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## DELINQUENCY AND EMOTIONAL PROBLEMS

### Longitudinal Associations Between Delinquency, Depression and Anxiety Symptoms in Adolescence: Testing the Moderating Effect of Sex and Family Socioeconomic Status

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### Abstract

*Purpose:* To examine the cross-lagged associations between delinquency (nonviolent and violent), depression and anxiety symptoms in adolescence and to test the moderating effect of sex and family socioeconomic status (SES).

*Methods:* Participants ( $n=1,515$ ) were from a birth cohort in the Canadian province of Quebec. Autoregressive cross-lagged panel analyses were used to examine the associations between delinquency (nonviolent and violent), depression and anxiety symptoms from ages 15 to 17 years, while taking into account conduct and emotional problems at ages 10-12 years.

*Results:* Findings suggest that delinquency (violent delinquency especially) and depression symptoms may develop according to a spiraling model, such that conduct problems in childhood give rise to depression symptoms in mid-adolescence, which in turn, contribute to more delinquent acts at the end of adolescence. Family SES, but not sex, had a moderating effect on the paths. We found that anxiety symptoms at age 15 years were associated with nonviolent delinquency at age 17 years when family SES was low, and that violent delinquency at age 15 years was associated with anxiety symptoms at age 17 years when family SES was high.

*Conclusions:* Delinquency and emotional problems do not develop independently from each other; both dimensions should be examined simultaneously.

*Keywords:* Nonviolent and violent delinquency; Depression and anxiety symptoms; Adolescence; Cross-lagged associations; Sex differences; Family socioeconomic status.

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### Highlights

1. Delinquency and depression may develop according to a spiraling model.
2. Family socioeconomic status, but not sex, had a moderating effect on the paths.
3. Anxious youths from lower socioeconomic environments are at risk for delinquency.
4. Violent youths from higher socioeconomic environments are at risk for anxiety.
5. Delinquency and emotional problems do not develop independently of each other.

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### Longitudinal Associations Between Delinquency, Depression and Anxiety Symptoms in Adolescence: Testing the Moderating Effect of Sex and Family Socioeconomic Status

#### Introduction

##### *Potential Associations Between Delinquency, Depression and Anxiety Symptoms*

An important number of adolescents who engage in delinquent behavior also have emotional problems, such as depression and anxiety symptoms (Cauffman, 2004; Moffitt, Caspi, Rutter, & Silva, 2001). Possible explanations of this co-occurrence have been proposed. For instance, the association between depression and delinquency could be explained by a failure model. That is, delinquency may result in negative social outcomes (such as lower levels of social support), which in turn lead to depression. The acting out model, in which depression is channeled into delinquent behavior, is also plausible (Ozkan, 2017; Wolff & Ollendick, 2006). Both models predict longitudinal, albeit unidirectional, associations between delinquency and depression. However, because both theoretical models may apply, it is possible that delinquency and depression are linked in a transactional (also referred to as cross-lagged) fashion, which involves longitudinal, bidirectional links between two variables. Different types of transactional models are theoretically possible. First, bidirectional longitudinal associations may appear simultaneously, such that two variables (e.g., delinquency and depression symptoms) mutually influence each other from one time point to the next. Second, bidirectional longitudinal associations may appear only sequentially (in a spiraling effect), where variable A (e.g., delinquency) assessed at time 1 is unidirectionally associated with variable B (e.g., depression symptoms) assessed at time 2, which in turn is unidirectionally associated with variable A at time 3, and so on. An empirical test of these different possibilities in the longitudinal link between delinquency and depression symptoms is still lacking, however.

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Anxiety has also been linked to delinquency. Specifically, low anxiety is expected to be associated with delinquency because of a lack of consideration for the possible negative consequences, whereas high anxiety is expected to negatively predict delinquency because of fear of punishment (El Sayed, Piquero, Schubert, et al., 2016). However, there is also evidence suggesting that anxiety could heighten responsiveness to threat, which in turn, could lead to persistent violent behavior (Hodgins, De Brito, Chhabra, & Côté, 2010).

### *Socioeconomic Status and Sex as Potential Moderators*

Moreover, it is possible that anxiety could lead to delinquency in specific contexts. For instance, according to the General Strain Theory (Agnew, 1992), individuals exposed to strains and stressors could develop negative emotions (such as anger, depression and also possibly anxiety), making them more likely to cope by engaging in delinquent behavior. This could be particularly the case for youth who grow up in a family with a low socioeconomic status (SES) and who face economic problems (strain/stressor; Agnew, Matthews, Bucher, Welcher, & Keyes, 2008). Alternatively, individuals who engage in delinquent behavior may also develop anxiety or depression symptoms in contexts where such behavior is considered to be highly reprehensible. For instance, mid- or high SES adolescents' failure to achieve a goal valued by their family (e.g., obtaining a university degree) as a consequence of their delinquent acts could experience higher levels of negative emotions, such as anxiety or depression symptoms. Thus, SES may moderate the associations between delinquency and emotional problems, although this hypothesis needs to be further investigated within the context of longitudinal studies.

Sex may also moderate the longitudinal associations between delinquency and depression symptoms or anxiety symptoms. The mean levels of delinquent behavior and emotional problems vary across sexes (e.g., boys are more involved than girls in violent delinquency, but manifest less emotional problems) (Côté et al., 2017). However, extant research suggests that sexes may

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be more similar than different in their comorbidity patterns, with the possible exception that females with delinquent behavior may be more likely to develop depression compared to their male counterparts (Moffitt et al., 2001).

### *Current Study*

Empirical research on possible bidirectional links between delinquency and emotional problems is limited and has led to inconsistent findings (Wolff & Ollendick, 2006). For instance, there is evidence suggesting that depression and anxiety symptoms could be associated with an escalation of delinquent behavior (Beyers & Loeber, 2003; Hodgins et al., 2010). However, other findings suggest that anxiety symptoms are not associated with a raise of future delinquency (El Sayed et al., 2016), and that delinquency is a risk factor for depression, but not the reverse (Defoe, Farrington, & Loeber, 2013). These inconsistent findings may result from a number of shortcomings in past studies, such as a lack of longitudinal research or failure to account for early symptomatology or confounding factors, such as SES (Wolff & Ollendick, 2006). It is also possible that moderating factors such as sex or SES are at play.

In this study, we used a cross-lagged approach (i.e., a path analysis in which we tested longitudinal, bidirectional associations between delinquency, depression and anxiety symptoms) to address a number of research gaps. More specifically, we (1) examined the cross-lagged associations between delinquency, depression and anxiety symptoms in a population-based sample of adolescents between ages 15 and 17 years and (2) tested the moderating effect of sex and family SES. We differentiated between nonviolent and violent delinquency because their associations with emotional problems may differ (Hodgins et al., 2010) and also included ages 10-12 conduct and emotional problems to examine possible developmental cascades. We expected longitudinal associations between delinquency (nonviolent and violent), depression and anxiety symptoms. However, given the different possible explanations of the associations

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between these variables over time (see above), simultaneous or sequential bidirectional associations between these variables are theoretically conceivable. In addition, we expected that the longitudinal associations would be similar across sexes, with the exception that females who engaged in delinquent behavior would further develop higher levels of depression symptoms compared to their male counterparts (Moffitt et al., 2001). Finally, based on theoretical assumptions (e.g., General Strain Theory; Agnew, 1992), we expected that SES would moderate the associations between delinquency and emotional problems (i.e., depression and anxiety). Specifically, we expected that youth with emotional problems would cope by subsequently engaging in delinquent behavior, but especially when their family SES would be low (e.g., given strains and stressors associated with economic problems). We also expected that, because delinquent behavior may constitute a specifically problematic breach of social norms in high SES families, delinquent youths from such families may be especially likely to experience increased anxiety and depression symptoms.

### Methods

#### *Participants*

Participants were from the Quebec Longitudinal Study of Child Development (QLSCD), a representative sample of 2,120 youths born in the Canadian province of Quebec in 1997–1998 and followed prospectively until 17 years of age (for more information about the study see: <http://www.jesuisjeserai.stat.gouv.qc.ca>). Participants included in the QLSCD were selected via the Quebec Birth Registry using a stratified procedure based on living area and birth rate. Data were collected annually or biennially from 1998 through 2015. Participants were selected if they spoke English or French (official languages of Canada). The QLSCD protocol was approved by the Quebec Institute of Statistics (Quebec City, Quebec, Canada) and the Sainte-Justine Hospital Research Centre (Montreal, Quebec, Canada) ethics committees. Written informed consent was

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obtained from all participants and parents at each data collection time.

The sampling frame of the present study included 1,515 participants ( $n = 790$  female, 52.1%) who had reported on their delinquent behavior and mental health at ages 15 and/or 17 years. The majority of the participants was Caucasian. We tested the extent to which sex as well as family SES, conduct problems and emotional problems at ages 10-12 years predicted attrition, and therefore exclusion from the current analyses. The tests revealed that participants excluded from the autoregressive cross-lagged analyses were more likely to be male (odds ratio = 1.5) and had lower levels of family SES (Cohen's  $d = -.19$ ) compared with the participants who were included.

### *Measures*

*Nonviolent and violent delinquency, and depression and anxiety symptoms at ages 15 and 17 years.* We used the Mental Health and Social Inadaptation Assessment for Adolescents (MIA; Côté, Orri, Brendgen, et al., 2017), a self-report instrument for assessing the frequency of mental health and psychosocial adaptation problems since the last 12 months using a dimensional approach and based on the DSM-5 (American Psychiatric Association, 2013). Participants rated each item using a three-point scale (“never true”, “sometimes true”, “always true”). Past research showed adequate internal validity and reliability of the MIA (Côté et al., 2017).

The nonviolent delinquency scale was created using 6 items from the MIA Conduct Disorder scale (e.g., “I stole money or objects from school or from stores”, “I deliberately destroyed someone else’s property”). Alphas at ages 15 and 17 years were .91 and .88, respectively. The violent delinquency scale was created using 11 items from the MIA Aggression scale (e.g., “I got into a fight intending to seriously hurt someone”, “I beat up someone who hadn’t done anything to me”). Alphas at ages 15 and 17 years were both .95. We applied a

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reciprocal transformation to the nonviolent and violent delinquency scales at ages 15 and 17 years to correct for non-normally distributed data.

The depression symptoms scale included 8 items from the MIA (e.g., “I felt sad and unhappy”, “I lost interest in things I usually like”). Alphas at ages 15 and 17 years were both .90. The anxiety symptoms scale included 9 items from the MIA (e.g., “I worried about my past behavior”, “I had worries that interfered with my everyday life”). Alphas at ages 15 and 17 years were .86 and .84, respectively.

*Conduct and emotional problems by early adolescence.* We created two self-reported scales (conduct problems and emotional problems) by computing the mean of the scores at ages 10 and 12 years. Items were derived from the Canadian National Longitudinal Study of Children and Youth (Statistics Canada and Human Resources Development Canada, 1995), which includes items from the Child Behavior Checklist (Achenbach, Edelbrock, & Howell, 1987), the Ontario Child Health Study Scales (Offord, Boyle, & Racine, 1989) and the Preschool Behavior Questionnaire (Tremblay, Desmarais-Gervais, Gagnon, & Charlebois, 1987). At each time point, the participants rated the items using a three-point scale (“never or not true”, “sometimes or somewhat true”, “often or very true”) according to a 6-month period. Conduct problems were assessed using the same 17 items at both time points (e.g., “You kick or hit other people your age”, “You steal outside your house”). Alphas at ages 10 and 12 years were both .93. We applied a square root transformation to the conduct problems scale to correct for the non-normal distribution of the data. The cross-time correlation between the two scores of conduct problems was .46. Emotional problems (i.e., depression and anxiety symptoms) were assessed using the same 7 items (e.g., “You are unhappy or sad”, “You worry a lot”) at both time points. Alphas at

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ages 10 and 12 years were .79 and .86, respectively. The cross-time correlation between the two scores of emotional problems was .34.

*Sex and family SES as moderators.* Sex and family SES were considered as potential moderators. A mean of the family SES (an aggregate measure of the annual gross income, parental education level, and occupational prestige, based on Willms & Shields, 1996) was computed according to parents' reports at ages 10 and 12. The cross-time correlation between the SES scores was .92.

### *Analyses*

We conducted structural equation (SEM) analyses with Mplus (Version 7.11; Muthén & Muthén, 1998-2012) using maximum likelihood estimation with robust standard errors (MLR). Associations between delinquency, depression symptoms and anxiety symptoms from ages 15 to 17 years were examined while taking into account sex as well as family SES, conduct problems and emotional problems at ages 10-12 years. Two models were estimated, one for nonviolent delinquency and one for violent delinquency (see Figure 1). We first tested whether the models fit equally well across sexes to explore the generalizability of our findings using the Satorra-Bentler scaled chi-square difference test ( $\chi^2$  DiffTest) based on the loglikelihood values (Satorra, 2000). When appropriate, the more parsimonious model (i.e., the model constraining the estimates of the paths to be equal across sexes, and thus suggesting that sex did not moderate the paths) was selected (Kline, 2005). Next, for each model, we examined whether family SES at ages 10-12 years moderated the longitudinal associations. We tested the interactions between family SES and the ages 10-12 variables (i.e., conduct and emotional problems) in the prediction of the ages 15 and 17 variables (i.e., delinquency, depression and anxiety symptoms) and between family SES and the age 15 variables in the prediction of the age 17 variables (i.e.,

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whether family SES moderated the autoregressive and the cross-lagged paths). All continuous variables were *Z* standardized prior to conducting the SEM analyses to facilitate the interpretation of the results. Missing data in the SEM analyses were managed using full information maximum likelihood estimation (Muthén & Muthén, 1998-2012).

### Results

#### *Descriptive and Correlation Analyses*

Table 1 presents the descriptive statistics of the study variables for boys and girls. Anxiety and depression symptoms showed higher average levels than delinquency, especially violent delinquency, at ages 15 and 17 years. Compared to girls, boys had higher mean levels ( $p \leq .05$ ) of conduct problems at ages 10-12 years as well as nonviolent and violent delinquency at ages 15 and 17 years, but lower mean levels of emotional problems at ages 10-12 years and of depression and anxiety symptoms at ages 15 and 17 years, with small to medium effect sizes (Cohen's *ds*).

Table 2 presents the correlations between the study variables for boys and girls. The correlations were similar across sexes. Overall, depression and anxiety symptoms at age 15 years were positively associated with nonviolent and violent delinquency at age 17 years, and nonviolent and violent delinquency at age 15 years were positively associated with depression and anxiety symptoms at age 17 years. In addition, the participants' levels of anxiety and depression symptoms as well as nonviolent and violent delinquency appeared relatively stable across time, as suggested by the moderate positive correlations found for each type of symptoms or behaviors across the two time points for both boys ( $r_s = .40 - .54$ ) and girls ( $r_s = .33 - .55$ ).

#### *Estimation of the Models and Examination of the Moderating Effect of Sex*

For each model, we tested the equality of fit of the models across sexes. For the model including nonviolent delinquency, the difference between the model in which the parameters were allowed to be freely estimated across sexes and the model in which the parameters were

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constrained to be equal across sexes was not statistically significant ( $\Delta\chi^2 = 32.22/\Delta df = 36$ , scaling correction factor = 1.10,  $p = .65$ ), suggesting that the associations between the variables were the same for boys and girls (i.e., that sex did not have a moderating effect). Likewise, for the model including violent delinquency, the difference between the model in which the parameters of the paths were allowed to be freely estimated across sexes and the model in which the parameters of the paths were constrained to be equal across sexes was not statistically significant ( $\Delta\chi^2 = 37.32/\Delta df = 36$ , scaling correction factor = 1.10,  $p = .41$ ), suggesting again that the associations between the variables were the same for boys and girls (i.e., that sex did not have a moderating effect).

Given previous results suggesting that sex did not moderate the paths, we then estimated two saturated models including boys and girls together, one for nonviolent delinquency and one for violent delinquency (see Figure 2 and Figure 3, respectively). Sex as well as family SES were included in both models as concurrent or predictor variables of the variables at ages 10-12, 15 and 17 years, but are not presented in the figures for clarity (see note of Figures 2 and 3 for more details).

Results from Figure 2 convey four main findings. First, nonviolent delinquency at 15 years old was not associated with depression and anxiety symptoms at age 17 years. Second, depression symptoms at age 15 years, but not anxiety symptoms, were associated with nonviolent delinquency at age 17 years, although the association did not reach the traditional threshold for statistical significance ( $p = .09$ ). Third, within each time point, nonviolent delinquency was associated with depression and anxiety symptoms. Fourth, conduct problems at ages 10-12 years were positively associated with depression symptoms at age 15 years. As expected, they were also associated with nonviolent delinquency at ages 15 and 17 years.

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Results from Figure 3 also convey four main findings. First, violent delinquency at age 15 years was not associated with depression and anxiety symptoms at age 17 years. Second, depression symptoms at age 15 years, but not anxiety symptoms, were associated with violent delinquency at age 17 years. Third, within each time point, violent delinquency was associated with depression and anxiety symptoms. Fourth, conduct problems at ages 10-12 years were positively associated with depression symptoms at age 15 years. As expected, they were also associated with violent delinquency at ages 15 and 17 years.

Because depression and anxiety symptoms were highly correlated, we reran the analyses to examine the associations between depression symptoms and delinquency without including anxiety symptoms, and then again to examine the associations between anxiety symptoms and delinquency without including depression symptoms. Similar to the findings from the models including both depression and anxiety symptoms, we found that conduct problems at ages 10-12 years were associated with depression symptoms at age 15 years ( $b = .07, p < .05$ ), which in turn, were associated with nonviolent delinquency ( $b = .10, p < .05$ ) as well as violent delinquency ( $b = .11, p < .05$ ) at age 17 years. Although anxiety symptoms at age 15 years were associated with both nonviolent ( $b = .09, p < .05$ ) and violent delinquency ( $b = .08, p < .05$ ) at age 17 years (most likely because the unique variance of anxiety symptoms and the variance shared with depression symptoms were not partitioned), the association between conduct problems at ages 10-12 years and anxiety symptoms at age 15 years was not significant ( $p > .05$ ).

### *Moderating Effect of Family SES*

For each model, we tested whether family SES at ages 10-12 years moderated the longitudinal associations between the variables at ages 10-12, 15 and 17 years. In the model including nonviolent delinquency, the association between anxiety symptoms at age 15 years and nonviolent delinquency at age 17 years was moderated by family SES ( $b = -.09, p < .05$ ). We

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examined the effect of nonviolent delinquency at three levels of family SES: low (1.5 SD below the mean), average (at the mean or 0), and high (1.5 SD above the mean). A breakdown of the interaction term showed that anxiety symptoms at age 15 years were associated with nonviolent delinquency at age 17 years ( $b = .17, p < .05$ ) when family SES was low. In contrast, when family SES was average or high, anxiety symptoms at age 15 years were not associated with nonviolent delinquency at age 17 years ( $b = .04, p > .05$  for average levels of family SES, and  $b = -.09, p > .05$  for high levels of family SES).

In the model including violent delinquency, the association between violent delinquency at age 15 years and anxiety symptoms at age 17 years was moderated by family SES ( $b = .05, p < .05$ ). We examined the effect of nonviolent delinquency at three levels of family SES: low (1.5 SD below the mean), average (at the mean or 0), and high (1.5 SD above the mean). A breakdown of the interaction term showed that violent delinquency at age 15 years was associated with anxiety symptoms at age 17 years ( $b = .10, p < .05$ ) when family SES was high. In contrast, when family SES was average or low, violent delinquency at age 15 years was not associated with anxiety symptoms at age 17 years ( $b = .02, p > .05$  for average levels of family SES, and  $b = -.06, p > .05$  for low levels of family SES).

### Discussion

In this study, we aimed to examine the cross-lagged associations between delinquency (nonviolent and violent), depression and anxiety symptoms in a sample of adolescents from a population-based sample. We also aimed to test the moderating effect of sex and family SES. Noteworthy findings emerged from this study.

First, although we found sex differences in the mean levels of the study variables (except for family SES), the paths were the same for boys and girls, suggesting that sex did not have a moderating effect. This finding appears to be in line with the study by Moffitt and colleagues

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(2001) on youth with antisocial behavior. These authors reported one sex-specific pattern, however, namely that depression of females with antisocial behavior grows more severe as they enter adulthood. Significant sex differences in the pattern of associations between delinquency and emotional problems in our sample may emerge as youth transition into adulthood.

Second, we found that the estimates of both models (i.e., the model including nonviolent delinquency and the model including violent delinquency) were relatively similar. Importantly, our findings suggest that delinquency (violent delinquency especially) and depression symptoms may develop according to a spiraling cascade model, such that conduct problems in childhood (ages 10-12 years) contribute to the development of depression symptoms in mid-adolescence (age 15 years), which in turn, lead to more violent delinquent acts at the end of adolescence (age 17 years). It should be noted, however, that the path from violent delinquency at 15 years to depression symptoms at 17 years was not significant (see Figure 3), suggesting that the pattern of associations between conduct problems, depression symptoms and violent delinquency follows a specific temporal sequence. The fact that we found spiraling associations between conduct-delinquency problems and depression symptoms but not anxiety symptoms is intriguing. Our findings suggest that processes according to two models focusing on the associations between conduct-delinquency problems and depression symptoms may be involved sequentially: first, the failure model (conduct-delinquency problems may result in negative social outcomes, e.g., peer rejection or conflicts with parents and teachers, which in turn lead to depression symptoms) and second, the acting out model (depression symptoms are channeled into delinquent behavior; Ozkan, 2017; Wolff & Ollendick, 2006). One possible explanation for the lack of significant longitudinal associations between conduct-delinquency problems and anxiety symptoms could be because we did not distinguish between proactive and reactive delinquent behavior. Indeed, anxiety symptoms could positively predict reactive (especially violent) delinquency (i.e.,

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behavior in response to real or perceived provocation), as anxiety could lead to violent delinquent behavior due to an increased responsiveness to threat (Hodgins et al., 2010). Conversely, anxiety symptoms could negatively predict nonviolent as well as violent proactive delinquency (i.e., premeditated behavior or for instrumental gain), because anxiety may inhibit involvement in delinquent behavior for fear of punishment (El Sayed et al., 2016). Thus, low levels of anxiety could predict proactive delinquency, whereas high levels of anxiety could predict reactive delinquency. Therefore, the associations between anxiety symptoms and delinquency may not emerge unless the different functions of delinquency (i.e., reactive and proactive) are taken into account (Vitaro, Brendgen, & Barker, 2006). It would be useful in future research to distinguish between the functions of delinquency (i.e., reactive and proactive) in addition to the forms of delinquency (i.e., nonviolent and violent). Still, the current findings suggest that an association between anxiety symptoms and delinquency emerges when the moderating effect of other variables, such as family SES (see below), is considered. Further research is needed to clarify the association between anxiety symptoms and delinquent behavior.

Third, we found that family SES at ages 10-12 years was not associated with nonviolent and violent delinquency at age 17 years once ages 10-12 emotional and conduct problems were included in the models. Our findings rather suggest that family SES has a moderating effect. Specifically, anxiety symptoms at 15 years were associated with nonviolent delinquency at age 17 years, but only when family SES was low. Low SES may be associated with economic problems, such as substantial changes in lifestyle due to lack of money and the inability to purchase needed goods and services (Agnew, Matthews, Bucher, Welcher, & Keyes, 2008). In concordance with the General Strain Theory (Agnew, 1992), youths who have anxiety symptoms may be highly reactive to emotionally charged or aversive stimuli (Suveg & Zeman, 2004), such as stressors associated with low SES (e.g., economic problems), leading to an increased risk of

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engaging in nonviolent delinquent behavior (e.g., theft) as a coping strategy. In addition, we found that violent delinquency at age 15 years was associated with anxiety symptoms at age 17 years when family SES was high. Youth from a high socioeconomic background who engaged in violent delinquency during mid-adolescence may be at high risk of experiencing negative emotions such as anxiety toward the end of adolescence because the consequences associated with their delinquent acts may have particularly severe consequences (e.g., arrests, judicial procedures and sanctions, such as incarceration) in their expected life course. For instance, they may worry that their past delinquent behavior and related problems (e.g., substance use dependence, truncated education without credentials; Moffitt, 2003) will make them fail to achieve goals valued by their family members (e.g., obtaining a university degree, getting a high pay, high status job). These youths may also be particularly likely to engage in conflicts with their family members (e.g., parents may have different values and feel disappointed), which could in turn lead to anxiety symptoms.

### *Conclusion*

This study has a number of important strengths, including the use of a large population-based sample, the application of an autoregressive cross-lagged panel approach to examine the longitudinal associations between delinquency (nonviolent and violent acts), depression and anxiety symptoms in adolescence, the inclusion of early symptomatology (conduct and emotional problems) and the examination of sex and family SES as putative moderators. However, a certain number of limitations should be noted. First, the analyses covered an important but limited period of time for the development of delinquency and emotional problems (i.e., ages 10-12, 15 and 17 years). Second, we relied on self-report measures, which – as any type of measurement – can be subject to bias (e.g., social desirability). However, this bias may be minimized in longitudinal studies where a trusting relationship is established over the years between the participants and the

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research team (Graziotti, Hammond, Messinger, et al., 2012). It should also be noted, that our measurement approach at 15 and 17 years is based on validated scales with high reliability to assess mental health among a population-based sample of youth (Côté et al., 2017). In addition, there is evidence suggesting a general concordance between self-reported and juvenile official offending behavior (Fontaine, Lacourse, Vitaro, & Tremblay, 2014; Piquero, Schubert, & Brame, 2014). Third, we relied on a population-based sample of youth in which the frequency of delinquent behavior, especially violent delinquency, was relatively low. Replications are needed with at-risk or clinical samples of youth to examine the generalizability of the findings. Fourth, in line with past research on mental health in youth (e.g., Axelson & Birmaher, 2001), we found that depression and anxiety symptoms were highly correlated within each time point (estimates of .60 and .68, see Figures 2 and 3). This could be associated with multicollinearity, and thus, may influence the estimates of these correlated variables. Still, although high, the correlations between depression and anxiety symptoms were not perfect. Based on the additional analyses we reran to examine the associations between depression symptoms and delinquency without including anxiety symptoms, and the associations between anxiety symptoms and delinquency without including depression symptoms (see the results section), it appears that the spiraling associations between conduct-delinquency problems and emotional problems may be more specific to depression symptoms.

Notwithstanding these limitations, the cross-lagged design used in this study revealed important new knowledge about the interplay between conduct-delinquency problems and emotional problems from early to late adolescence. The results suggest that conduct-delinquency problems and emotional problems are interdependent, with early conduct problems fostering depression symptoms, in turn giving rise to further (violent and nonviolent) delinquency. Implications for clinical practice should also be noted. Our findings suggest that interventions for

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youths at high risk of engaging in delinquent acts should also address co-occurring depression and anxiety symptoms. In addition, interventions for youths and their parents should be sensitive to their socioeconomic background, as risk factors and consequences associated with delinquency may depend on the family socioeconomic environments and related difficulties (e.g., economic problems). More concretely, interventions targeting youth with delinquent behavior (such as interventions provided by the criminal justice system) should include an individualized component, for instance by using an individualized intervention plan; IIP). Such IIP should include specific objectives to be reached and adapted interventions (e.g., cognitive behavioral therapy) that meet the needs related to the youth's personal characteristics (e.g., mental health problems) and environmental or family factors (e.g., family background and values). Adopting a preventive approach by targeting emotional and behavioral problems in middle childhood or earlier could also prove beneficial, especially if it involves the family and other socialization agents around the child (Vitaro & Tremblay, 2017).

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### Figure captions

Figure 1. Model testing the stabilities and the cross-lagged paths of delinquency (nonviolent and violent), depression and anxiety symptoms.

Note. Sex as well as family SES at ages 10-12 years as concurrent or predictor variables of the variables at ages 10-12, 15 and 17 years were included in the final models, but are not showed in the figure for clarity.

Figure 2. Stabilities and cross-lagged associations between nonviolent delinquency, depression, and anxiety symptoms.

Note. Sex as well as family SES at ages 10-12 years as concurrent or predictor variables of the variables at ages 10-12, 15 and 17 years were included in the model, but are not showed in the figure for clarity. Being a female was positively associated ( $p \leq .05$ ) with emotional problems at ages 10-12 years as well as depression and anxiety symptoms at ages 15 and 17 years old, but was negatively associated with conduct problems at ages 10-12 years and nonviolent delinquency at 17 years old. Family SES at ages 10-12 years was negatively associated ( $p \leq .05$ ) with conduct and emotional problems at ages 10-12 years.

Only significant ( $p \leq .05$ ) estimates are showed.

<sup>†</sup>  $p = .09$ .

$n = 1,515$ .

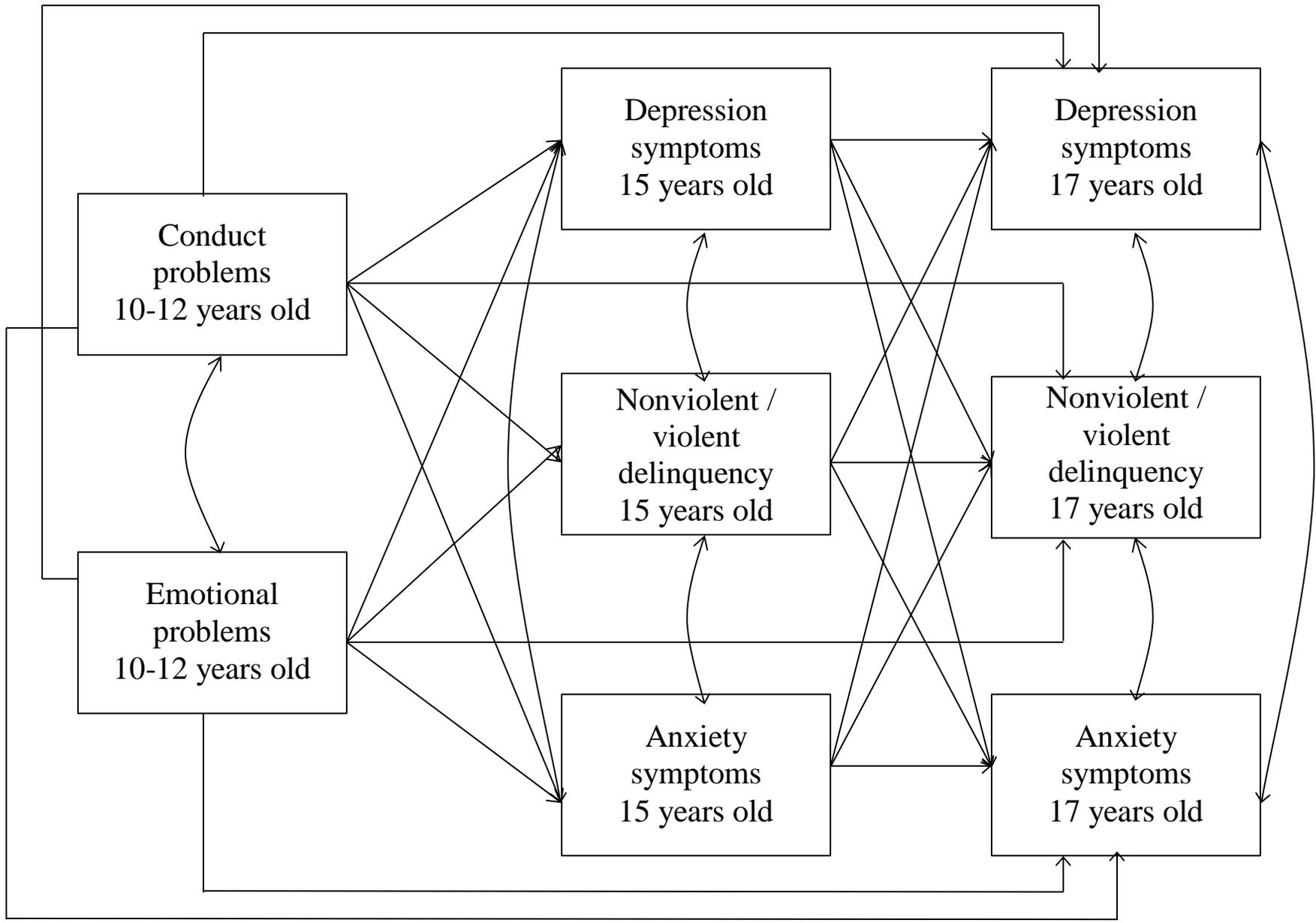
Figure 3. Stabilities and cross-lagged associations between violent delinquency, depression, and anxiety symptoms.

Note. Sex as well as family SES at ages 10-12 years as concurrent or predictor variables of the variables at ages 10-12, 15 and 17 years were included in the model, but are not showed in the figure for clarity. Being a female was positively associated ( $p \leq .05$ ) with emotional problems at ages 10-12 years as well as depression and anxiety symptoms at ages 15 and 17 years old, but was negatively associated with conduct problems at ages 10-12 years and violent delinquency at both time points. Family SES at ages 10-12 years was negatively associated ( $p \leq .05$ ) with conduct and emotional problems at ages 10-12 years and violent delinquency at age 15 years.

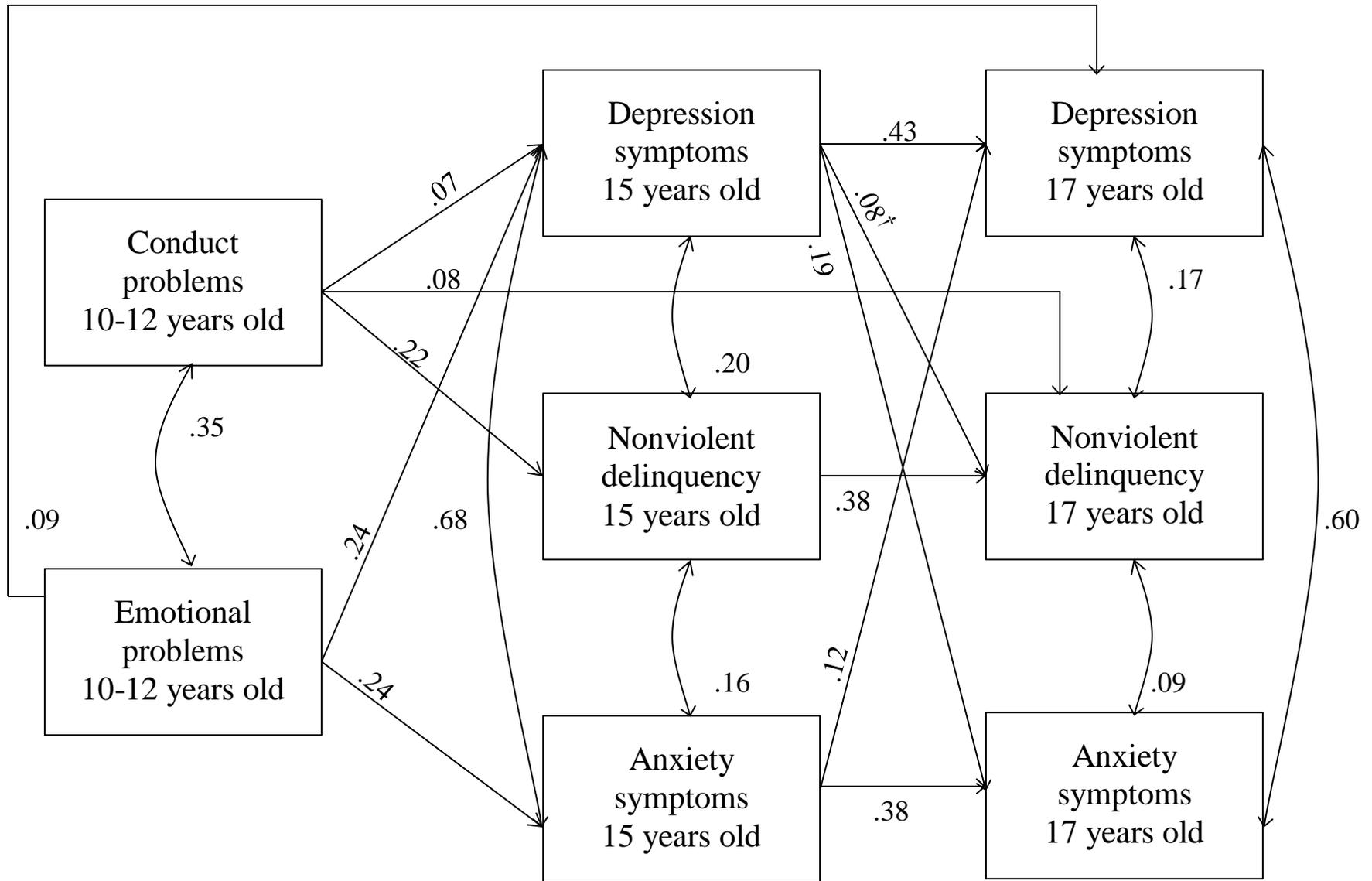
Only significant ( $p \leq .05$ ) estimates are showed.

$n = 1,515$ .

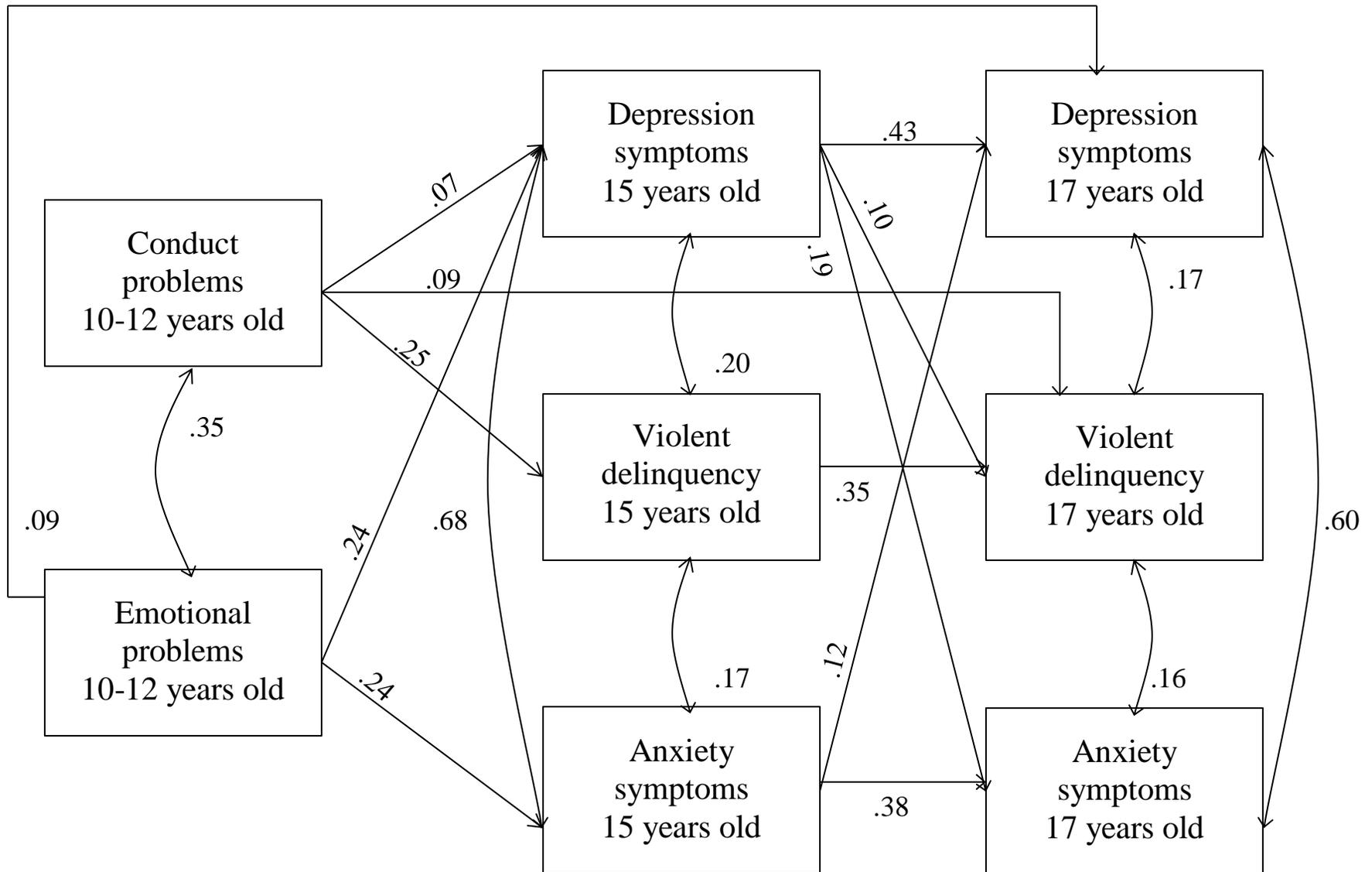
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Table 1. Descriptive statistics of the study variables for boys and girls

	<i>Boys</i>		<i>Girls</i>		<i>d</i>	<i>Minimum</i>	<i>Maximum</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
<i>Variables at ages 10-12 years</i>							
Conduct problems	3.45 <sub>a</sub>	3.33	1.93 <sub>b</sub>	2.40	0.52	0.00	22.00
Emotional problems	3.41 <sub>a</sub>	2.24	3.99 <sub>b</sub>	2.23	-0.26	0.00	13.00
Family SES	-0.01 <sub>a</sub>	0.94	-0.02 <sub>a</sub>	1.03	0.01	-3.02	2.82
<i>Variables at age 15 years</i>							
Nonviolent delinquency	0.39 <sub>a</sub>	1.03	0.27 <sub>b</sub>	0.84	0.13	0.00	11.00
Violent delinquency	1.02 <sub>a</sub>	1.96	0.41 <sub>b</sub>	1.40	0.36	0.00	21.00
Depression symptoms	4.21 <sub>a</sub>	3.12	6.82 <sub>b</sub>	3.55	-0.78	0.00	16.00
Anxiety symptoms	5.89 <sub>a</sub>	3.54	8.74 <sub>b</sub>	3.74	-0.78	0.00	18.00
<i>Variables at age 17 years</i>							
Nonviolent delinquency	0.41 <sub>a</sub>	0.98	0.28 <sub>b</sub>	0.76	0.15	0.00	7.20
Violent delinquency	0.74 <sub>a</sub>	1.87	0.30 <sub>b</sub>	1.09	0.29	0.00	13.00
Depression symptoms	4.82 <sub>a</sub>	3.36	7.18 <sub>b</sub>	3.64	-0.67	0.00	16.00
Anxiety symptoms	6.41 <sub>a</sub>	3.63	9.19 <sub>b</sub>	3.73	-0.76	0.00	18.00

Note.

Means with different subscripts differ significantly at  $p < .05$ .

*ns* = 1,264–1,443 due to missing data.

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Table 2. Correlations among the study variables for boys and girls

	1	2	3	4	5	6	7	8	9	10	11
<i>Boys</i>											
1. Conduct problems at 10-12 y	-										
2. Emotional problems at 10-12 y	.38***	-									
3. Family SES at 10-12 y	-.07	-.12**	-								
4. Nonviolent delinquency at 15 y	.26***	.11**	-.08*	-							
5. Violent delinquency at 15 y	.26***	.07	-.10*	.43***	-						
6. Depression symptoms at 15 y	.18***	.31***	.01	.25***	.24***	-					
7. Anxiety symptoms at 15 y	.10*	.25***	.02	.15***	.17***	.65***	-				
8. Nonviolent delinquency at 17 y	.19***	.07	-.06	.40***	.28***	.19***	.08	-			
9. Violent delinquency at 17 y	.21***	.07	-.10*	.32***	.40***	.20***	.10*	.41***	-		
10. Depression symptoms at 17 y	.14**	.25***	-.02	.22***	.16***	.52***	.44***	.26***	.30***	-	
11. Anxiety symptoms at 17 y	.13**	.21***	.01	.18***	.17***	.45***	.54***	.18***	.24***	.67***	-
<i>Girls</i>											
1. Conduct problems at 10-12 y	-										
2. Emotional problems at 10-12 y	.43***	-									
3. Family SES at 10-12 y	-.15***	-.12**	-								
4. Nonviolent delinquency at 15 y	.19***	.10*	-.05	-							
5. Violent delinquency at 15 y	.24***	.12**	-.18***	.31***	-						
6. Depression symptoms at 15 y	.15***	.23***	-.01	.21***	.21***	-					
7. Anxiety symptoms at 15 y	.08*	.23***	.01	.19***	.19***	.74***	-				
8. Nonviolent delinquency at 17 y	.17***	.13***	-.10*	.40***	.21***	.19***	.21***	-			
9. Violent delinquency at 17 y	.18***	.13***	-.11**	.20***	.33***	.19***	.20***	.35***	-		
10. Depression symptoms at 17 y	.13***	.26***	-.04	.09*	.07	.55***	.45***	.24***	.18***	-	
11. Anxiety symptoms at 17 y	.13***	.22***	-.02	.09*	.11**	.51***	.53***	.19***	.22***	.73***	-

Note.

*ns* Boys = 627–686 due to missing data. *ns* Girls = 525–580 due to missing data.

\*  $p \leq .05$ . \*\*  $p \leq .01$ . \*\*\*  $p \leq .001$ .