



Association of childhood externalizing, internalizing, comorbid problems with criminal convictions by early adulthood

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ABSTRACT

Childhood externalizing problems have been linked with adult criminality. However, little is known about criminal outcomes among children with comorbid externalizing and internalizing problems. We examined the associations between profiles of behavioral problems during childhood (i.e., externalizing, internalizing, and comorbid) and criminality by early adulthood. Participants were $N = 3017$ children from the population-based Quebec Longitudinal Study of Kindergarten Children followed up from age 6–25. Multitrajectory modeling of teacher-rated externalizing and internalizing problems from age 6–12 years identified four distinct profiles: no/low, externalizing, internalizing, and comorbid problems. Juvenile (age 13–17) and adult (age 18–25) criminal convictions were extracted from official records. Compared to children in the no/low profile, those in the externalizing and comorbid profiles were at higher risk of having a criminal conviction, while no association was found for children in the internalizing profile. Children with comorbid externalizing and internalizing problems were most at risk of having a criminal conviction by adulthood, with a significantly higher risk when compared to children with externalizing or internalizing problems only. Similar results were found when violent and non-violent crimes were investigated separately. Specific interventions targeting early comorbid behavioral problems could reduce long-term criminality.

1. Introduction

Criminal behavior represents an important societal concern, with an estimated annual cost in the United States is \$4.71–\$5.76 trillion (Anderson, 2021), and associations with a range of negative health outcomes, including suicide (Favril et al., 2022; Robinson and Keithley, 2000). Preventing criminal behavior is therefore a priority. Much attention has been devoted to identifying childhood predictors of criminality (Leschied et al., 2008), as early interventions targeting these

predictors have the potential to reduce criminal behavior, including convictions, in the long term (Heckman et al., 2013; Reynolds et al., 2007). A consistent finding from four decades of longitudinal studies is that externalizing behavioral problems during childhood (i.e., behavioral symptoms that are focused ‘outwards’ such as aggression, opposition, and conduct problems) predict violent and delinquent behavior in adult life, including criminal convictions (Aebi et al., 2014; Chung et al., 2002; Reinke et al., 2012; Schaeffer et al., 2003; Sourander et al., 2006). However, while some children uniquely exhibit externalizing problems,

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for a sizable proportion of children, these problems co-occur with internalizing problems (i.e., behavioral symptoms that are focused ‘inwards’ such as depression, social withdrawal, and anxiety) (Angold et al., 1999; Boutin et al., 2020; Wolff and Ollendick, 2006). Long-term studies show that children who exhibit comorbid externalizing and internalizing problems are at higher risk for a range of negative outcomes in adulthood, when compared to children showing externalizing symptoms alone, including major depressive disorder, substance abuse, and suicide attempts (Commisso et al.; Brook et al., 2015; Commisso et al.; Winsper et al., 2019). However, little is known about criminal outcomes of children with comorbid externalizing and internalizing problems. In a previous study, Sourander and colleagues (2006) found that boys with comorbid conduct and emotional problems at age eight were four times more likely to be convicted of a criminal offense by age 20 compared to those with no childhood behavioral problems. Consistent with these findings, Copeland and colleagues (2007) found that youth between 9 and 16 years old who were diagnosed with comorbid depression and conduct disorder were six times more likely to commit a violent offense by early adulthood, when compared to those with no psychiatric diagnosis. While these studies have shown that children with comorbid externalizing and internalizing problems are at higher risk of committing a crime compared to those without behavioral problems, it is unclear whether the risk for those children differ when compared to those with externalizing problems only. On the one hand, it is possible that criminal behavior is only a continuation of early externalizing problems, irrespective of the co-occurrence of internalizing symptoms. On the one hand, it has been suggested that internalizing problems may be indicative of low self-esteem, poor coping strategies, and emotional regulation difficulties, which could predispose individuals to antisocial behavior, and that the co-occurrence of externalizing problems additively increases the risk (Copeland et al., 2007). A third possibility is that internalizing problems can protect disruptive children from future delinquency. For example, one study showed that inhibition, a specific dimension of internalizing problems, reduced the risk of delinquency in disruptive boys (Kerr et al., 1997). Understanding whether children with comorbid externalizing and internalizing problems are more at risk of subsequent criminal convictions could help inform the development of more personalized prevention strategies based on the specific behavioral problems of the child.

Using data from a large population-based cohort of children followed from the age of 6–25 years, we examined the associations between behavioral profile (e.g., externalizing, internalizing, and comorbid) from age 6–12 years and criminal convictions obtained from court records in early adulthood. In contrast to previous studies that assessed problems in preadolescence and adolescence (Copeland et al., 2007), or at one time point only (Copeland et al., 2007; Sourander et al., 2006), we used repeated annual measurement of teacher-reported externalizing problem from ages 6 to 12, which provide a more continuous and comprehensive picture of behavior, when compared with assessments obtained at one time point only. Additionally, we aimed to compare the risk of criminal convictions of children with comorbid problems to children with only externalizing and only internalizing problems.

2. Methods

2.1. Participants

Participants were from the Quebec Longitudinal Study of Kindergarten Children (QLSKC), a population-based sample of children ($n = 3017$) attending kindergarten in French-speaking schools in the province of Québec in 1986–87 and 1987–88 school years (Rouquette et al., 2014). Consent forms and questionnaires were distributed to the teachers of children enrolled in French-speaking state kindergartens (average age of 6.0 ± 0.3 years). The selection process involved a random sampling method stratified based on administrative region (Quebec province comprising 11 regions) and school board size (small,

medium, and large) for 2000 children (representative sample) Additionally, children, who, in kindergarten, scored ≥ 80 th percentile on the disruptive behaviors scale from the Social Behavior Questionnaire (SBQ) (Tremblay et al., 1991) were oversampled, adding 1017 children to the sample (disruptive sample). The QLSKC data was linked to official court records detailing juvenile and adult criminal convictions with full coverage (i.e., no missing data on the outcomes). QLSKC was approved by the University of Montreal Ethics Board (#2009–198).

2.2. Teacher reports of externalizing and internalizing problems from age 6 to 12

School teachers rated children on the SBQ (Tremblay et al., 1991) at 6, 7, 8, 9, 10, 11, and 12 years via mail-in questionnaires. Given that teacher raters differed each year, the yearly assessments were independent, eliminating bias arising from using a single rater. The SBQ has shown good psychometric properties such as good to excellent reliability estimates and good convergent, discriminant and predictive validity (Pingault et al., 2014; Rouquette et al., 2018; Tremblay et al., 1987; Vergunst et al., 2019; Collet et al., 2023). Items were rated on a 3-point scale according to the frequency of the behaviors, with 0 indicating never applies; 1, sometimes applies; and 2, frequently applies. At each time point, we use confirmatory factor analysis to derive externalizing (13 items eg, “destroys own or others’ belongings”, “fights with other children”; $\alpha = 0.89-0.93$) and internalizing (five items eg, “tends to be fearful or afraid of new things or new situations”, “cries easily”; $\alpha = 0.61-0.76$) problems scales. Derived factor scores computed in Mplus were used as measures of externalizing and internalizing problems latent constructs. Higher scores indicate more problem behavior (see [Supplementary Tables 1, 2 and 3](#)).

Using the Mplus software, multitrajectory modeling was applied to the longitudinal measures of internalizing and externalizing problems to identify different profiles of children defined by the joint development of externalizing and internalizing problems from ages 6–12 years. This method is based on mixture models and robust maximum likelihood estimation (Nagin, 2005). The result of this analysis allowed the identification of different profiles defined by the joint development of externalizing and internalizing problems across seven timepoints in childhood (from ages 6 to 12). To select the best-fitting model, we estimated a series of models including one to five groups based on participants having at least one data point ($n = 3017$, with missing data handled using Full Information Maximum Likelihood). These models were compared using the Bayesian Information Criterion (BIC), the Bootstrapped Likelihood Ratio (BLRT), entropy, theoretical relevance, and class size ($>10\%$ of the sample retained at smaller class size) (see [Supplementary Table 4](#)). The trajectory modeling, as seen in [Commisso et al.](#), identified four mutually exclusive groups: *no/low problems*, characterized by low internalizing and low externalizing problems across time points ($n = 1369$, 45.35%); *internalizing*, characterized by high internalizing and low externalizing problems across all time points ($n = 354$, 11.74%); *externalizing*, characterized by low internalizing and moderate externalizing problems across time points ($n = 882$, 29.23%) and; *comorbid*, characterized by moderate and increasing internalizing, and high externalizing problems across time points ($n = 413$, 13.65%) (see [Fig. 1](#)).

2.3. Criminality

Information on juvenile (13–17 years old) and adult (18–25 years old) criminal convictions was extracted from official records obtained from the archives of the juvenile court and the adult courts of Quebec. Our primary outcome was conviction for any crime. In secondary analyses, we distinguished between violent crimes, including offences that involved physical aggression towards other individuals (e.g., sexual assault, battery, homicide), and nonviolent crimes, including all other offences (e.g., credit card fraud, drug possession). Lifetime total criminal

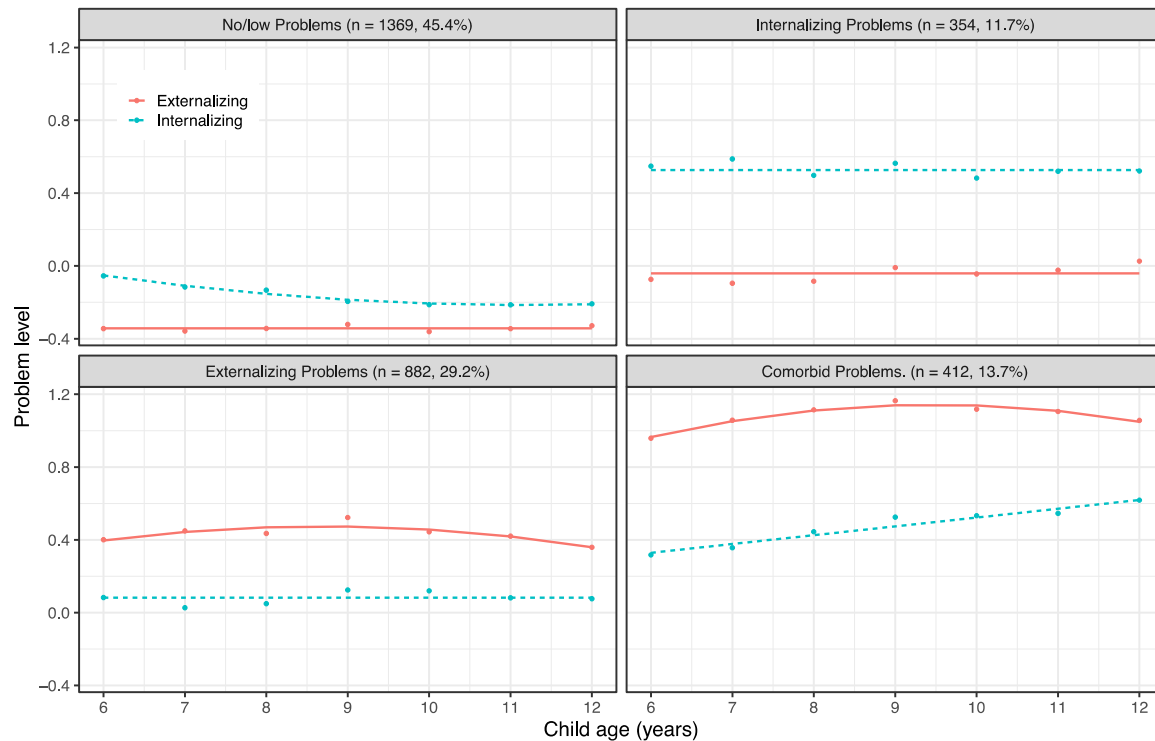


Fig. 1. Multitrajectories of externalizing and internalizing behavioral problems from age 6–12 years from Comisso et al. (2021).

Footnote. The y axis represents the level of behavioral problem on the internalizing and externalizing latent factors, as derived using confirmatory factor analysis in Comisso et al. (2021).

Table 1

Child and family characteristics by profiles of childhood externalizing and internalizing problems from age 6 to 12.

Variables	Whole Sample (n = 3017)	No/low problems (n = 1369, 45.35%)	Internalizing problems (n = 354, 11.74%)	Externalizing problems (n = 882, 29.23%)	Comorbid problems (n = 413, 13.65%)	P-values
Child and family characteristics						
Sex						
Males	1594 (52.8)	545 (39.8)	144 (40.7)	566 (64.2)	339 (82.3)	<.001
Females	1423 (47.2)	824 (60.2)	210 (58.3)	316 (35.8)	73 (17.7)	<.001
Cognitive ability ^a	9.82 (1.54)	10.1 (1.36)	9.50 (1.55)	9.82 (1.50)	9.20 (2.06)	<.001
Family adversity index ^a	0.30 (0.26)	0.25 (0.24)	0.32 (0.25)	0.33 (0.26)	0.40 (0.28)	<.001
Mother language not French	146 (4.9)	68 (5.0)	12 (3.4)	41 (4.7)	25 (6.1)	0.376
Father language not French	166 (6.1)	77 (6.1)	13 (4.1)	49 (6.2)	27 (7.5)	0.320
Monther not born in Canada	126 (4.2)	62 (4.6)	9 (2.6)	34 (3.9)	21 (5.1)	0.276
Father not born in Canada	155 (5.8)	67 (5.4)	16 (5.2)	49 (6.3)	23 (6.6)	0.703
Criminal convictions						
<i>Lifetime</i>						
Any crime	443 (14.7)	83 (6.1)	27 (7.6)	180 (20.4)	153 (37.1)	<.001
Violent crime	127 (4.2)	17 (1.2)	6 (1.7)	45 (5.1)	59 (14.3)	<.001
Non-violent crime	400 (13.3)	73 (5.3)	23 (6.5)	167 (18.9)	137 (33.3)	<.001
<i>Adult</i>						
Any crime	233 (7.7)	40 (2.9)	14 (4.0)	90 (38.6)	89 (21.6)	<.001
Violent crime	58 (1.9)	7 (.05)	3 (0.8)	19 (2.2)	29 (7.0)	<.001
Non-violent crime	209 (6.9)	35 (2.6)	13 (3.7)	82 (9.3)	79 (19.2)	<.001
<i>Juvenile</i>						
Any crime	299 (9.9)	52 (3.8)	14 (4.0)	128 (14.5)	105 (25.5)	<.001
Violent crime	80 (2.7)	10 (0.7)	3 (0.8)	29 (3.3)	38 (9.2)	<.001
Non-violent crime	270 (8.9)	45 (3.3)	11 (3.1)	120 (13.6)	94 (22.8)	<.001

Footnote. P values are based on ANOVA and chi-square tests, they indicate significant difference between groups; all numbers are counts (%) if not otherwise specified.

^a Mean (SD); the combined frequency of adult and juvenile crime variables will almost always be larger than the frequency of the lifetime crime variable because if a participant has committed a crime as a juvenile, they may have also committed a crime as an adult.

convictions were computed by combining juvenile and adult records.

2.4. Confounding factors

We adjusted for participant sex assigned at birth, cognitive ability and family adversity (decided a priori) because they are the main confounding factors used in previous studies (Copeland et al., 2007; Jolliffe and Farrington, 2004; Sourander et al., 2006). Cognitive ability was measured at age 13 using the Sentence Completion Test (Lorge and Thorndike, 1954). This is a validated measure that has been found to be highly correlated with other established measures of intelligence and academic achievement (Veroff et al., 1971). A family adversity index was calculated by combining the following variables measured at age 6: years of parental education, parental age at birth of the first child, parental occupational status, and family structure, using the criteria developed by Blishen et al. (1987) (see Table 1). We additionally adjusted for the main language spoken by the parents (French vs other), and the nationality of the parents (born in Canada vs not).

2.5. Statistical analysis

We examined the association of profiles of childhood externalizing and internalizing problems with lifetime criminal convictions using logistic regression models in R version 4.1. We adjusted for the aforementioned confounders, which were also associated with the identified problem trajectories. Additionally, sub-sample membership (disruptive vs representative) was adjusted for in all analyses. We first used the low/no problems profile as reference category to estimate the increased risk of crime for children with externalizing, internalizing, and comorbid problems. Next, we used the externalizing and the internalizing profiles as the reference category to compare children with comorbid problems to those with either externalizing only or internalizing only problems. To test whether there were differences in associations by sex, we included a sex-by-multitrajectory profile interaction term. No significant interactions were observed for any crime ($p = 0.562$), as well as for violent ($p = 0.272$) and non-violent ($p = 0.722$) crimes, and analyses are therefore reported for both sexes combined. Secondary analyses were conducted in which violent and nonviolent crimes were investigated separately. To avoid data loss on the confounding variables, missing data in the cognitive ability (43.3%) and family adversity (5.7%) confounding variables were handled using multiple imputation by chained equations (Azur et al., 2011), and analyses were conducted across 50 pooled datasets. An expectation-maximization algorithm with bootstrapping for multivariable multiple imputations was used, as implemented in the Amelia II package in R was used (Honaker, 2011). Our multitrajectory and criminality variables had complete data. Significance thresholds were set at $P < 0.05$ and all tests were two tailed.

3. Results

Child and family characteristics of children in each multitrajectory profile are presented in Table 1. Children presenting with externalizing and comorbid problems were more likely to be male, while children with internalizing problems were more likely to be females. All child and family characteristics were associated with either externalizing and/or internalizing problems. Notably, children with comorbid problems had the lowest level of cognitive abilities and were exposed to the highest level of family adversity.

By age 25 years, 443 (14.7%) had committed at least one crime (369, 23.1%, males; 74, 5.2%, females; male/female Risk Ratio [RR] = 5.3; Table 1). A total of 400 (13.3%) individuals were convicted for nonviolent crimes, while 127 (4.2%) were convicted of a violent crime (84, 2.8%, individuals had convictions for both violent and non-violent crimes). Of those who were convicted of non-violent crimes, 336 (26.7%) were male and 64 (5.0%) were female (male/female RR = 5.3). For violent crimes, 110 (8.7%) were male and 17 (1.2%) were female

(male/female RR = 7.3). Individuals convicted for non-violent crimes were more likely to be convicted for violent crimes (for crimes by age 25, RR = 12.78, CI = 9.85–18.46; for juvenile crime, RR = 17.89, CI = 11.34–28.23; for adult crime, RR = 19.03, CI = 11.29–32.10). Table 2 also shows that individuals committing juvenile crimes were more likely to commit adult crimes, and that those committing juvenile non-violent crimes were more likely to commit violent crimes in adulthood than those who did not commit any crime.

The highest rate of convictions by adulthood was observed among participants in the childhood comorbid problems profile (Table 1). As shown in Table 3, after adjustment for sex, cognitive ability, and family adversity, children in the externalizing and comorbid problems profiles were at higher risk of having a conviction for a crime compared to children in the no/low problems profile, while no association was found for children in the internalizing problems profile. Similar results were found when violent and non-violent crimes were investigated separately. Specifically, children in the externalizing and comorbid problems profiles were at increased risk of having a conviction, while no association was found for children in the internalizing problems profile relative to participants in the no/low problems profile.

To assess whether children with comorbid problems were at increased risk of criminality compared with children with externalizing or internalizing behavioral problems only, we re-estimated our models using the externalizing and then the internalizing problems profiles as reference categories. We found that children in the comorbid problems profile were at higher risk of committing a crime even when compared to children in the externalizing (OR = 1.84, CI = 1.43–2.37) and internalizing (OR = 4.48, CI = 2.84–7.05) problem profiles (see also Supplementary Table 5). Similar results were obtained for violent and non-violent crimes when children in the comorbid profiles were compared to those in the externalizing (violent, OR = 2.47, CI = 1.62–3.76; nonviolent, OR = 1.70, CI = 1.29–2.24) and internalizing (violent, OR = 5.75, CI = 2.41–13.74; nonviolent, OR = 4.48, CI = 2.76–7.27) problems profiles. Similar associations were found were juvenile and adult crime were analyzed separately (Supplementary Table 6).

4. Discussion

Our study examined the associations between distinct profiles of behavioral problems in middle childhood (i.e., externalizing, internalizing, and comorbid) and violent and non-violent criminal convictions by early adulthood. To our knowledge, this is the first study to investigate whether children with comorbid externalizing and internalizing problems were at higher risk of criminal convictions compared to children with externalizing or internalizing problems alone. Our findings revealed that children with externalizing problems, with or without co-occurring internalizing problems, were at higher risk of criminal conviction by early adulthood compared to children with no problems, with similar patterns for violent or non-violent offences. Notably, children with comorbid problems were at higher risk of having a criminal conviction even when compared to children presenting with either externalizing or internalizing problems alone, suggesting that the combination of both types of symptoms significantly increases risk for future

Table 2
Longitudinal associations between juvenile and adult crime.

		Adult crime		
		Any	Violent	Non-violent
Juvenile crime	Any	5.62 (4.31–7.32)	9.09 (5.43–15.21)	6.11 (4.63–8.05)
	Violent	5.84 (4.02–8.49)	8.59 (4.46–16.57)	6.39 (4.37–9.36)
	Non-violent	5.74 (4.39–7.49)	10.17 (6.08–17.02)	8.33 (6.07–11.42)

Footnote. Numbers are Risk Ratios (95% CI).

Table 3

Associations between childhood profiles of externalizing and internalizing problems and having a criminal conviction for a violent crime by age 25.

Outcome Profile	Unadjusted OR (95% CI)	Adjusted ^a OR (95% CI)
Any crime		
No/low problems	1	1
Internalizing	1.27 (0.81–2.00)	1.20 (0.76–1.90)
Externalizing	3.94 (2.99–5.18)	2.90 (2.18–3.85)
Comorbid	9.12 (6.79–12.23)	5.26 (3.84–7.20)
Violent crime		
No/low problems	1	1
Internalizing	1.37 (0.53–3.50)	1.26 (0.49–3.23)
Externalizing	4.24 (2.41–7.46)	2.98 (1.67–5.30)
Comorbid	13.11 (7.52–22.84)	7.34 (4.10–13.11)
Non-violent crime		
No/low problems	1	1
Internalizing	1.23 (0.76–2.00)	1.16 (0.71–1.90)
Externalizing	4.10 (3.06–5.48)	3.05 (2.26–4.12)
Comorbid	8.67 (6.33–11.88)	5.20 (3.73–7.24)

Footnote. OR=Odds Ratio.

^a Adjusted for sex, cognitive ability, family adversity index.

criminal conviction.

Our results confirm and extend previous work by showing that children with externalizing problems had approximately three times higher odds of having a criminal conviction, when compared with children without early behavioral problems (Aebi et al., 2014; Chung et al., 2002; Reinke et al., 2012; Schaeffer et al., 2003; Sourander et al., 2006). These findings provide further evidence of the continuity of externalizing problems across the lifespan, with externalizing problems in childhood likely to predict the same or similar problems later in life. Further, our findings provide support for Moffitt's (1993) (Moffitt, 1993) theory of life course persistent antisocial behavior, which posits that the emergence of antisocial behavior is likely to occur in early development and present itself continuously throughout the life course, suggesting that adult criminality can be traced back to disruptive childhood behaviors.

Our findings concur with two previous studies showing that children with comorbid problems were at higher risk of having a criminal conviction by adulthood compared to children with either externalizing or internalizing problems alone (Copeland et al., 2007; Sourander et al., 2007), with similar estimates as in our sample. However, our findings diverge from Kerr et al. (1997) (Kerr et al., 1997) who showed that internalizing problems can protect disruptive boys from further delinquency. Specifically, they found that inhibition reduced the risk of delinquency in disruptive boys, while withdrawal increased risk. One reason for this divergence may be that the current study used a broad measure of internalizing problems rather than assessing specific sub-features.

Future research in this area should prioritize clarifying the mechanisms that explain the association between comorbid externalizing and internalizing problems in childhood and criminal convictions by adulthood. As previously noted, Copeland et al. (2007) (Copeland et al., 2007) have suggested that specific features of internalizing problems (low self-esteem, pessimism) combined with externalizing problems may increase the risk for criminal behavior. The presence of both externalizing and internalizing problems may also indicate difficulties in emotional regulation and impulse control, which may increase the likelihood of committing some forms of crimes (Kemp et al., 2017). However, it is also possible that children with comorbid problems have more problems overall compared with children with only externalizing or internalizing problem, and that the type of problem (i.e., internalizing or externalizing) plays a secondary role. Another possibility is that compared to children with one problem, those with comorbid problems have more limited access to educational opportunity, unfavorable socioeconomic conditions, and unemployment which, in turn, increases their likelihood of turning to crime because conventional pathways are

not available to them (Vergunst et al., 2022).

In our study, 4.2% of participants in the sample were convicted of a violent crime, while 13.3% of participants were convicted of a nonviolent crime. These rates are higher than the national prevalence estimates reported for Canada, with less than 1% of the population accounting for violent crime and 5% for property crime in 1986 (Government of Canada, S. C., 2015). One explanation for these differences is that a third of our sample had high levels of disruptive behavioral problems when they were recruited at the end of kindergarten (Rouquette et al., 2014) (though this was adjusted for in the multivariable analyses). Consistent with a well-established finding in the literature, we found that males had higher rates of convictions than females, especially for violent crimes (Carrabine et al., 2020). However, no significant sex by multitrajectory profile interactions were observed. This finding may be due to low statistical power, given that a prior study found that males with comorbid childhood problems were at higher risk of committing a moderate crime compared to females (Copeland et al., 2007). Given the mixed and scarce findings on sex differences, future studies should aim to clarify differences and similarities in conviction outcomes among males and females with comorbid behavioral problems.

This large population-based cohort study has several strengths. First, externalizing and internalizing problems were assessed by a different teacher every year for seven years throughout elementary school, eliminating bias arising from a single-rater approach. Second, administrative data was used to measure convictions, thus eliminating risk of social desirability bias or recall failure. In addition, these records provide accurate documentation regarding the severity of the crime and are available for the whole sample resulting in no attrition. Third, externalizing and internalizing problems are known to change across development, yet previous studies on criminality have assessed these problems at a single time point (Copeland et al., 2007; Sourander et al., 2006). Our use of group-based multitrajectories of childhood behavioral problems allowed us to estimate the simultaneous development of externalizing and internalizing problems taking into account the whole developmental period of middle childhood. Fourth, we used a prospective longitudinal design spanning nearly 20 years. Some limitations should be noted. First, in a school setting, internalizing problems are more difficult to identify than externalizing problems because they are less disruptive to a classroom setting. Therefore, teachers may have underrated children's internalizing problems (Cytryn and McKnew Jr., 1996; Green et al., 1996). Second, as noted above, despite our large sample, the small number of females participants committing crimes may have limited our ability to detect sex differences. Third, despite our effort to control for confounding factors, unmeasured confounders (including genetic factors) may at least partially explain our associations. Fourth, the comorbid profile had the highest levels of externalizing problems, which could partially explain why children in this group had the higher risk of convictions. Due to the person-centered approach used to create behavior profiles in our study, we were unable to address differences in the scores of each profile, as the profile to which the child belongs was the unit of analysis. Therefore, the findings of our study should be interpreted within the context of the broad literature, and in particular of studies using dimensional and variable-centered approaches, to have a more complete understanding of the links between childhood symptoms and criminal outcomes. Fifth, and relatedly, our analysis focused on the two broad dimensions of externalizing and internalizing problems, thus, overlooking the potential influence of more specific subdimensions (including the fear/anxiety dimension). Future studies using a more fine-grained approach should be conducted to complement our results, including network analysis and other symptom-level approaches (Rouquette et al., 2018). Sixth, race and ethnicity information for our participants was not available. Although our sample comes from a relatively homogenous population of children attending French-speaking schools in Québec (a predominantly French-speaking Province in Canada), this limitation is important since some racial and ethnic minorities are known to be over-represented in

the Canadian criminal justice system. To palliate to this limitation, we added nationality and language spoken by the parents as proxies for race/ethnicity in our multivariable models, but these variables are likely to poorly reflect race and ethnicity. Seventh, females were significantly less likely to leave the study. Although our models relied on Full Information Maximum Likelihood and were therefore estimated on complete data, this differential attrition for males and females should be taken into account when considering the generalizability of our findings, as the contribution of externalizing symptoms (more common in males) to criminality may be underestimated.

In sum, the present study demonstrated that children with comorbid externalizing and internalizing problems and with externalizing problems alone were at higher risk of having a criminal conviction by early adulthood compared to children with no problems. Children with comorbid problems were particularly likely to have a criminal conviction also when compared with children with only externalizing and only internalizing problems. Our findings suggest that screening for internalizing problems in children exhibiting externalizing problems may help detect the group most at risk of criminal convictions in youth. Though preventive interventions tend to focus on externalizing problems, they should consider targeting both externalizing and internalizing problems to maximize the likelihood of reducing criminal behavior across the life course. Currently, there is a lack of knowledge on preventive interventions for reducing childhood comorbid problems. Given the implications of these problems for children's subsequent social adaptation, research should focus on developing specialized interventions for comorbid problems.

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Ethics statement

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects/patients were approved by research ethics boards of the University of Montreal, McGill University, and St-Justine Hospital.

Data availability statement

The data that support the findings of this study are available from the Group de Recherche sur l'Inadaptation Psychosociale chez l'Enfant (GRIP).

CRedit authorship contribution statement

Melissa Commisso: Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Marie-Claude Geoffroy:** Conceptualization, Resources, Supervision, Validation, Writing – review & editing. **Caroline Temcheff:** Conceptualization, Methodology, Resources, Supervision, Validation, Writing – review & editing. **Sara Scardera:** Conceptualization, Writing – original draft, Writing – review & editing. **Francis Vergunst:** Conceptualization, Methodology, Validation, Writing – review & editing. **Sylvana M. Côté:** Conceptualization, Resources, Writing – review & editing. **Frank Vitaro:** Conceptualization, Validation, Writing – review & editing. **Richard E. Tremblay:** Conceptualization, Writing – review & editing. **Massimiliano Orri:** Conceptualization, Formal analysis, Methodology, Supervision, Visualization, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychires.2024.01.039>.

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