000) and with conduct problems. More conduct problems have been found among those

adolescents who have been victims of bullying, for example, rejected by peers, and who have conflicted with their peers and teachers (Kasen, Johnson, & Cohen, 1990; Kumpulainen, Räsänen, & Puura, 2001; Laird, Jordan, Dodge, Pettit, & Bates, 2001; Lätsch, Raufelder, & Wulff, 2016; Schaeffer, Petras, Ialongo, Poduska, & Kellam, 2003).

The present study

Leaning on the stress-vulnerability perspective (Grant et al., 2004; Grant & McMahon, 2005), we suggest that the risk for conduct problems is higher for adolescents who are more vulnerable and are exposed to school-related stressors. Drawing on the earlier evidence, we propose that difficulties in schoolwork and being bullied by peers are the most potential stressors for students at school (Farrington, 2003; Hämäläinen & Pulkkinen, 1996; Kasen et al., 1990; Kumpulainen et al., 2001; Laird et al., 2001; Lätsch et al., 2016; Schaeffer et al., 2003). Thus, our first purpose is to explore the direct effects of the difficulties in schoolwork and being bullied by peers on adolescents' conduct problems in the longitudinal design controlling for potential vulnerability factors.

According to the literature, the most critical vulnerability factor of later conduct problems is earlier conduct problems (Canino et al., 2010; Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Erskine et al., 2013), but low prosociality and low cognitive competence have also been shown to have longitudinal effects on conduct problems (Farrington, 2003; Goodman et al., 1995; Hämäläinen & Pulkkinen, 1996; Hastings et al., 2000; Manninen et al., 2013; Moffitt, 1993; Piquero, 2001).

Our second aim is to analyze the interaction effect of these three vulnerability factors and school-related stress factors (difficulties in schoolwork and being bullied by peers) on conduct problems. We propose two research questions: (a) To what extent do earlier difficulties in schoolwork and being bullied by peers predict later conduct problems when earlier conduct problems, vulnerability factors, and controlling variables are included in the analysis; and (b) to what extent do earlier difficulties in schoolwork and being bullied by peers moderate the effect of earlier conduct problems, low prosociality, and low cognitive competence on later conduct problems? The conceptual model of the moderation effects is displayed in Figure 1.

Method

Procedure and participants

This study utilized longitudinal data collected in 2014 and 2016 in the Helsinki metropolitan area in a large MetloFin study (Hotulainen et al., 2016; Minkkinen et al., 2017). The baseline data of this study (T1) were collected at the end of compulsory school (ninth grade) from all comprehensive schools ($N = 130$) in the area. The students were reached via the participating schools: All students in the target grade were asked to participate. The educational authorities of each of the 14 municipalities gave permission for the study. Two online questionnaires, a Health Survey and a Learning-to-Learn Assessment, were filled out in computer classrooms by 7,729 students (49.2% girls; 9.4% with an immigrant background), which was 53.6% of all the ninth graders in the area. The sample was not selected by gender compared with the official statistics in
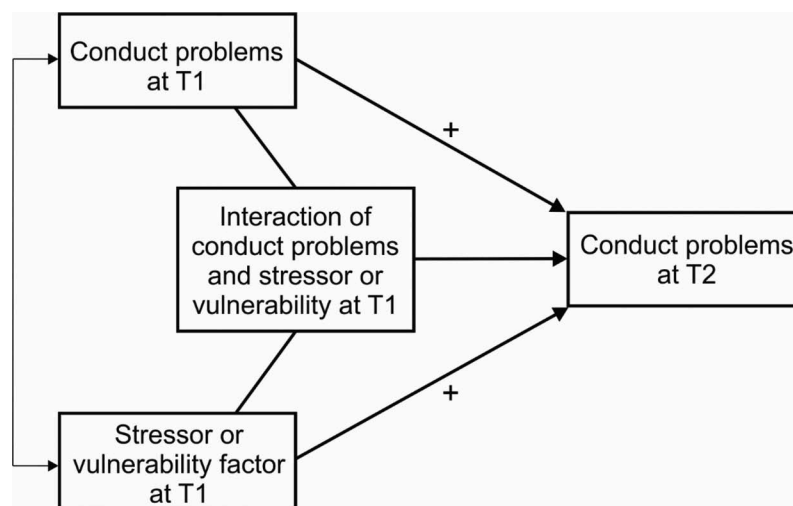

Figure 1. The conceptual model of moderation analyses. The stronger arrows refer to the hypothesized effects on conduct problems at T2. The thinner arrows refer to the correlation. The plus sign refers to the hypothesized positive association between variables.

Finland. The average age of participants at T1 was 16 years ($M = 15.91$, $SD = .38$). The students were asked to complete the questionnaires during a typical double lesson (90 min) in the presence of a teacher. Teachers informed the students, and every student had a personal code to use in answering the questionnaire. Participation in the study was voluntary, which was mentioned at the beginning of the questionnaire on the first page. Participants over 15 years old are able to decide whether to participate without parents' allowance according to the National Advisory Board on Research Ethics (2009). Questionnaires were submitted anonymously. The study protocol was approved by the Ethics Committee of the National Institute for Health and Welfare in Finland.

All participants at T1 were in the target group at the follow-up (T2). Data collection at T2 followed the principles and structure of the baseline survey but included only one combined questionnaire, and the data collection was extended to the institutions of upper secondary education in which the adolescent from the original cohort studied, that is, general upper secondary schools and vocational upper secondary schools. The final study population consisted of 5,108 adolescents (52.5% girls; 9.1% immigrant background) who had data of conduct problems at T2. The participants were aged 18 years at T2 ($M = 17.91$, $SD = .36$); 75.7% of them were students in general upper secondary schools, and 24.3% were students in vocational upper secondary schools. The adolescents who participated in the follow-up studied more often in general upper secondary schools (75.7%) than the official statistics showed (61%) in the study area and correspondingly less often in vocational upper secondary schools (Official Statistics of Finland, 2017).

Attrition and nonresponse analysis

There were several reasons for the nonresponses, one of which was students' absences from the class on the survey day (e.g., school absence, student in special needs education; about 10–15% of the students). The information about whether the student had refused to participate or was absent from school was not available from participating schools. Two separate questionnaires decreased the response rate at T1. Special schools and classes for children with serious learning difficulties, intellectual disabilities, or those situated in pediatric hospital wards were excluded from the sample because of the students' expected difficulty in answering the questions. Two administratively independent schools were not interested in participating in T1.

To assess whether adolescents in the longitudinal sample shared characteristics with those who participated in the baseline survey, t-tests and chi-square tests were conducted. The longitudinal sample included more girls (52.5% versus 49.2%, $\chi 2[1] = 3.931$, $p < .001$), more students with highly educated parents (41.2% versus 36.9%, $\chi 2[1] = 13.571$, $p < .001$), and less students who had been bullied at T1 than the baseline sample at T1 ($M_L = 1.22$, $M_B = 1.25$, $t = 2.465$, $df = 6863.254$, $p < .001$). No differences were found with regard to immigrant background. The longitudinal sample (M_L) included adolescents who had fewer conduct problems and schoolwork difficulties at T1 than the baseline sample (M_B) (respectively, $M_L = 1.149$, $M_B = 1.299$, $t = 4.633$, $df = 6786.172$, $p < .001$; $M_L = 6.301$, $M_B = 6.901$, $t = 5.093$, $df = 10,147$, $p < .001$). Also, the longitudinal sample included adolescents who had more prosociality and cognitive competence at T1 than the baseline sample ($M_L = 7.070$, $M_B = 6.940$, $t = -2.894$, $df = 10,863$, $p < .01$; $M_L = 50.516$, $M_B = 44.683$, $t = -10.935$, $df = 11,277$, $p < .001$). Some reasons for the differences between samples can be considered. Students who did not receive a place in further education after compulsory school are missing at T2 (5.3% of the T1 sample). Attrition bias was also caused by students in the cohort dropping out of further data collection because reaching the students in the institutions of upper secondary education was challenging at T2, and all schools were not willing to participate.

Measures

Conduct problems at T1 and T2

Conduct problems were self-assessed by students using a subscale of the Strengths and Difficulties Questionnaire (SDQ; Goodman, Meltzer, & Bailey, 1998). The SDQ is a widely used indicator of psychosocial adjustment among children and adolescents (Goodman, 2001; Koskelainen, Sourander, & Vauras, 2001). The SDQ covers subscales of conduct problems, peer relationship problems, prosocial behaviors, hyperactivity and inattention, and emotional symptoms, thus providing opportunities to screen the subscales separately, but the adolescents' total difficulties were also of interest in the collection of MetloFin data used in this study (Goodman, 2001; Hotulainen et al., 2016). Each subscale consists of five items, and for each item, the options include a three-point scale (0 = not true, 1 = somewhat true, 2 = certainly true; Goodman et al., 1998).

The scale of conduct problems in the SDQ is composed of items related to lying, fighting, stealing, disobedience, and temper tantrums (Goodman, 2001). The reliability and validity of the SDQ have also been shown

to be high in Finnish studies (Goodman, 2001; Koskelainen, 2008; Koskelainen et al., 2001). However, we had to drop the item concerning disobedience ("I usually do as I am told"), as the alpha reliabilities of conduct problems were undesirable according to the criteria of DeVellis (2003) if all five items were included (α_{T1} = .620, α_{T2} = .614). Thus, the item ratings of four items (lying, fighting, stealing, and temper tantrums) were summed up to a total score, with lower scores indicating fewer conduct problems (range 0–8). The alpha reliabilities were low but acceptable for both time points (α_{T1} = .684, α_{T2} = .696). The variables of conduct problems were highly skewed (M_{T1} = 1.149, SD_{T1} = 1.522, skewness$_{T1}$ = 1.742, kurtosis$_{T1}$ = 3.439; M_{T2} = .995, SD_{T2} = 1.446, skewness$_{T2}$ = 1.845, kurtosis$_{T2}$ = 3.850).

Schoolwork difficulties at T1

Schoolwork difficulties were measured using an eight-item indicator that was used in the Finnish School Health Promotion studies (Luopa, Kivimäki, & Matikka, 2014). The question was "How are you doing at school? Do you have difficulties in the following areas: Paying attention to the teacher during class; Working in groups; Doing homework or similar tasks; Preparing for exams; Finding the right study-method for you; Doing assignments that require you to work independently; Doing assignments that require writing; and Doing assignments that require reading (e.g., a book)?" The options were on a four-point scale (0 = No, 1 = Some, 2 = Quite a lot, 3 = Very much). The results of the exploratory factor analysis using SPSS 23 demonstrated that the items were loaded on one factor. The explained variance of the factor was 69.382% (Eigenvalue 5.551; principal axis factoring with Oblimin rotation). Communalities were at least .568 for all items, and the highest factor loadings after extraction were on "Doing homework or similar tasks" and "Doing assignments that require writing" (both .689; KMO = .944; Bartlett's Test $\chi2$ = 21,504.835, df = 28, p < .001). The reliability analysis indicated good psychometric support for the internal consistency of the composition variable of schoolwork difficulties (α = .918). Thus, eight items were combined to form a composite variable, with a higher value indicating more difficulties (range 0–24; M = 6.301, SD = 5.371, skewness = .836, kurtosis = .458).

Being bullied by peers at T1

Bullying was defined in the questionnaire: "Bullying refers to intentionally and repeatedly hurting feelings of some student who has difficulties in defending him/herself. Bullying refers also to teasing a student repeatedly in a mean and insulting way. Bullying does not refer to teasing in a friendly and playful way. An argument or a fight between two roughly equal students is also not considered bullying." Being a victim of bullying by peers at school was measured using one item that was used in the Finnish School Health Promotion studies (Luopa et al., 2014). The question was, "How often has a student/students bullied you at your school?" The options include a five-point scale (0 = never, 1 = I have been bullied less often than once a week, 2 = about once a week, 3 = several times a week, 4 = almost daily). At the age of 16 years, 8.1% of students had been bullied less often than once a week, 2.0% about once a week, 0.9% several times a week, and 1.7% almost daily.

Prosociality at T1

Prosociality was measured using the SDQ's prosociality scale. The scale comprises the five items related to sympathy, including kindness, sharing, helping, consideration for others, and volunteering (Goodman et al., 1998). For each item, the options include a three-point scale (0 = not true, 1 = somewhat true, 2 = certainly true). Item ratings were added together to obtain a total score, with lower scores indicating a lack of prosociality (range 0–10; M = 7.070, SD = 2.067, skewness = −.798, kurtosis = .870). The internal reliability was adequate (α = .712).

Cognitive competence at T1

Cognitive competence was constructed by two cognitive tasks, Control of Variables and Invented Mathematical Concepts, with each measure reasoning in different domains taken from the Finnish Learning-to-Learn Assessment (Kupiainen, Vainikainen, Marjanen, & Hautamäki, 2014). The Control of Variables task is based on a modified version of Shayer's (1979) Science Reasoning Tasks, the Pendulum (Kupiainen et al., 2014). The task consisted of eight items, each including a comparison pair of variables in the world of Formula 1 races: driver, car, tires, and track. One item included three or four subsections, and in each one, the adolescents had to decide whether the comparison pair gave information to decide the single effect of the driver, car, tires, or track to the lap time. The options in each subsection were "No," "Maybe," and "Yes." All the subsections had to be answered correctly to get points from the item. The task score was the percentage of correctly answered items (1 item = 12.50, 2 items = 25.00 etc.). The maximum score for the task was 100. Internal reliability was adequate (α = .822).

The Invented Mathematical Concepts task was a modified version of the Sternberg Triarchic Test, Creative Number Scale (Sternberg, Castejon, Prieto, Hautamäki, & Grigorenko, 2001). In the task, two imaginary mathematical concepts were introduced to adolescents who should solve seven arithmetic tasks (items) based on the new concepts. There were four multiple-choice alternatives in each item. The score was the percentage of correct answers (1 correct answer = 14.29, 2 correct answers = 28.57 etc.). The maximum score for the task was 100. Internal reliability was adequate (α = .776). Cognitive competence was constructed by the mean of the two cognitive tasks divided by 10 (range 0–10; M = 5.052, SD = 2.701, skewness = −.183, kurtosis = −1.154).

Controlling variables

The controlling variables were gender (boy = 0, girl = 1), age at T2 (range 16.7–25; M = 17.911, SD = .359), immigrant background, and parents' education, which were all reported by students except the age, which was acquired from schools. Immigrant status was opted for the adolescent if the adolescent or at least one of the adolescent's parents was born in a country other than Finland. The questions included the following: "In which country were your parents born?" (asked separately for mother and father) and "Where were you born?" (the options were "in Finland" and "in another country"). Finland was coded as 0 and the other country as 1. Parents' education was assessed separately for mothers and fathers, and the highest level of either parent's education was included in the analysis. The question was, "What kind of education do your parents have?" The options included the following: basic education only, vocational upper secondary education or vocational college, matriculation examination certificate and vocational college, university degree, and no mother or father. University degree was encoded as 1 and other options as 0. No mother or father was coded as a missing value. A total of 41.2% of students had at least one parent with a university-level education. This matches well with the official statistics concerning the education level in the population of the Helsinki Metropolitan area. In the area, 38–48% of all 25- to 64-year-olds had university-level education (Jaakola, Cantell, & Vass, 2015).

Data analysis

First, we calculated intraclass correlation and design effect for the dependent variable as students were nested within schools. The intraclass correlation coefficient was .008, and the design effect was 1.29, which was below the suggested cutoff point of 2.0 (Hox & Maas, 2002). Thus, it was deemed unnecessary to take

clustering of data into account, and we used the whole data set in the analyses. Linear regression analysis (Model 1) was accomplished in order to explore the longitudinal effects of schoolwork difficulties at T1 and being bullied by peers at school at T1 on conduct problems at T2. Model 1 included also conduct problems at T1, vulnerability factors at T1, and controlling variables. Several moderation models were executed to explore the interaction effects of the measures (research question b), and the significant interactions (Model 2–4) were further examined using regression plots.

Multivariate linear regression and moderation analyses were conducted using the Mplus statistical package (version 8) with 30,000 iterations (Muthén & Muthén, 2012). As the outcome variable of conduct problems at T2 was not normally distributed, we applied the approach with Bayesian inference with no distributional assumptions because it was more appropriate, as opposed to traditional frequentist statistics (Muthén & Asparouhov, 2012). The Bayesian estimation with Markov chain Monte Carlo (MCMC) was executed with the potential scale-reduction convergence criterion. One-tailed significance testing for posterior estimates at the criterion level of p = .025 was applied. The Bayesian information criterion and the Bayesian posterior predictive checking using $\chi 2$ were reported. Missing data in predictive variables (0–38.3%) were handled using full information maximum likelihood (FIML) estimation in Mplus. Descriptive statistics, statistical tests, and bivariate correlations were performed in IBM SPSS statistics 23.

Results

Conduct problems significantly decreased from T1 measurement to T2 measurement (Related-Samples Wilcoxon Signed Rank Test; Z = −7.499, p < .001, *rank correlation* = .401). There was moderate stability of conduct problems between the time points (Spearman's ρ = .397, p < .001). The longitudinal regression analysis showed that 14% of conduct problems measured at T2 were explained by the T1 measurement. Conduct problems, schoolwork difficulties, prosociality, and cognitive competence correlated significantly at T1 (all p < .001; Table 1).

Direct effects

The results of Model 1 showed that more schoolwork difficulties at T1 predicted more conduct problems at T2 when several other variables were controlled for, including the autoregression coefficient of conduct problems (Table 2). Using the confidence intervals of standardized regression coefficients, we compared the effects of

Table 1. Bivariate correlations[1] for continuous study variables.

Variable	1	2	3	4	5
1. Conduct problems T2	1				
2. Conduct problems T1	.397***	1			
3. Schoolwork difficulties T1	.245***	.353***	1		
4. Being bullied T1	.113***	.194***	.156***	1	
4. Prosociality T1	−.145***	−.171***	−.154***	−.045*	1
5. Cognitive competence T1	−.173***	−.247***	−.235***	−.112***	.131***

Note. [1] Spearman ρ.
*$p < .05$, ** $p < .01$, *** $p < .001$, two-tailed.

Table 2. Predicting conduct problems at T2 ($N = 5{,}108$).

Predictor	b	SD	b*	SD	95% CI LL	95% CI UL
Conduct problems T1	.276***	.018	.294***	.019	.254	.332
Schoolwork difficulties T1	.023***	.005	.086***	.021	.050	.134
Being bullied T1	.044	.035	.021	.017	−.007	.056
Prosociality T1	−.080***	.012	−.117***	.017	−.150	−.083
Cognitive competence T1	−.033***	.009	−.062***	.016	−.094	−.030
Girl	−.003	.042	−.001	.015	−.029	.027
Age	.047	.054	.012	.013	−.011	.039
Immigrant background	.123	.069	.024	.014	−.001	.053
Parents' education	−.071	.041	−.024	.014	−.053	.003
R^2	.173					
n of free parameters	65					
χ2	.500					
BIC	108,316.084					

Note. b = unstandardized posterior coefficient; SD = posterior standard deviation; $b*$ = standardized posterior coefficient; CI = confidence interval; LL = lower limit; UL = upper limit; χ2 = Bayesian posterior predictive p value; BIC = Bayesian information criterion.
*** $p < .001$, one-tailed.

schoolwork difficulties and the autoregression of conduct problems with each other. They were interpreted as significantly different because the confidence intervals did not overlap. That is, the effect of schoolwork difficulties at T1 was significantly smaller ($b* = .086$, 95% CI: .050, .134, $p < .001$) than the effect of conduct problems at T1 ($b* = .294$, 95% CI: .254, .332, $p < .001$). Being bullied by peers at school at T1 did not predict conduct problems at T2 ($p = .075$). Lower prosociality and lower cognitive competence at T1 predicted more conduct problems at T2 (both $p < .001$). Although boys had more conduct problems than girls in the data, gender did not predict conduct problems at T2 in the multivariate regression analysis. Also, the age, immigrant background, and parents' education had no effects on conduct problems at T2. For Model 1, the R-square of conduct problems at T2 was 17.5%, meaning that 3.3% of the variance was explained by other variables than conduct problems at T1.

Moderation effects

Firstly, we applied four moderation regression models to examine the pattern in which the stressor moderates the effect of the vulnerability factor on conduct problems. Each model included one stressor measured at

T1 (school difficulties or being bullied by a student at school), one vulnerability factor measured at T1 (prosociality or cognitive competence), and their interaction term as predictors of conduct problems at T2. No significant interactions were found. Secondly, we ran two interaction models to examine whether the school-related stressors (schoolwork difficulties or being bullied) moderate the effect of conduct problems at T1 on conduct problems at T2. Both models showed the significant interaction. Schoolwork difficulties at T1 moderated the effect of conduct problems at T1 on conduct problems at T2 (interaction term $b* = −.077$, $p < .001$; Model 2, Table 3). More conduct problems at T2 were found among those adolescents who had plenty of difficulties in schoolwork at T1 (the regression slope a in Figure 2), when compared to those who had fewer difficulties at T1 (slope b), except when the level of conduct problems at T1 was ca 1.2 SD above mean or higher (line c). Also, being bullied by peers at school at T1 exaggerated the autoregressive effect of conduct problems (interaction term $b* = −.095$, $p < .001$; Model 3, Table 3). More victimization at T1 predicted more conduct problems at T2 (the regression slope a in Figure 3) compared to less-victimized adolescents (slope b), except when the level of conduct problems at T1 was high, that is, ca .90 SD above mean or higher (line c).

Table 3. Moderation effects on conduct problems at T2.

	Model 2		Model 3		Model 4	
Predictor	b*	SD	b*	SD	b*	SD
Conduct problems T1	.346***	.019	.367***	.016	.360***	.017
Schoolwork difficulties T1	.124***	.018				
Being bullied T1			.091***	.020		
Cognitive competence T1					−.094***	.017
Interaction term	−.077***	.019	−.095***	.020	.075***	.018
R²	.146		.139		.141	
n of free parameters	14		14		14	
χ2	.465		.468		.489	
BIC	35,838.443		39,133.709		35,059.491	

Note. b* = standardized posterior coefficient; SD = posterior standard deviation; χ2 = Bayesian posterior predictive p value; BIC = Bayesian information criterion.
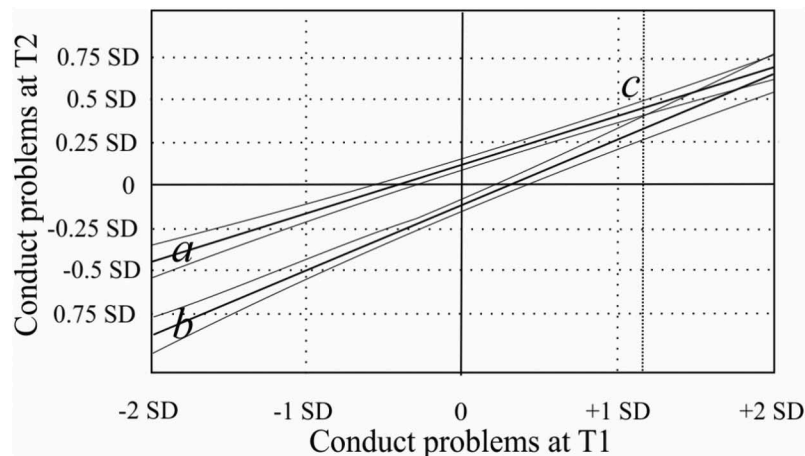*** p < .001 one-tailed.

Figure 2. Interaction of schoolwork difficulties and conduct problems at T1 predicting conduct problems at T2. Note: Regression slope a illustrates conduct problems at T2 with plenty of schoolwork difficulties at T1 (1 SD above mean). Regression slope b illustrates conduct problems at T2 with not many schoolwork difficulties at T1 (1 SD below mean). Line c illustrates the highest level of conduct problems at T1 when the interaction is significant. Confidence intervals of 95% are displayed above and below the slopes. The figure includes standardized scales of the measures.

Figure 3. Interaction of being bullied and conduct problems at T1 predicting conduct problems at T2. Note: Regression slope a illustrates conduct problems at T2 among adolescents who were bullied at T1. Regression slope b illustrates conduct problems at T2 among adolescents who were not bullied at T1. Line c illustrates the highest level of conduct problems at T1 when the interaction is significant. Confidence intervals of 95% are displayed above and below the slopes. The figure includes standardized scales of the measures.
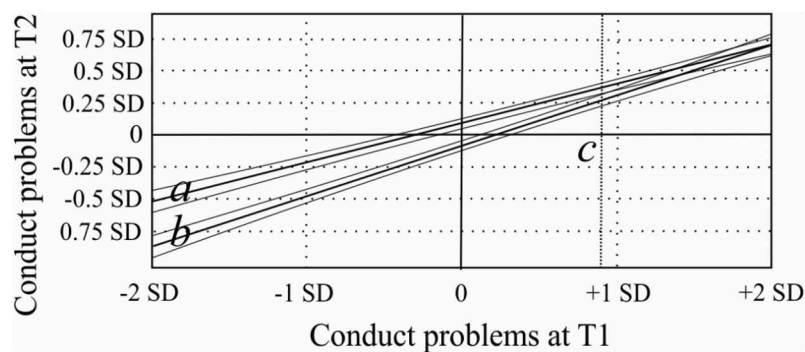
Thirdly, we executed two interaction models to examine whether the vulnerabilities (low prosociality or low cognitive competence) moderate the effect of conduct problems at T1 on conduct problems at T2. One significant interaction was found, as cognitive competence at T1 moderated the effect of conduct problems at T1 on

conduct problems at T2 (interaction term $b^* = .075$, $p < .001$; Model 4, Table 3). The level of conduct problems at T2 was higher among adolescents who had low cognitive competence at T1 (the regression slope a in Figure 4) compared to adolescents with high competence at T1 (slope b), except when the level of conduct problems at T1 was ca .70 SD above mean or higher (line c).

Discussion

Our research increases the knowledge of the school-related factors that contribute to the fact that some adolescents continue their antisocial behavior from mid-adolescence to late adolescence when the general trend of conduct problems is decreasing. Using a large sample from Finland, we found that schoolwork difficulties, low prosociality, and low cognitive competence at the age of 16 predicted conduct problems at the age of 18 when earlier conduct problems were also controlled for. Further, we found that schoolwork difficulties, being bullied by peers at school, and cognitive competence interacted in a complex way with conduct problems at the age of 16 predicting later conduct problems.

Consistent with previous studies, we found the moderate stability of conduct problems from mid-adolescence to late adolescence (Costello et al., 2003). Given that the strongest predictor of conduct problems at the age of 18 was earlier conduct problems, one main finding in this study was that perceived schoolwork difficulties at the age of 16 emerged as a risk factor for later conduct problems. This finding is in line with other research that found poor

academic achievement to be a risk factor for later delinquency (Farrington, 2003; Hämäläinen & Pulkkinen, 1996; Moffitt et al., 1996). Although the effect size was small in our study, it has relevance, as the study period was characterized by decreasing conduct problems. The interpretation for why schoolwork difficulties predict conduct problems could be drawn from feelings of loss through the fault encountered in the ability to perform school tasks. This causes emotional distress that could erupt into antisocial behavior. Further, we found that schoolwork difficulties strengthened the effect of earlier conduct problems so that the adolescent was at greater risk of continuing the antisocial behavior at the age of 18 if he or she had plenty of difficulties in schoolwork at the age of 16. The finding supports the stress-vulnerability perspective, which suggests that exposure to a stressor, in this case, schoolwork difficulties, had a role in the adverse development of adolescents' mental health in the presence of vulnerability, in this case, earlier conduct problems (Grant et al., 2004; Grant & McMahon, 2005).

This study has been unable to demonstrate that being bullied by peers at school directly predicted conduct problems when the earlier conduct problems were controlled for. This was contrary to some earlier findings (Kasen et al., 1990; Kumpulainen et al., 2001; Laird et al., 2001; Schaeffer et al., 2003), but Deković, Buist, and Reitz (2004) detected a parallel result with our findings using the latent growth analysis where the earlier problem behavior was controlled for: Poor relationships with other students did not affect the initial level nor the rate of change in problem behavior.
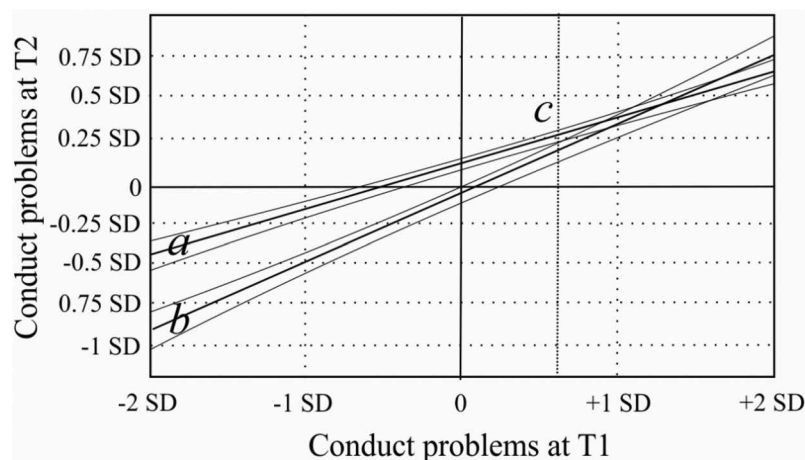

Figure 4. Interaction of cognitive competence and conduct problems at T1 predicting conduct problems at T2. Note: Regression slope a illustrates conduct problems at T2 with low cognitive competence at T1 (1 SD below mean). Regression slope b illustrates conduct problems at T2 with high cognitive competence at T1 (1 SD above mean). Line c illustrates the highest level of conduct problems at TI when the interaction is significant. Confidence intervals of 95% are displayed above and below the slopes. The figure includes standardized scales of the measures.

However, our results showed that being bullied by peers at school was still involved in the development of conduct problems through the interaction effect. Adolescents who did not have many conduct problems at the age of 16 were more prone to have them two years later if they were bullied more at the age of 16. This finding implies that those who have not behaved antisocially before could also have conduct problems under the emotional distress caused by victimization on reaching adulthood, when peer acceptance has a great meaning for adolescents' adjustment (Brown & Larson, 2009). In the stress-vulnerability frame (Grant et al., 2004; Grant & McMahon, 2005), this interaction can be interpreted so that the stressor (being bullied) exacerbated the effect of the vulnerability factor (earlier conduct problems) on mental health. This also accords with an earlier observation showing that peer rejection in middle childhood moderates the link between dysregulation at school entry and mood dysregulation at late adolescence among children with early externalizing problems (Okado & Bierman, 2015).

When the findings of conduct problems and being bullied by peers are evaluated, it is necessary to take into consideration that, in some cases, the victims of bullying have probably bullied others as well. In a recent large-scale study of 17,586 Finnish students, bully-victims formed the smallest group among 9- to 15-year-olds after victims and bullies (Yang, Li, & Salmivalli, 2016). Depending on the evaluation method, there were 6.4–9.8% victims, 1.9–4.2% bullies, and .5–2.5% bully-victims (Yang et al., 2016). Bullying is defined as "a subtype of interpersonal aggression in which there is a power differential between the child who is doing the bullying and the child who is being victimized" (Pepler, Jiang, Craig, & Connolly, 2008, p. 329). That is, bullying is antisocial behavior directed to peers. The indicator of conduct problems in this study did not include bullying but consisted of questions of lying, fighting, stealing, and temper tantrums at a more general level (Goodman, 2001). In sum, the literature on bullying has shown that the picture of the associations between being bullied by peers at school and conduct problems is still more complex than was possible to reach in the design of this study, and more research concerning this issue is needed. Moreover, in future studies, these mechanisms are worth studying in cultures and countries other than in the West.

The current study detected that low prosociality predicted more conduct problems, which corroborates the findings of a great number of previous studies in this field (de Wied et al., 2010; Euler et al., 2017; Kimonis et al., 2014). The link between low prosociality and conduct problems has been explained through empathy that restrains conduct problems and enhances prosocial behavior (Euler et al., 2017). Further, low cognitive competence predicted more conduct problems concordantly with prior research (Farrington, 2003; Moffitt, 1993; Goodman et al., 1995; Manninen et al., 2013; Murray & Farrington, 2010; Piquero, 2001). These findings support that low prosociality and low cognitive competence are vulnerability factors for conduct problems. Moreover, we found that cognitive competence was involved in the continuity of conduct problems, as adolescents with low cognitive competence were at a greater risk of continuing their antisocial behavior from middle into late adolescence. A possible explanation for this association could derive from consequences that emerged from antisocial behavior, for example, disciplinary actions at school. Adolescents who have more cognitive competence may better learn that antisocial behavior is not allowed and could also cause them harm, which may diminish further conduct problems.

Conclusions and implications

This study pointed out that attention should be turned to school in addition to individuals and families when studying conduct problems in adolescence. Three adolescent groups more prone to continue antisocial behavior into late adolescence were detected: adolescents with plenty of schoolwork difficulties, victims of bullying, and adolescents with low cognitive competence. These findings hint at what could be done in schools to prevent the continuity of adolescents' conduct problems.

First, more support from teachers and assisting school personnel should be provided to the students who have difficulties in schoolwork through the lower and upper grades and those already in preschool, as school difficulties develop in the long run. Systems and practices to support students with schoolwork and learning difficulties vary according to country and school (Rimpelä, Caan, Bremberg, Wiegersma, & Wolfe, 2013). They have a crucial role when also trying to prevent conduct problems in adolescence. School health services, for example, school psychologists, have an important role in recognizing conditions leading to learning difficulties in the early phase, screening mental health problems, and offering support and treatment to students with psychosocial and behavioral problems. Social workers and school health nurses with a low-threshold clinic provide individual students an opportunity to approach help in an early phase and when needed. Adding assisting personnel in the classroom supports teachers in organizing their work and helps individual students in their tasks during everyday school activities. As parents have a major role in supporting students' schoolwork, communication and cooperation

between teachers and the home are important and should be improved. The focus on the earliest possible support for learning must be underlined in order to prevent the emergence and growth of school-related difficulties.

Second, school- and class-level efforts should be harnessed against bullying at school and could include actions such as promoting anti-bullying attitudes and empathy toward victims. There are some evidence-based practices to implement a bullying-free school environment. An example is the KiVa Anti-Bullying Program, which among other things includes voluntary students in the mediation role in stopping bullying (Salmivalli, Kärnä, & Poskiparta, 2011; Swift et al., 2017). A health-promoting school would imply, too, that the school has an anti-bullying policy that includes a systematic detection of bullying and instructions on how to deal with bullying situations. Headmasters and teachers are the key persons to implement bullying-free school practice and handle cooperation between the school and victims' and bullies' families. The statistics on Finnish comprehensive schools shows that 8% of headmasters do not even know if there is bullying in their school, and in only half of the schools, the compulsory school inspection every third year includes assessment of the prevention and actions of bullying, violence, and harassment (Wiss et al., 2018). These show there is work to be done with school structures and practices to decrease bullying.

Strengths and limitations

The strength of this study is the large longitudinal data of one age cohort in the Helsinki metropolitan area, comprising variations of socioeconomic and regional differences among municipalities and schools in the area. Even so, there are several limitations to this study. All measures were self-reports from students that must be considered. Conduct problems were measured via four questions of the SDQ, as the reliability of all five items was not acceptable. Future research may have benefits in expanding the analysis of conduct problems and may include, among others, school suspension rates and behavioral referrals under the study. The teacher–student relationship was not studied here, although it could also be the origin of school-related stress and teacher behavior, for example, a lack of teacher's appreciation may affect the development of conduct problems (Weyns et al., 2017). Additionally, we had no information about whether adolescents' conduct problems were early-onset or emerged for the first time in adolescence or if they had simultaneously internalized symptoms that would possibly have an additional insight into the found results. The limitation regarding data is that follow-up data included

relatively more students in the general upper secondary school than in vocational upper secondary school, and the students who did not immediately receive a place in further education after compulsory school were missing from the follow-up data.

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