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Differences and Similarities in Predictors of Externalizing Behavior Problems Between Boys  
and Girls: A 1-year Follow up Study

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Differences and Similarities in Predictors of Externalizing Behavior Problems Between Boys and Girls: A 1-year Follow up Study

Abstract

The aim of this study was to investigate the sex-specific predictive value of age of onset of delinquent behaviors, callous-unemotional (CU) traits, and anger-irritability problems for externalizing behavior problems in institutionalized adolescents over the course of one year. A total of 118 girls and 240 boys from child welfare and juvenile justice institutions were evaluated twice: at T1, age of onset, CU traits, anger-irritability problems, non-verbal reasoning and externalizing behavior problems were measured; at T2 (one year later), externalizing behavior problems were measured a second time. Results showed significant interactions between sex and anger-irritability problems, and between sex and CU traits, in the sense that the relation between these two predictors at T1 and externalizing behavior problems at T2 was stronger in girls than in boys. Results of this study point out sex differences in the validity of predictors of externalizing behavior problems.

*Keywords:* externalizing behavior problems, sex, anger-irritability problems, callous-unemotional traits, age of onset

Identifying predictors for serious externalizing behavior problems (i.e., delinquency and aggressive behaviors) has been an important challenge in the field of juvenile forensics over the past decades (e.g., Dölitzsch et al., 2016). For some individuals, externalizing behaviors reach a peak at adolescence and gradually decline into adulthood; for others, these behaviors may be more profoundly anchored in the functioning of the individual, increasing the risk of engaging in a long term criminal career (Campbell, 1995, 2006; Moffitt, 2003).

Various factors have been found to enhance the risk for externalizing behavior problems, such as impulsivity (e.g., Meier, Slutske, Arndt, & Cadoret, 2008), traumatic experiences (e.g., Hubbard & Pratt, 2002; Kerig & Becker, 2012), or conditions related to low socio-economic status (SES) (e.g., Agnew, Matthews, Bucher, Welcher, & Keyes, 2008). However, recent studies have identified three main factors specifically predicting serious and persisting externalizing behavior problems at adolescence, and, as a result, impairing chances for desistance over years : (1) an early age of onset of externalizing behavior problems (e.g. Moffitt, 1993; Odgers et al., 2008); (2) callous-unemotional (CU) traits (lack of empathy, callous use of others; e.g., Frick, Ray, Thornton, & Kahn, 2014), and (3) anger-irritability problems (e.g., Brotman, Kircanski, Stringaris, Pine, & Leibenluft, 2017; Zisner & Beauchaine, 2016). Moreover, these three predictors have an important clinical relevance for defining psychopathologies in the externalizing spectrum. Indeed, an early age of externalizing behavior problems onset and CU traits were recently identified as specifiers of conduct disorders (DSM-V, 2013). Furthermore, anger-irritability problems were shown to trigger and maintain symptoms of intermittent explosive disorder (IED) and of oppositional defiant disorder (ODD) (DSM-V, 2013).

The majority of studies examining externalizing behavior problems in adolescence focused mainly on boys, as boys are more prone to show aggressive and delinquent behavior, and are therefore more represented in juvenile justice system than girls (e.g., Erskine et al.,

2013; Seedat et al., 2009). In 2016 in Switzerland, for instance, official justice statistics showed a sex ratio of four adolescent boys to one girl sentenced under the criminal law (Federal Statistical Office, 2017). Furthermore, recidivism rates in Switzerland were clearly higher for boys than for girls; in 2012, 29% of convicted boys versus 12% of convicted girls had already been sentenced before. This raises the question whether boys and girls differ on the three aforementioned main predictors for serious externalizing behavior problems. As girls are less at risk to display externalizing behavior problems and were found to be less persisting than boys (Federal Statistical Office, 2017), it can be hypothesized that risk factors in boys do not affect, or differently affect externalizing behavior problems in girls.

However, even if there is less concern about girls' externalizing behavior problems, a significant number is still at risk for delinquency (the steep decreasing trend observed in boys' offending behavior [45% reduction between 2009 and 2014] was not observed in girls as their rates remained stable [Scheidegger, 2015]) and need to be considered in studies investigating risk and protective factors for serious externalizing behavior problems in order to provide tailor-made treatment for girls.

## **Sex Differences in Predictors of Externalizing Behavior Problems**

### **Age of Onset of Externalizing Behavior Problems**

It is generally acknowledged that an early onset of externalizing behavior problems (< 10 years old) is an important risk factor for serious and persisting externalizing behavior problems in boys (e.g., Moffitt, 2003). The same relationship between age of onset and severity of externalizing behavior problems was found in girls in various studies (e.g., Odgers et al., 2008), suggesting that age of onset was not a sex-specific predictor of externalizing behavior problems. These studies, however, were carried out in relatively small (e.g.,  $N = 62$ ; Leve & Chamberlain, 2004) or community samples, or used age at first arrest as an indicator of onset of externalizing behavior problems (age of first arrest may differ according to

country's criminal laws concerning underaged individuals, and is not representative of externalizing behavior problems' first occurrence).

Furthermore, some studies challenged the idea of early onset of externalizing behavior problems as a predictor of serious and chronic externalizing behavior problems in girls, showing that, compared to boys, a delayed onset in girls was related to more serious and chronic externalizing behavior problems (Silverthorn, Frick, & Reynolds, 2001). These authors found similar profiles of problems in impulse control and CU traits in boys with an early onset and in girls with a delayed onset, both trajectories leading to serious forms of externalizing behavior problems. However, the sample in this study was also relatively small ( $n$  of boys with early onset = 11;  $n$  of girls with delayed onset = 30) and composed of adjudicated adolescents, therefore, already showing serious patterns of delinquent behavior (Silverthorn et al., 2001). The homogeneity of the group combined with a possible lack of statistical power does not provide sufficient evidence for the risks associated with a delayed onset in girls, and pleads for further research. Especially as another study by A. Piquero and Chung (2001), in a sample including 151 male and 69 female adolescent who committed an offense, showed that age of onset did not predict delinquency in girls. Results of this last study should, however, be mitigated, as the sample consisted of African-Americans only and original data about offending were extracted from police records.

### **CU Traits**

Although adjudicated girls reported less CU traits than boys (Meier et al., 2008; Stickle, Marini, & Thomas, 2012), similar to boys, girls with higher levels of CU traits displayed more serious and persisting externalizing behavior problems than girls with lower levels of CU traits (McMahon, Witkiewitz, & Kotler, 2010; Pardini, Stepp, Hipwell, Stouthamer-Loeber, & Loeber, 2012). These results suggest that CU traits were also an important predictor for serious delinquency in girls, just like in boys, but that fewer girls

seemed to be involved. A recent study challenged this supposition by showing that, among adjudicated youths diagnosed with conduct disorders, girls showed less CU traits, but more serious externalizing behavior problems than boys (Euler et al., 2015). Even though this last study did not test the association between CU traits and externalizing behavior problems across sexes, their results may suggest that CU traits are not as strong a predictor for persisting externalizing behavior problems in girls than in boys. Furthermore, a recent study investigating the relationship between CU traits and brain structure in community adolescent boys ( $n = 81$ ) and girls ( $n = 108$ ) showed neuroanatomical correlates for CU traits in boys, but not in girls (Raschle et al., 2018), supporting biologically-rooted sex-differences in CU traits.

### **Anger-Irritability Problems**

Irritability describes interindividual difference in proneness to anger, and, therefore, has often been closely associated with anger dysregulation (Stringaris & Taylor, 2015). Anger-irritability problems have been shown to be a strong predictor of many psychiatric diseases, including psychopathologies in the spectrum of externalizing behaviors (reviews and meta-analysis by Evans et al., 2017; Vidal-Ribas, Brotman, Valdivieso, Leibenluft, & Stringaris, 2016). Although the relation between anger-irritability problems and externalizing behavior problems has been clearly established (e.g., Herts, McLaughlin, & Hatzenbuehler, 2012), few studies have investigated sex differences in the relation between anger-irritability problems and serious or chronic externalizing behavior problems in adolescents. For instance, a study on adult social drinkers showed that the relation between problems in executive functioning and externalizing behavior problems was mediated by anger-irritability problems in males, but not in females (Godlaski & Giancola, 2009), suggesting that anger-irritability problems may play a different role in women's externalizing behavior problems. These findings were confirmed by another study showing that anger-irritability problems were not significantly related to aggression in delinquent girls with substance use problems,

whereas it was in delinquent boy; this, despite a higher level of anger-irritability problems in girls than in boys (N. L. Piquero & Sealock, 2004). Hence, it seems that, while girls may report more anger-irritability problems, their role and impact in externalizing behavior problems are more crucial in boys.

De Coster and Zito (2010) suggested that the expression of anger-irritability problems may be sex-specific, with girls being more encouraged to internalize their feelings and boys being more encouraged to externalize them. Hence, it can be suggested that boys experience less anger than girls, but express it more overtly (through externalizing behaviors), which might explain why the relation between anger problems and delinquency in girls was non-significant in previous studies.

However, the two studies presented above were carried out on very specific samples of adolescents and adults with substance use problems. Their findings are, therefore, not generalizable to a larger group of delinquent or at-risk adolescents, because the use of substances may be a girl's way to cope with strain and emotions (e.g., Posick, Farrell, & Swatt, 2013), which could diminish the potential relation between anger-irritability problems and externalizing behavior problems. However, on the other hand, a study on incarcerated adolescents found a strong relationship between outward anger and substance use (Eftekhari, Turner, & Larimer, 2004). Based on these studies, it can be suggested that substances may either be used as a coping mechanism decreasing anger, or that substances increased anger. In support of this last assumption, a recent study in a sample of community adults found that the presence of intermittent explosive disorder, a disorder very closely related to anger regulation, increased substance use severity, but that the reverse was not true (Coccaro et al., 2016). If this is case, using a sample of adolescents with substances use problems might enhance the strength of the relationship between anger-irritability and externalizing behavior problems, and is therefore not representative of adolescents with externalizing behavior problems.



In general, the use of homogeneous samples (such as community samples, adolescents in the juvenile justice system or with substance use problems) may be problematic when investigating predictors of externalizing behavior problems as, on the one hand, community adolescents are not representative of adolescents with externalizing behavior problems (i.e., predictors may differ between both populations). On the other hand, adjudicated adolescents are generally already engaged in persisting criminal activities. Hence, predictors may be underestimated. This pleads for studies including larger and more heterogeneous samples allowing more variability in predictors and in outcome variable (i.e., externalizing behavior problems).

### **The Current Study**

Although early age of onset, the presence of CU traits, and anger-irritability problems are found to be strong predictors of serious externalizing behavior problems in boys, few studies have taken girls into account. Studies in community samples have systematically found a later onset of symptoms of externalizing behavior problems, less CU traits, less anger-irritability problems, and less externalizing behavior problems in girls than in boys. Sex differences in samples of adjudicated adolescents, however, are less clear.

Furthermore, the majority of earlier studies assessing these factors have focused on community or adjudicated samples of adolescents separately. The homogeneity of such samples does not provide a full picture of the relationship between predictors of serious externalizing behavior problems. Some adolescents who are not part of community or adjudicated samples, such as institutionalized adolescents, are systematically overlooked in studies examining predictors of persisting externalizing behavior problems. However, these adolescents have shown to be at heightened risk for delinquent behaviors (e.g., Jonson-Reid & Barth, 2000; Ryan, Testa, & Zhai, 2008), and need to be studied in more detail. The present study, therefore, aimed at investigating age of onset of externalizing behavior problems, CU

traits, and anger-irritability problems, and the moderating effect of sex in explaining the severity of externalizing behavior problems after one year in a large and heterogenous sample of adolescents institutionalized in child welfare and juvenile justice institutions.

As suggested by previous literature, sex seems to have an influence on the relationship between age of onset, CU traits, anger-irritability problems, and externalizing behaviors problems. Differences among sexes were evidenced in social roles, behaviors and expectations (e.g., girls are expected to internalise anger while boys are expected to externalize it), and education (e.g., girls are educated to be calm and boys to be active) (e.g., see Eagly, 2013). Furthermore, many differences were highlighted between boys and girls in terms of emotions (e.g., in processing, in expressing), and in terms of externalizing behaviors. For these reasons, we expected to find sex-specific influences on the three main predictors of externalizing behaviors problems. Based on previous literature, especially in adjudicated samples, we expected, first, to find less influence of age of onset in girls than in boys on later externalizing behavior problems (e.g., A. Piquero & Chung, 2001). Second, we expected that CU traits would be a weaker predictors of externalizing behaviors in girls than in boys, as supported by Euler et al. (2015)'s results. Finally, we expected that, even if girls might show a higher level of anger-irritability problems, it would be less related to externalizing behaviors problems than in boys, as suggested by N. L. Piquero and Sealock (2004).

## **Method**

### **Participants**

This study is part of the Swiss Model Project for Clarification and Goal-attainment in Child Welfare and Juvenile-Justice Institution (Modellversuch zur Abklärung und Zielerreichung in stätionären Massnahmen [MAZ Study]; Schmid, Kölch, Fegert, Schmeck, & MAZ-Team, 2013), investigating adolescents and young adults institutionalized in Switzerland. All adolescents who had been living for at least one month prior to their

participation in the study in one of the 64 socio-educational institutions that agreed to take part in the study were eligible for participation. Adolescents were institutionalized either by criminal law (remand, completion of a sentence following offenses such as theft, burglary, substance use, abuse or dealing, driving without license), civil law (e.g., run away, truancy, bullying, or because they needed to be placed out of their homes for safety reasons [i.e., parental mental or physical illness, abuse and neglect, parental toxicomania] or because they were unaccompanied illegal immigrants), or by voluntary placement (the adolescents want/can no longer live in his/her family). Importantly, all adolescents are mixed regarding reasons for their placement in institutions. The sample was composed of 177 girls and 359 boys aged between 11 and 19 years. For the follow-up assessment, one year later (T2), about 33% (59 girls and 119 boys) of the sample refused to participate or could not be reached, making the total sample included in the present study 118 girls and 240 boys.

### **Procedure**

In a first step (T1), the MAZ Study team contacted Swiss child welfare and juvenile institutions to explain the study in detail and asked for their formal agreement concerning their participation in the study. Social caseworkers in institutions, adolescents, and their legal representative received oral and written information about the study and were asked to sign a written consent if they agreed to participate. The procedure was approved by the Ethics Committees for Research on human in the States of Basel and Vaud, and by the Institutional Review Board of the University of Ulm. Then, participants were asked to complete a set of computer-based questionnaires, including socio-demographic information, non verbal reasoning, age of onset of externalizing behavior problems, anger-irritability problems, CU traits, and externalizing behavior problems (for more details about the questionnaires, see *Measures*).

Participants were assessed a second time (T2), approximately one year after the first assessment ( $mdn = 52$  weeks,  $SD = 18.52$ ). They were asked to complete a computer-administered questionnaire, including a scale regarding the severity of externalizing behavior problems (see *Measures*). In order to have information from various points of view, the caseworker who had been assigned as the adolescent's primary caretaker in the institution was also asked to complete the "other report" form of the questionnaire measuring the youth's externalizing behavior problems at T1 and T2. The assigned caseworkers had to know the adolescents for at least one month and had to confirm that they felt they knew the adolescent well enough to complete the questionnaire.

### **Measures**

As the study included all linguistic area of Switzerland, the German, French, and Italian translations of questionnaires were used. However, only the original reference is given.

**Predictor measures at T1.** Age of onset was assessed with an adapted version of the Criminology Questionnaire (Boers & Reinecke, 2007). This instrument is an anonymous (computerized) self-report questionnaire for past externalizing behavior problems (violence, property damage, stealing, sexual harassment, substance use, use of hardcore pornography, etc.). It includes the number of occurrences of the various externalizing behavior problems over the past years, and the age of onset of the behavior. By ensuring anonymity, and thus reducing social desirability bias, this self-report questionnaire is assumed to give a relatively accurate estimation of the age of onset of externalizing behavior problems (Boers & Reinecke, 2007; Wittenberg, Reinecke, & Boers, 2009).

Anger-irritability problems were assessed using the anger-irritability subscale of the Massachusetts Youth Screening Instrument - second version (MAYSI-2; Grisso & Barnum, 2014). Items of this scale describe an excessive focus on emotions such as anger or vengeance, as well as a general tendency to respond to situations by irritability, frustration

and stress-related anger. For instance, participants are asked if they hurt or boke something on purpore because they were mad, if they loose their temper easily, or if they think a lot about getting back at someone they have been angry at. Participants responded (Yes/No) whether each of the nine items applied to them during the last month. Items rated “yes” were added with a higher score indicating more anger-irritability problems. Previous studies reported a strong relationship between the Anger-Irritability scale of the MAYSI and the Aggression scale of Youth Self-Report (Achenbach, 1991a), and between the Anger-Irritability scale of the MAYSI and the Impulsive dimension of the Millon Adolescent Clinical Inventory (Grisso, Barnum, Fletcher, Cauffman, & Peuschold, 2001; Millon, 1993).

CU traits were assessed using the Affective Domain score (callous, unemotional, remorselessness) of the Youth Psychopathic traits Inventory (YPI; Andershed, Kerr, Stattin, & Levander, 2002; Pihet, Suter, Meylan, & Schmid, 2014; Stadlin, Pérez, Schmeck, Di Gallo, & Schmid, 2015), composed of 20 items. The participants rated on the degree to which items such as “I think that crying is a sign of weakness even if no one sees you” or “I don’t let my feelings affect me as much as other people’s feelings seem to affect them” applied to them a 4-point Likert scale (1 = does not apply; 4 = applies very well). Items were then added. A higher score representing more CU traits.

**Control variables at T1.** As non-verbal reasoning differed between sex groups, it was controlled for in the analyses ( $t(382) = 2.02, p = .044$ ) with girls ( $M = 94.66, SD = 13.79$ ) having lower non-verbal reasoning than boys ( $M = 97.68, SD = 13.87$ ). Non-verbal reasoning ability was assessed using the Standard Progressive Matrices of Raven (21.8% of the sample) (J. Raven, Raven, & Court, 2000; J. C. Raven, 1938), or the Culture Fair Intelligence Test (Cattell, 1940; Weiß, 2006), two valid and relatively comparable measures of intelligence independent of language capacities and culture ( $r = .68$ ) (Engle, Tuholski, Laughlin, & Conway, 1999).

**Externalizing behavior problems at T1 and T2.** Externalizing behavior problems at T1 and T2 were assessed by the youths using Youths self-report (YSR) or Young Adults self-report forms (YASR) (YSR/YASR; Achenbach, 1991a), as well as each their assigned caseworker from the institution using the Child Behavior Checklist (CBLC) or Adult Behavior Checklist (ABCL) (Achenbach, 1991b). These questionnaires list 120 specific behavior problems commonly found in children and adolescents (rated on a 3-point Likert scale). Only the externalizing behavior problems score (composed of aggressive and delinquent behaviors subscales; Cronbach's  $\alpha = .89$  for the self-report and  $.92$  for the other-report) was taken into account. Items investigating the adolescents' externalizing behaviors such a setting fire, running away, playing truant, stealing or starting fights, were rated on a 0 to 2-point scale, according to which extend these behaviors corresponded to the adolescent's over the last 12 months. Raw scores were transformed into T-scores in order to merge data from the adolescents and the young adult versions, with higher scores indicating more problems. To obtain a multiple informants score, the T-scores from youths and caseworkers ratings were averaged ( $r = .567, p < .001$ ).

### **Data Analysis**

The exploration of data distribution revealed that the data were suitable for parametric testing. A multivariate analysis of variance (MANOVA) was computed to assess the differences between adolescents who dropped out and those who still participated at T2. Student's *t*-tests assessed sex differences in variables of interests. Bravais-Pearson coefficients of correlations were computed to assess the relation between predictors (sex, age of onset, CU traits, anger-irritability) and dependent variables (externalizing behavior problems at T2; controlled for non verbal reasoning, externalizing behaviors at T1). Finally, regression analyses were computed to predict externalizing behavior problems at T2. The regression analysis were computed with Mplus v7.11 (Muthén & Muthén, 1998-2010) and

Bayes as an estimator. Bayesian statistics are one of the most robust methods to assess moderation effects (van de Schoot et al., 2014; Yuan & MacKinnon, 2009). The default settings of Mplus were used (except the number of iterations, which was set at 10,000 iterations and four chains in order to estimate the parameters). In Bayesian statistics, credibility intervals are used to indicate the 95% probability that the estimates will be between the lower and upper bounds of the interval. When zero is not included within the credibility interval, the effect is assumed to be “significant” (for more information, see Lynch, 2007; van de Schoot et al., 2011). For all analyses, Bayesian posterior parameter distributions and Bayesian posterior parameter trace plots were inspected for each significant effect, revealing that the estimates converged adequately. A model explaining variance in externalizing behavior problems at T2 by age of onset, CU traits, anger-irritability problems, and sex (specific contribution and moderation effect of sex), including non-verbal reasoning and externalizing behaviour problems at T1 as control variables was computed. To examine the moderation effect of sex, variables were centred and each specific factor (age of onset, CU traits, and anger/irritability) was then multiplied by sex (girls = 0 and boys = 1).

## **Results**

### **Descriptive Statistics**

Table 1 provides detailed socio-demographic information by sex. No significant differences were found across sex, except for living circumstances before placement, with girls more often in an assisted living home, whereas boys were more often living with their parents.

#### Table 1

Table 2 reports the descriptive data and differences between boys and girls in variable of interest. Girls had significantly lower scores on non-verbal reasoning and reported less CU traits, and significantly more externalizing behavior problems (both at T1 and T2) than boys.

Except for age (drop out participants being older), no differences were found between the participants who dropped out and those who remained in the study for T2 assessment, neither in the socio-demographic and controlled variables (non-verbal reasoning, externalizing behavior problems at T1), nor in the predictors (age of onset, CU traits, and anger-irritability).

Table 2

### **Correlations Between Predictors, Dependant, and Controlled Variables**

In Table 3, correlations between predictors, control, and dependent variables are reported. Anger-irritability problems and CU traits correlated positively with each other and with externalizing behavior problems at T1 and T2. Sex correlated positively with non-verbal reasoning (overall, girls had a lower IQ score than boys) and CU traits (overall, girls had lower CU trait scores than boys), and negatively with externalizing behavior problems at T1 and T2 (overall, girls had more externalizing behavior problems than boys).

Insert Table 3

### **Predicting Externalizing Behavior Problems at T2**

Results of the regression analysis (based on complete data for 120 participants) revealed that externalizing behavior problems at T1, anger-irritability problems as well as the interaction between sex and anger-irritability problems, and the interaction between sex and CU traits were related to externalizing behavior problems at T2 (Table 4). More specifically, higher externalizing behavior problems at T1 and higher anger-irritability problems at T1 predict higher externalizing behavior problems at T2. With regard to sex differences, the relation between higher CU traits at T1 and lower externalizing behavior problems at T2 was observed in girls but not in boys. Moreover, higher anger-irritability problems at T1 are predictive of higher externalizing behavior problems at T2 only in girls. Figure 1 illustrates these results. The model accounted for 50.3% of the variance of externalizing behavior problems at T2 ( $p < .001$ , 95% C.I.: 39.3 – 60.6).



Table 4 &amp; Figure 1

### Discussion

The aim of the current study was to examine sex-specific influences of three important predictors (age of onset, CU traits, and anger-irritability problems) for externalizing behavior problems one year later in a sample of adolescents institutionalized in child welfare and juvenile justice institutions. Results showed that anger-irritability problems, and the interaction between sex and anger-irritability problems, as well as the interaction between sex and CU traits predicted the severity of externalizing behavior problems over the course of one year (T2), even after controlling for non-verbal reasoning, age and externalizing behavior problems at T1. Hence, displaying a high level of anger-irritability problems significantly predicted higher externalizing behavior problems one year later. Furthermore, girls with high levels of anger-irritability problems or lower CU traits at T1 had an increased risk of higher levels of externalizing behavior problems at T2 (one year later) compared to boys.

First, results of this study showed the importance of anger-irritability problems above CU traits and age of onset in predicting externalizing behavior problems a year later. The fundamental role of anger-irritability problems in the externalizing spectrum is shown by its contribution to many psychopathological diagnoses within this realm, such as ODD, conduct disorder, psychopathic personality traits, and antisocial personality disorder (DSM-V; APA, 2013; ICD-10; WHO, 2004). Previous studies suggested that anger-irritability problems were triggered by neurobiological dysregulations (e.g., Pardini & Frick, 2013), genetic components (Taylor & Kim-Cohen, 2007), inadequate rearing environment such as hostile and coercive parenting styles (Gershoff, 2002; Teicher & Samson, 2016), or exposure to a series of traumatic experiences (Schmid, Petermann, & Fegert, 2013; Sevecke, Franke, Kosson, & Krischer, 2016), that could affect the individual's capacity to control anger-related mechanisms. While many of these factors explaining the development of anger-irritability

problems are not sex-specific per se, girls were found to be at heightened risk for sexual assault and abuse, which is also a strong predictor of anger-irritability problems (e.g., Kerig & Becker, 2012). A pathway linking anger-irritability problems and externalizing behavior problems was proposed by some authors (e.g., see Kerig & Becker, 2012; Novaco, 2010), suggesting that individuals highly irritable and easily angered are thought to have problems in appropriately controlling anger-related mechanisms (Novaco, 2010), resulting in a lower threshold of activation, and a heightened expression and experience when it is not appropriate. Some authors suggested that anger increases energy for action and desire for revenge and retaliation (e.g., De Coster & Zito, 2010), leading to violent and aggressive behaviors (e.g., Keane & Calkins, 2004; Wilson, Gardner, Burton, & Leung, 2006). All these factors explain why anger-irritability problems were so important in externalizing behavior problems in both boys and in girls. Furthermore, the greater risk for exposure to childhood trauma in girls could explain why the relation between anger-irritability problems and externalizing behavior problems at the course of one year was stronger in girls than in boys.

Second, results of this study are in contrast to some previous finding that CU traits equally predicted externalizing behavior problems in boys and in girls (e.g., Longman, Hawes, & Kohlhoff, 2016; Pardini et al., 2012), but in line with some others (Euler et al., 2015), showing that girls reported fewer CU traits but more externalizing behavior problems than boys. Indeed, results of the present study found that boys showed a higher level of CU traits than girls, but that the association between CU traits and externalizing behavior problems at T2 was stronger in girls than in boys, girls with fewer CU traits displaying a higher level of externalizing behavior problems. Furthermore, the association between CU traits and externalizing behavior problems was not significant when sex was not in the equation. This result was in contrast to a large majority of studies that found that CU traits

were a strong predictor of externalizing behaviors problems in general (Frick, Cornell, Barry, Bodin, & Dane, 2003; Stickle et al., 2012).

As studies investigating CU traits in girls, especially samples of girls at risk with externalizing behavior problems, are scarce, and showing mixed results, we need to question the link between CU traits and behaviors problems in girls. Results of the current study showed that CU traits were strongly and negatively predictive for externalizing behaviors problems in girls. This may reflect the fact that the expression of CU traits in girls may take other forms than those measured by the CBCL Youth Self-report. While overt aggression was shown as a typical pattern of behaviors found of boys with externalizing behavior problems, many studies showed that girls with externalizing behavior problems more typically showed relational aggression (e.g., Currie, Kelly, & Pomerantz, 2007; Murray-Close, Nelson, Ostrov, Casas, & Crick, 2016). For example, a study by Frick et al. (2003) showed that the link between psychopathic traits (including CU traits) and relational aggression (i.e. gossiping, spreading rumors, excluding someone from a group, etc.) was stronger in girls than in boys. Moreover, girls with higher levels of psychopathic traits showed more relational aggression. Furthermore, a recent study showed that girls with higher levels of CU traits showed more relational aggression and more externalizing behaviors problems, than girls with lower CU traits (Centifanti, Fanti, Thomson, Demetriou, & Anastassiou-Hadjicharalambous, 2015). The authors suggested that CU traits would lead to relational aggression as a way of gaining status and revenge. The instrument used in the current study to measure externalizing behaviors in the present study especially measured pattern of overt aggression. It is then possible that, in the present sample, girls showed more externalizing behaviors problems (overt aggression) as a reaction to more anger-irritability problems, while girls with more CU traits would have shown more relational aggression, explaining the inverse relation that was found between CU traits and externalizing behaviors problems.

The finding that age of onset of externalizing behavior problems did not predict the severity of externalizing behavior problems, especially in boys, is in contrast to previous literature (Moffitt, Caspi, Rutter, & Silva, 2001; Odgers et al., 2008). It may result from the fact that, in the present sample, the mean age of onset was around 14 years, with few individuals displaying a childhood-onset (< 10 years) of externalizing behavior problems. Indeed, this variable was evaluated by the adolescents only, and it is possible that also asking parents about their child's first display of externalizing behaviors may have provided a more accurate estimation of age of onset.

### **Implications for practice**

Results of the present studies impact the way boys and girls in institutions in Switzerland should be treated. The fact that girls showed more externalizing behavior problems and more anger-irritability problems than boys indicate that they are a group highly vulnerable and at heightened risk for later behavior problems, in need of special attention. Indeed, prevention or treatment programs focused on their specific areas of difficulties may be effective to decrease the risk for long term behaviors problems. For example, treatment focused on anger regulation was shown to have a positive effect in girl samples with delinquent behavior (e.g., Ford, Steinberg, Hawke, Levine, & Zhang, 2012). Furthermore, a recent study suggested that applying sex-specific treatments to girls would only work with girls showing gender-specific patterns of problems (Day, Zahn, & Tichavsky, 2015). The authors stressed case-to-case screening in order to tailor treatment to each individual.

Further studies should investigate risk profiles for externalizing behavior problems in institutionalized girls, especially relational aggression, and its relationship with CU traits. In this regard, it is of interest to mention that the juveniles/young adults in the present study are currently being followed-up (mean follow-up period approximately 8 years). Within this follow-up study (called JAEL: Jugendhilfeverläufe: Aus Erfahrung Lernen [Youth care

trajectories: learning from experience]) the trajectories of CU traits and externalizing behavior problems will be reassessed.

### **Limitations**

Results of the study should be considered in the light of some limitations. First, the main limitation is without doubt the issue of the comparability of the samples of boys and girls. Indeed, even if boys and girls were in general comparable in terms of socio-demographic variables, some differences were highlighted across sexes. In particular, girls had significantly lower scores in non-verbal reasoning and in CU traits than boys, but showed more externalizing problem behaviors at T1 and T2. Of note, however, with regards to non-verbal reasoning, boys and girls were within the normal range regarding non-verbal intelligence. The gender difference, although significant, has probably little importance for the results. CU traits have already been shown to be higher in boys than in girls in various samples (e.g., Stickle et al., 2012). However, the higher non-verbal reasoning and the lower severity of externalizing behavior problems in boys were unexpected. An explanation for this result may be related to differences in how judges perceive male and female delinquency in Switzerland. It might be that, as girls are underrepresented in criminal and violent behaviors, and as sensitivity and fragility are traditionally associated with a feminine image, criminal and civil judges are more tolerant or indulgent with delinquent girls and would favor alternative sentences, sending them to institutions only in case of extreme delinquent behaviors. This would result in more girls with higher problematic externalizing behavior problems in institutions compared to boys. The second possibility is that the girls sample has had a more complex family background and more often had a history of institutionalization than boys. More in detail, 33% of the girls versus 15% of boys lived in an assisted form (e.g., boarding school, institution for younger children, closely followed by a social caregiver) before they were placed in the institution where the present study took place. Additionally, 50 % of girls

compared to 66% of boys lived with their parents before placement in the institution of the current study. These results might explain part of the higher levels of problematic behaviors in girls compared to boys.

Second, the study design using retrospective data to assess the age of onset of externalizing behavior problems was less accurate than assessing the age of first externalizing behavior problems at the time they occur (e.g., Fairchild et al., 2011).

Third, results of this study are mainly based on self-report data. A social desirability bias or a lack of introspective abilities bias cannot be excluded. In order to limit this problem, interrater scores (youths and assigned caregiver) were used in the outcome variable. Finally, the dropout rate between T1 and T2 was important. The final sample is therefore not representative for all adolescents institutionalized in Switzerland. Furthermore, there was a considerable amount of missing data which might have influenced our results. Therefore, the use of Bayesian statistics was more appropriate.

## **Conclusions**

This study examined the sex-specific predictive effect of age of onset, anger-irritability problems, and CU traits on the severity of externalizing behavior problems after one year. Results indicated that anger-irritability problems and CU traits were more predictive of externalizing behavior problems in girls than in boys. Furthermore, while girls with more anger-irritability problems showed externalizing behavior problems, it was girls with fewer CU traits who showed more externalizing behavior problems. In previous literature, CU traits were often considered as a strong predictor for a long term criminal career: individuals with high CU traits also showed more extreme violent behaviors than individuals with low CU traits (e.g., Frick et al., 2003). However, results of the present study do not necessarily suggest that girls with high CU traits are less at risk than those with low CU traits for delinquent or criminal trajectories. Indeed, some studies did show that in girls, more CU traits were related

to more relational aggression (e.g., Centifanti et al., 2015), suggesting that CU traits could have different forms of expression in girls compared to boys.

### References

- Achenbach, T. M. (1991a). *Manual for the Youth Self-Report and 1991 Profiles*. Burlington: University of Vermont, Department of Psychiatry.
- Achenbach, T. M. (1991b). *Manual of the child behaviour checklist 4/18 and 1991 Profiles*. Burlington: University of Vermont, Department of Psychiatry.
- Agnew, R., Matthews, S. K., Bucher, J., Welcher, A. N., & Keyes, C. (2008). Socioeconomic status, economic problems, and delinquency. *Youth & Society, 40*(2), 159-181. doi: 10.1177/0044118X08318119
- Andershed, H., Kerr, M., Stattin, H., & Levander, S. (2002). Psychopathic traits in non-referred youths: A new assessment tool. In E. Blauuw & L. Sheridan (Eds.), *Psychopaths: Current International Perspectives* (pp. 131-158). The Hague: Elsevier.
- APA. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*: American Psychiatric Pub.
- Boers, K., & Reinecke, J. (2007). *Delinquenz im Jugendalter: Erkenntnisse einer Münsteraner Längsschnittstudie [Delinquency in adolescence: Findings of a longitudinal study in Münster]* Münster: Waxmann.
- Brotman, M. A., Kircanski, K., Stringaris, A., Pine, D. S., & Leibenluft, E. (2017). Irritability in Youths: A Translational Model. *American Journal of Psychiatry, 174* (6), 520-532. doi: 10.1176/appi.ajp.2016.16070839
- Campbell, S. B. (1995). Behavior problems in preschool children: a review of recent research. *Child Psychology & Psychiatry & Allied Disciplines, 36*(1), 113-149.
- Campbell, S. B. (2006). *Behavior problems in preschool children: Clinical and developmental issues*. New York: Guilford Press.
- Cattell, R. B. (1940). A culture-free intelligence test. *Journal of Educational Psychology, 31*(3), 161-179. doi: 10.1037/h0059043



- Centifanti, L., Fanti, K. A., Thomson, N. D., Demetriou, V., & Anastassiou-Hadjicharalambous, X. (2015). Types of relational aggression in girls are differentiated by callous-unemotional traits, peers and parental overcontrol. *Behavioral Sciences, 5*(4), 518-536. doi: 10.3390/bs5040518
- Coccaro, E. F., Fridberg, D. J., Fanning, J. R., Grant, J. E., King, A. C., & Lee, R. (2016). Substance use disorders: Relationship with intermittent explosive disorder and with aggression, anger, and impulsivity. *Journal of Psychiatric Research, 81*, 127-132. doi: 10.1016/j.jpsychires.2016.06.011
- Currie, D. H., Kelly, D. M., & Pomerantz, S. (2007). 'The power to squash people': understanding girls' relational aggression. *British Journal of Sociology of Education, 28*(1), 23-37. doi: 10.1080/01425690600995974
- Day, J. C., Zahn, M. A., & Tichavsky, L. P. (2015). What works for whom? The effects of gender responsive programming on girls and boys in secure detention. *Journal of Research in Crime and Delinquency, 52*(1), 93-129. doi: 10.1177/0022427814538033
- De Coster, S., & Zito, R. C. (2010). Gender and general strain theory: The gendering of emotional experiences and expressions. *Journal of Contemporary Criminal Justice, 26*(2), 224-245. doi: 10.1177/1043986209359853
- Dölitzsch, C., Schmid, M., Keller, F., Besier, T., Fegert, J. M., Schmeck, K., & Kölch, M. (2016). Professional caregiver's knowledge of self-reported delinquency in an adolescent sample in Swiss youth welfare and juvenile justice institutions. *International Journal of Law and Psychiatry, 47*, 10-17. doi: 10.1016/j.ijlp.2016.02.026
- Eagly, A. H. (2013). *Sex differences in social behavior: A social-role interpretation*. Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

- Eftekhari, A., Turner, A. P., & Larimer, M. E. (2004). Anger expression, coping, and substance use in adolescent offenders. *Addictive Behaviors, 29*(5), 1001-1008. doi: 10.1016/j.addbeh.2004.02.050
- Engle, R. W., Tuholski, S. W., Laughlin, J. E., & Conway, A. R. (1999). Working memory, short-term memory, and general fluid intelligence: a latent-variable approach. *Journal of Experimental Psychology, 128*(3), 309-331.
- Erskine, H. E., Ferrari, A. J., Nelson, P., Polanczyk, G. V., Flaxman, A. D., Vos, T., . . . Scott, J. G. (2013). Research Review: Epidemiological modelling of attention-deficit/hyperactivity disorder and conduct disorder for the Global Burden of Disease Study 2010. *Journal of Child Psychology and Psychiatry, 54*(12), 1263-1274. doi: 10.1111/jcpp.12144
- Euler, F., Jenkel, N., Stadler, C., Schmeck, K., Fegert, J. M., Kölch, M., & Schmid, M. (2015). Variants of girls and boys with conduct disorder: anxiety symptoms and callous-unemotional traits. *Journal of Abnormal Child Psychology, 43*(4), 773-785. doi: 10.1007/s10802-014-9946-x
- Evans, S. C., Burke, J. D., Roberts, M. C., Fite, P. J., Lochman, J. E., Francisco, R., & Reed, G. M. (2017). Irritability in child and adolescent psychopathology: An integrative review for ICD-11. *Clinical Psychology Review, 53*, 29-45. doi: 10.1016/j.cpr.2017.01.004
- Fairchild, G., Passamonti, L., Hurford, G., Hagan, C. C., von dem Hagen, E. A., van Goozen, S. H., . . . Calder, A. J. (2011). Brain structure abnormalities in early-onset and adolescent-onset conduct disorder. *American Journal of Psychiatry, 168*(6), 624-633. doi: 10.1176/appi.ajp.2010.10081184
- Ford, J. D., Steinberg, K. L., Hawke, J., Levine, J., & Zhang, W. (2012). Randomized trial comparison of emotion regulation and relational psychotherapies for PTSD with girls

- involved in delinquency. *Journal of Clinical Child & Adolescent Psychology*, 41(1), 27-37. doi: 10.1080/15374416.2012.632343
- Frick, P. J., Cornell, A. H., Barry, C. T., Bodin, S. D., & Dane, H. E. (2003). Callous-unemotional traits and conduct problems in the prediction of conduct problem severity, aggression, and self-report of delinquency. *Journal of Abnormal Child Psychology*, 31(4), 457-470. doi: 10.1023/A:1023899703866
- Frick, P. J., Ray, J. V., Thornton, L. C., & Kahn, R. E. (2014). Can callous-unemotional traits enhance the understanding, diagnosis, and treatment of serious conduct problems in children and adolescents? A comprehensive review. *Psychological Bulletin*, 140(1), 1-57. doi: 10.1037/a0033076
- Gershoff, E. T. (2002). Corporal punishment by parents and associated child behaviors and experiences: a meta-analytic and theoretical review. *Psychological Bulletin*, 128(4), 539-579.
- Godlaski, A. J., & Giancola, P. R. (2009). Executive functioning, irritability, and alcohol-related aggression. *Psychology of Addictive Behaviors*, 23(3), 391-403.
- Grisso, T., & Barnum, R. (2014). *Massachusetts youth screening instrument-version 2 (MAYSI-2): User's manual and technical report*. Sarasota: Professional Resource Press.
- Grisso, T., Barnum, R., Fletcher, K. E., Cauffman, E., & Peuschold, D. (2001). Massachusetts Youth Screening Instrument for mental health needs of juvenile justice youths. *Journal of the American Academy of Child & Adolescent Psychiatry*, 40(5), 541-548. doi: 10.1097/00004583-200105000-00013
- Herts, K. L., McLaughlin, K. A., & Hatzenbuehler, M. L. (2012). Emotion dysregulation as a mechanism linking stress exposure to adolescent aggressive behavior. *Journal of Abnormal Child Psychology*, 40(7), 1111-1122. doi: 10.1007/s10802-012-9629-4

- Hubbard, D. J., & Pratt, T. C. (2002). A meta-analysis of the predictors of delinquency among girls. *Journal of Offender Rehabilitation, 34*(3), 1-13. doi: 10.1300/J076v34n03\_01
- Jonson-Reid, M., & Barth, R. P. (2000). From placement to prison: The path to adolescent incarceration from child welfare supervised foster or group care. *Children and Youth Services Review, 22*(7), 493-516. doi: 10.1016/S0190-7409(00)00100-6
- Keane, S. P., & Calkins, S. D. (2004). Predicting kindergarten peer social status from toddler and preschool problem behavior. *Journal of Abnormal Child Psychology, 32*, 409-423. doi: 10.1023/B:JACP.0000030294.11443.41
- Kerig, P. K., & Becker, S. P. (2012). Trauma and girls' delinquency *Delinquent girls* (pp. 119-143). New York: Springer.
- Leve, L. D., & Chamberlain, P. (2004). Female juvenile offenders: Defining an early-onset pathway for delinquency. *Journal of Child and Family Studies, 13*(4), 439-452. doi: 10.1023/B:JCFS.0000044726.07272.b5
- Longman, T., Hawes, D. J., & Kohlhoff, J. (2016). Callous-unemotional traits as markers for conduct problem severity in early childhood: a meta-analysis. *Child Psychiatry and Human Development, 47*(2), 326-334. doi: 10.1007/s10578-015-0564-9
- Lynch, S. (2007). *Introduction to applied bayesian statistics and estimation for social scientist*. New York: Springer.
- McMahon, R. J., Witkiewitz, K., & Kotler, J. S. (2010). Predictive validity of callous-unemotional traits measured in early adolescence with respect to multiple antisocial outcomes. *Journal of Abnormal Psychology, 119*(4), 752-763. doi: 10.1037/a0020796
- Meier, M. H., Slutske, W. S., Arndt, S., & Cadoret, R. J. (2008). Impulsive and callous traits are more strongly associated with delinquent behavior in higher risk neighborhoods among boys and girls. *Journal of Abnormal Psychology, 117*(2), 377-385. doi: 10.1037/0021-843X.117.2.377

- Millon, T. (1993). *Millon adolescent clinical inventory*. Minneapolis, MN: National Computer Systems.
- Moffitt, T. E. (1993). Adolescence-limited and life-course-persistent antisocial behavior: a developmental taxonomy. *Psychological Review*, *100*(4), 674-701.
- Moffitt, T. E. (2003). Life-course-persistent and adolescence-limited antisocial behavior: a 10-year research review and research agenda. In B. B. Lahey, T. E. Moffitt & A. Caspi (Eds.), *Causes of conduct disorder and juvenile delinquency* (pp. 49-75). New York: Guilford.
- Moffitt, T. E., Caspi, A., Rutter, M., & Silva, P. A. (2001). *Sex differences in antisocial behavior: Conduct disorder, delinquency, and violence in the Dunedin longitudinal study*. Cambridge: Cambridge University Press.
- Murray-Close, D., Nelson, D. A., Ostrov, J. M., Casas, J. F., & Crick, N. R. (2016). Relational aggression: A developmental psychopathology perspective. *Developmental Psychopathology*. doi: 10.1002/9781119125556.devpsy413
- Muthén, L. K., & Muthén, B. O. (1998-2010). *Mplus User's Guide (Sixth Edition)*. Los Angeles, CA: Muthén & Muthén.
- Novaco, R. W. (2010). Anger and psychopathology *International handbook of anger* (pp. 465-497). New York: Springer.
- Odgers, C. L., Moffitt, T. E., Broadbent, J. M., Dickson, N., Hancox, R. J., Harrington, H., . . . Caspi, A. (2008). Female and male antisocial trajectories: from childhood origins to adult outcomes. *Developmental Psychopathology*, *20*(2), 673-716. doi: 10.1017/S0954579408000333
- OFS. (2017). Statistique des condamnations pénales des mineurs (JUSUS) [Statistics of criminal convictions of minors]. In O. f. d. l. statistique (Ed.). Neuchâtel: Office fédéral de la statistique.

- Pardini, D., & Frick, P. J. (2013). Multiple developmental pathways to conduct disorder: current conceptualizations and clinical implications. *Journal of the Canadian Academy of Child and Adolescent Psychiatry, 22*(1), 20-25.
- Pardini, D., Stepp, S., Hipwell, A., Stouthamer-Loeber, M., & Loeber, R. (2012). The clinical utility of the proposed DSM-5 callous-unemotional subtype of conduct disorder in young girls. *Journal of the American Academy of Child and Adolescent Psychiatry, 51*(1), 62-73. e64. doi: 10.1016/j.jaac.2011.10.005
- Pihet, S., Suter, M., Meylan, N., & Schmid, M. (2014). Factor Structure of the Youth Psychopathic traits inventory: Using the total score, three scale scores and/or 10 subscale scores. *Criminal Justice and Behavior, 41*, 1214-1231. doi: 10.1177/0093854814540287
- Piquero, A., & Chung, H. L. (2001). On the relationships between gender, early onset, and the seriousness of offending. *Journal of Criminal Justice, 29*(3), 189-206. doi: 10.1016/S0047-2352(01)00084-8
- Piquero, N. L., & Sealock, M. D. (2004). Gender and general strain theory: A preliminary test of Brody and Agnew's gender/GST hypotheses. *Justice Quarterly, 21*(1), 125-158. doi: 10.1080/07418820400095761
- Posick, C., Farrell, A., & Swatt, M. L. (2013). Do boys fight and girls cut? A general strain theory approach to gender and deviance. *Deviant behavior, 34*(9), 685-705. doi: 10.1080/01639625.2012.748626
- Raschle, N. M., Menks, W. M., Fehlbaum, L. V., Steppan, M., Smaragdi, A., Gonzalez-Madruga, K., . . . Martinelli, A. (2018). Callous-unemotional traits and brain structure: Sex-specific effects in anterior insula of typically-developing youths. *NeuroImage: Clinical, 17*, 856-864. doi: 10.1016/j.nicl.2017.12.015

- Raven, J., Raven, J. C., & Court, J. H. (2000). *Manual for Raven's Progressive Matrices and Vocabulary Scales. Section 3: The Standard Progressive Matrices*. Oxford, England: Oxford Psychologists Press.
- Raven, J. C. (1938). *Progressive matrices: A perceptual test of intelligence*. London: HK Lewis.
- Ryan, J. P., Testa, M. F., & Zhai, F. (2008). African American males in foster care and the risk of delinquency: The value of social bonds and permanence. *Child Welfare, 87*(1), 115.
- Scheidegger, F. (2015). *La violence des jeunes dans la statistique policière de la criminalité: 2009-2014 [Youths violence in criminal police statistics]*. Neuchâtel: Office fédéral de la statistique.
- Schmid, M., Kölch, M., Fegert, J. M., Schmeck, K., & MAZ-Team. (2013). Abschlussbericht Modellversuch Abklärung und Zielerreichung in stationären Massnahmen. Bern: Bundesamt für Jutiz.
- Schmid, M., Petermann, F., & Fegert, J. M. (2013). Developmental trauma disorder: pros and cons of including formal criteria in the psychiatric diagnostic systems. *BMC Psychiatry, 13*(3), 1-12. doi: 10.1186/1471-244X-13-3
- Seedat, S., Scott, K. M., Angermeyer, M. C., Berglund, P., Bromet, E. J., Brugha, T. S., . . . Jin, R. (2009). Cross-national associations between gender and mental disorders in the World Health Organization World Mental Health Surveys. *Archives of General Psychiatry, 66*(7), 785-795. doi: 10.1001/archgenpsychiatry.2009.36
- Sevecke, K., Franke, S., Kosson, D., & Krischer, M. (2016). Emotional dysregulation and trauma predicting psychopathy dimensions in female and male juvenile offenders. *Child and Adolescent Psychiatry and Mental Health, 10*(1), 43. doi: 10.1186/s13034-016-0130-7

- Silverthorn, P., Frick, P. J., & Reynolds, R. (2001). Timing of onset and correlates of severe conduct problems in adjudicated girls and boys. *Journal of Psychopathology and Behavioral Assessment, 23*(3), 171-181. doi: 10.1023/A:1010917304587
- Stadlin, C., Pérez, T., Schmeck, K., Di Gallo, A., & Schmid, M. (2015). Konstruktvalidität un Faktorenstruktur des deutschsprachigen Youth Psychopathic Traits Inventory (YPI) in einer repräsentativen Schulstichprobe. *Diagnostica, 62*, 85-96. doi: 10.1026/0012-1924/a000139
- Stickle, T. R., Marini, V. A., & Thomas, J. N. (2012). Gender differences in psychopathic traits, types, and correlates of aggression among adjudicated youth. *Journal of Abnormal Child Psychology, 40*(4), 513-525. doi: 10.1007/s10802-011-9588-1
- Stringaris, A., & Taylor, E. (2015). *Disruptive mood: Irritability in children and adolescents*: Oxford University Press, USA.
- Taylor, A., & Kim-Cohen, J. (2007). Meta-analysis of gene–environment interactions in developmental psychopathology. *Development and Psychopathology, 19*(04), 1029-1037. doi: 10.1017/S095457940700051X
- Teicher, M. H., & Samson, J. A. (2016). Annual Research Review: Enduring neurobiological effects of childhood abuse and neglect. *Journal of Child Psychology and Psychiatry, 5*(3), 241-266. doi: 10.1111/jcpp.12507
- van de Schoot, R., Hoijsink, H., Mulder, J., Van Aken, M. A., de Castro, B. O., Meeus, W., & Romeijn, J. W. (2011). Evaluating expectations about negative emotional states of aggressive boys using Bayesian model selection. *Developmental Psychology, 47*(1), 203-212. doi: 10.1037/a0020957
- van de Schoot, R., Kaplan, D., Denissen, J., Asendorpf, J. B., Neyer, F. J., & van Aken, M. A. (2014). A gentle introduction to bayesian analysis: applications to developmental research. *Child Development, 85*(3), 842-860. doi: 10.1111/cdev.12169



- Vidal-Ribas, P., Brotman, M. A., Valdivieso, I., Leibenluft, E., & Stringaris, A. (2016). The status of irritability in psychiatry: a conceptual and quantitative review. *Journal of the American Academy of Child & Adolescent Psychiatry, 55*(7), 556-570. doi: 10.1016/j.jaac.2016.04.014
- Wei, R. H. (2006). *CFT 20-R: grundintelligenztest skala 2-revision*. Gttingen: Hogrefe.
- WHO. (2004). *International statistical classification of diseases and related health problems* (Vol. 1): World Health Organization.
- Wilson, C., Gardner, F., Burton, J., & Leung, S. (2006). Maternal attributions and young children's conduct problems. *Infant and Child Development, 15*, 109-121. doi: 10.1002/icd.440
- Wittenberg, J., Reinecke, J., & Boers, K. (2009). Dissemination, Development and Explanation of Delinquency during Adolescence. Results of a Current Longitudinal Study. *Journal for Educational Research Online/Journal fr Bildungsforschung Online, 1*(1), 106-134.
- Yuan, Y., & MacKinnon, D. P. (2009). Bayesian mediation analysis. *Psychological Methods, 14*(4), 301-322. doi: 10.1037/a0016972
- Zisner, A., & Beauchaine, T. P. (2016). Neural substrates of trait impulsivity, anhedonia, and irritability: Mechanisms of heterotypic comorbidity between externalizing disorders and unipolar depression. *Development and Psychopathology, 28*(4pt1), 1177-1208. doi: 10.1017/S0954579416000754

Table 1  
*Socio-Demographic Variables*

		Included		Excluded/Drop out		Excluded/drop out vs included <sup>1</sup>	Sex comparison included <sup>2</sup>
		Girls ( <i>n</i> = 118)	Boys ( <i>n</i> = 240)	Girls ( <i>n</i> = 59)	Boys ( <i>n</i> = 119)		
		<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )		
Age (years)		15.72 (1.71)	16.16 (2.28)	15.94 (1.62)	16.76 (2.11)	.013	<i>ns</i>
Socio-economic status		5.29 (2.01)	5.80 (1.80)	5.74 (1.56)	6.05 (2.26)	<i>ns</i>	<i>ns</i>
		<i>n</i> (%)	<i>n</i> (%)				
Born in Switzerland	Yes	90 (76.3)	188 (78.3)	44 (74.6)	96 (80.7)	<i>ns</i>	<i>ns</i>
Nationality	Swiss	51 (43.2)	131 (54.6)	19 (32.2)	57 (47.9)	<i>ns</i>	<i>ns</i>
Housing before institution	Parents	58 (50.0)	155 (66.0)	29 (51.8)	64 (55.7)	<i>ns</i>	.009
	Relatives	4 (3.4)	7 (3.0)	3 (5.4)	4 (3.5)		
	Own home	1 (0.9)	1 (0.4)	0	1 (0.9)		
	Family care	5 (4.3)	16 (6.8)	2 (3.6)	4 (3.5)		
	Assisted living form	36 (31.0)	35 (14.9)	15 (26.8)	29 (25.2)		
	Psychiatric service	10 (8.7)	12 (5.1)	5 (8.9)	8 (7.0)		
	Homeless	0	1 (0.4)	0	0		
	Other	2 (1.7)	8 (3.4)	2 (3.6)	5 (4.4)		
Custody	Both parents living together	20 (17.4)	64 (27.8)	7 (12.5)	20 (18.2)	<i>ns</i>	<i>ns</i>
	Both parents	7 (6.1)	22 (9.6)	5 (8.9)	10 (9.1)		
	Father	6 (5.2)	15 (6.5)	8 (14.3)	6 (5.5)		
	Mother	66 (57.4)	99 (43.0)	26 (46.4)	58 (52.7)		
	Guardian	16 (13.9)	30 (13.0)	10 (17.9)	16 (14.5)		
Last youth's education level	Compulsory special school	23 (25.8)	57 (32.0)	12 (31.6)	24 (20.2)	<i>ns</i>	<i>ns</i>
	Compulsory regular school	66 (74.2)	121 (68.0)	26 (68.4)	59 (71.1)		

*Note.* <sup>1</sup>Results of Chi-square tests (Fisher's exact estimates) or *t*-tests for independent sample, as appropriate comparing the participants included to those excluded or who dropped out. <sup>2</sup>Results of Chi-square tests (Fisher's exact estimates) or *t*-tests for independent samples, as appropriate comparing included girls and boys.

Table 2  
*Differences between boys and girls in variables of interest*

		Boys ( <i>n</i> = 240)		Girls ( <i>n</i> = 118)		<i>t</i> (df)	<i>p</i>
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
T1	Non-verbal reasoning	97.68	13.87	94.66	13.79	-2.02 (382)	.044
	Age of onset	14.19	2.60	14.39	1.45	0.74 (178.84)	.462
	CU traits	34.44	7.54	29.25	6.01	-8.29 (400.68)	< .001
	Anger-irritability	4.41	2.72	4.90	2.50	1.88 (293)	.062
	Externalizing behaviors	61.69	8.19	64.20	8.86	3.20 (513)	.001
T2	Externalizing behaviors	59.67	8.26	61.63	9.23	2.00 (343)	.046

*Note.* Mean and standard deviation (*SD*); CU traits = Callous Unemotional traits

Table 3

*Correlations Between Controlled Variables, Predictors at T1 and Outcome at T2*

	1	2	3	4	5	6
1. Sex (0 : female, 1 : male)	-					
2. Non verbal reasoning	.103*	-				
3. Age of onset	-.036	.072	-			
4. Anger-irritability	-.109	-.082	.127	-		
5 CU traits	.328**	.025	-.026	.142*	-	
6. Externalizing behaviors at T1	-.140**	-.035	-.055	.386**	.301**	-
7. Externalizing behaviors at T2	-.107*	-.055	.046	.581**	.236**	.881**

Note. \*  $p < .05$ , \*\*  $p < .01$ ; CU traits = Callous Unemotional traits

Table 4  
*Regression Analyses Predicting Externalizing Behaviors at T2*

Criterion	Predictors	<i>Estimates</i>	<i>SD</i>	95% C.I.		<i>p</i>
				<i>Lower</i>	<i>Upper</i>	
Ext. behav. T2	Non verbal reasoning	-0.10	0.07	-0.23	0.03	.130
	Ext. behav. T1	0.58	0.07	0.44	0.72	< .001
	Age of onset	-0.31	0.23	-0.75	0.17	.184
	Anger-irritability	0.38	0.17	0.03	0.71	.036
	Sex	0.10	0.09	-0.08	0.27	.252
	CU traits	-0.36	0.20	-0.73	0.03	.072
	Sex x Age of Onset	0.37	0.23	-0.07	0.82	.108
	Sex x CU traits	0.43	0.18	0.06	0.77	.022
	Sex x Anger-irritability	-0.34	0.16	-0.65	-0.04	.036

*Note.* 95% C.I. = Credibility interval at 95%; CU traits = Callous-unemotional traits; Ext. behav. T2 = Externalizing behavior problems at T2.

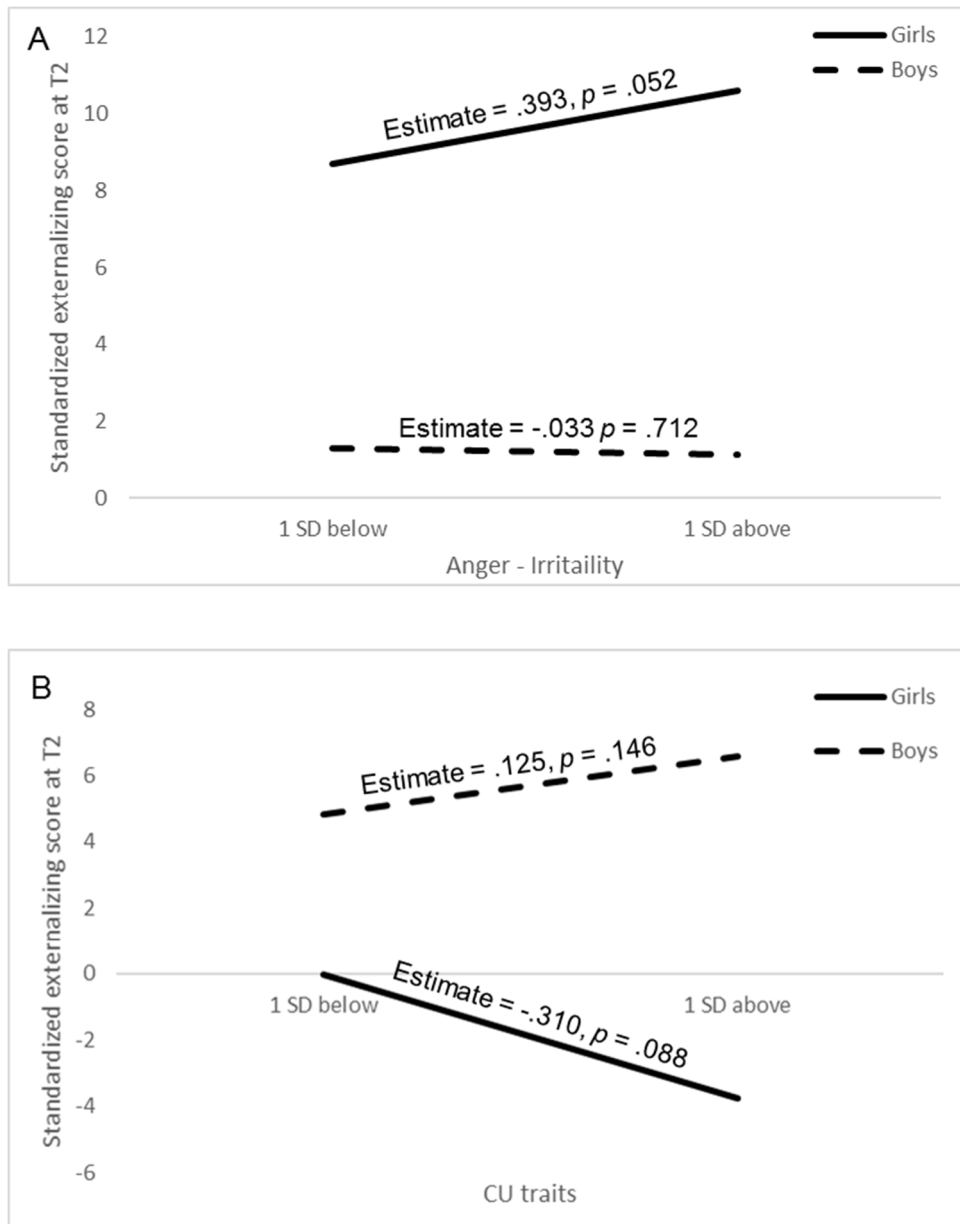


Figure 1.

Moderation effect of gender on the link between externalizing symptoms at T2 and anger-irritability (Panel A) or callous-unemotional (CU) traits (Panel B)