



EMPIRICAL ARTICLE

Mechanisms and pathways linking kindergarten behavior problems with mid-life employment earnings for males from low-income neighborhoods

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Abstract

Childhood behavior problems are associated with reduced labor market participation and lower earnings in adulthood, but little is known about the pathways and mechanisms that explain these associations. Drawing on a 33-year prospective birth cohort of White males from low-income backgrounds ($n = 1040$), we conducted a path analysis linking participants' teacher-rated behavior problems at age 6 years—that is, inattention, hyperactivity, aggression-opposition, and low prosociality—to employment earnings at age 35–39 years obtained from tax records. We examined three psychosocial mediators at age 11–12 years (academic, behavioral, social) and two mediators at age 25 years (non-high school graduation, criminal convictions). Our findings support the notion that multiple psychosocial pathways—especially low education attainment—link kindergarten behavior problems to lower employment earnings decades later.

Across the world, people participate in wage labor to secure their livelihoods. But successful participation depends on the development of a range of cognitive and non-cognitive skills (Shi & Moody, 2017). General cognitive abilities including IQ are an important predictor

of employment success—as indexed by employment earnings for example (Jensen, 1998)—but the majority of earnings variation remains unexplained after adjusting for conventional measures of cognitive ability (Bowles et al., 2001; Watts, 2020). As a result, researchers have

Abbreviations: PEI, Pupil Evaluation Inventory; SCT, sentence completion task; SRDQ, Self-Reported Delinquency Questionnaire.

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increasingly relied on non-cognitive skills—such as personality factors (e.g., self-control), behavior (e.g., social skills or deficits), and attitudes—to explain the residual variance (Cunha et al., 2006; Heckman et al., 2006).

Much of the work linking non-cognitive skills to long-term economic outcomes focuses on behavioral problems and social skills deficits in early childhood, partly because that is when these skills are developing and are most malleable (Kautz et al., 2014). For example, low self-control (i.e., a composite of hyperactivity, lack of persistence, inattention, impulsivity, and impulsive aggression) assessed between the ages of 3 and 10 years, has been linked to lower earnings and less wealth by the age of 32, independent of IQ and socioeconomic status (Fergusson et al., 2013). Lower levels of prosocial skills assessed in kindergarten have also been linked with lower employment retention at age 25 (Jones et al., 2015). Using two different datasets and controlling for the possible overlap between these different non-cognitive skills (or lack thereof), Vergunst and colleagues showed that teacher-rated behavior problems in kindergarten—notably high inattention, high hyperactivity (albeit marginally), and low prosociality (males only)—were associated with lower future earnings as measured by government tax returns when participants were in their mid-thirties (Vergunst, Tremblay, Nagin, Algan, Beasley, Park, Galera, et al., 2019; Vergunst, Tremblay, Nagin, Algan, Beasley, Park, Vitaro, et al., 2019). They also showed that kindergarten inattention, aggression-opposition, and low prosociality are associated with severe and sustained economic hardship as indexed by long-term welfare receipt (Vergunst et al., 2021). Taken together, these studies indicate an important link between childhood behavior problems—such as inattention, hyperactivity, aggression, opposition, and low-prosocial skills—and future adverse economic outcomes, but the *pathways and mechanisms* through which these long-term associations occur remain unclear and must be tested.

Elucidating the psychosocial pathways and mechanisms that compromise future economic participation is important for at least three reasons. First, it can help clarify how adverse developmental pathways that include behavior problems (which are arguably more modifiable than systemic problems like poverty or cognitive problems like low IQ) contribute to later earnings. Such knowledge will inform developmental models of key personal characteristics that account for economic advantages or disadvantages in adulthood. Second, it can help uncover the relative importance, and possible interplay, of different pathways that have been only individually examined in previous studies. Third, it can help identify key skills that can be encouraged and promoted in childhood and adolescence, in the event that early efforts to teach non-cognitive skills are unsuccessful or only partially successful. The aim of this study was therefore to examine the pathways through which behavior problems assessed by teachers in kindergarten (i.e., non-cognitive

skills deficits) were related to lower earnings in adulthood as reported by Vergunst, Tremblay, Nagin, Algan, Beasley, Park, Galera, et al. (2019) in the same sample of White males from low-income backgrounds.

A cascade model

A developmental cascade model is premised on the hypothesis that risk factors that occur in childhood will increase exposure to risks in adolescence, which, in turn, will increase exposure to risks in early adulthood (Masten & Cicchetti, 2010). Previous studies have employed such models to describe the relationship between early childhood behavior problems and occupational success (Converse et al., 2014). In our study, two sets of mediators—or intermediate variables—assessed at two different points in development (i.e., early adolescence and early adulthood) are proposed according to a cascade model (Figure 1). Putative mediator variables measured by early adolescence include academic performance, delinquency, and peer acceptance. These variables were selected because they index success or failure with respect to three important domains of functioning (i.e., academic, behavioral, and social)—during the early adolescent period when psychosocial characteristics are more stable than in early childhood, but more malleable than in late adolescence (Caspi et al., 2005), which could make them suitable targets for support or prevention programs designed to improve long-term economic outcomes. Putative mediator variables measured in early adulthood include non-high school graduation and problems with the criminal justice system. These two variables were chosen because they represent established outcomes of the putative mediators' variables measured during early adolescence and because they represent two important proximal predictors of economic outcomes in adulthood—including unemployment, lower earnings, and higher welfare receipt—that are especially relevant for males from low-income backgrounds (Schmitt & Warner, 2011; Watts, 2020).

To our knowledge, no study has examined the complete proposed cascade model to determine the direct or indirect links between behavior problems assessed in preschool and lower employment earnings three decades later. Several studies have, however, examined some pathways separately in order to account for the link between early behavior problems or social skills deficits and adult economic outcomes. Their findings are summarized below.

Inattention

The association between kindergarten inattention and adverse adult economic outcomes is well-documented (Feinstein, 2000; Jones et al., 2015; Vergunst, Tremblay, Nagin, Algan, Beasley, Park, Vitaro, et al., 2019). This is

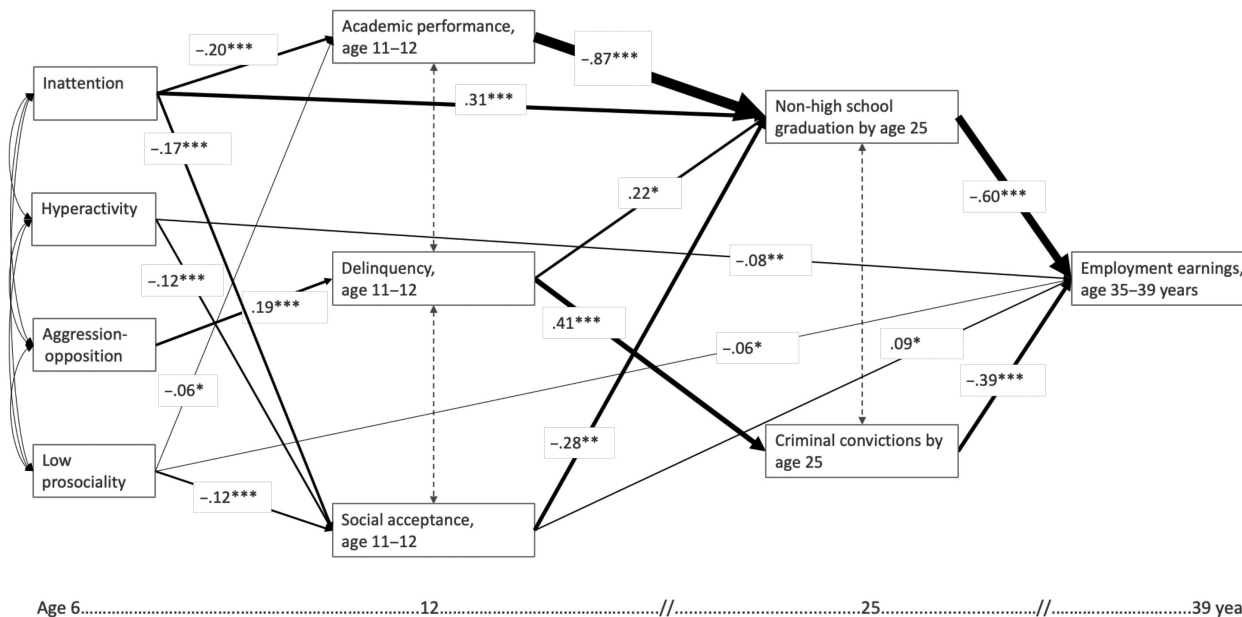


FIGURE 1 Pathways from kindergarten behavior problems to mid-life employment earnings. Standardized coefficients are shown for significant pathways only. * Sig. at .05, ** Sig. at .01, *** Sig. at .001. Model adjusted for childhood cognitive abilities and family adversity (not illustrated). Significant indirect effects are shown in Table 3. Full model results are shown in the Supplement.

hardly surprising since children who are easily distracted in school (i.e., are inattentive and disengaged) are more likely to experience lower educational attainment and, on average, to have lower subsequent employment earnings, independent of their cognitive abilities and family background (Converse et al., 2012, 2014; Fergusson et al., 2013; Spengler et al., 2018). As suggested by Caspi and his collaborators, social deviancy may also play a role. To illustrate, children who are inattentive are more likely to engage in socially deviant behavior, such as substance use or rule breaking, which can undermine the accumulation of human capital (e.g., job training, higher education) that supports successful workforce participation (Caspi et al., 1998). They are also more likely to become involved in delinquent activities and get into trouble with the justice system (Fontaine et al., 2014). Converse et al. (2014) reported data in support of these two pathways. They showed that delinquent behavior and low educational attainment (i.e., operationalized as the highest grade achieved by age 20) partially mediated the association between low childhood self-control (of which inattention is a major component) and low levels of future job success and job satisfaction. However, no study to our knowledge examined whether social experiences may also play a role in this context. Indeed, inattentive children are also more likely to be criticized by their teachers (Rudasill & Rimm-Kaufman, 2009), to be rejected by peers, and to enjoy few high-quality friendships compared to children without attention problems (Mrug et al., 2012). In one study, attention-control in a laboratory setting was found to negatively predict peer rejection, net of other types of externalizing problems (Trentacosta & Shaw, 2009). These negative

social experiences represent important social predictors of dropping out of school, possibly because they foster feelings of loneliness and social dissatisfaction (Parker & Asher, 1993). As already mentioned, failure to graduate from high school, in turn, is an important proximal determinant of lower occupational attainment and employment income (Ng et al., 2005).

Hyperactivity

Evidence from the attention-deficit hyperactivity disorder literature consistently links the condition with numerous adverse outcomes during adolescence and adult-life—including the academic, behavioral, and social mediator variables examined in our study (Mrug et al., 2012). However, few studies have examined long-term outcomes of childhood hyperactivity net of inattention, especially in population-based samples. Those that did have produced inconsistent results. For example, with respect to educational attainment, Pingault et al. (2011) found that inattention, but not hyperactivity, predicted failure to graduate from high school. In contrast, Wu et al. (2021) found that childhood hyperactivity-impulsivity—but not inattention—was associated with not being in education, employment, or training in early adulthood. Thus, it remains open whether hyperactivity per se contributes to lower future earnings and whether educational achievement (i.e., academic performance and high school graduation) plays a meaningful role in this association. Indeed, childhood delinquency may be a more plausible mediator/intermediate variable linking kindergarten hyperactivity to lower future earnings via

problems with the justice system. For instance, Pingault et al. (2013) showed that childhood hyperactivity was significantly associated with future criminal convictions, although most of the variance was explained by aggression and opposition. Similarly, Babinski et al. (1999) found that teacher- and mother-rated hyperactivity-impulsivity, but not inattention, predicted a greater likelihood of having an arrest record, albeit only for males. Finally, teacher- and mother-reported hyperactivity-impulsivity, but not inattention, was found to predict adolescent delinquency, which in turn predicted arrest or incarceration by early adulthood (Ahmad & Hinshaw, 2017). Negative social experiences can also contribute to this process. Hyperactive children who are also impulsive are more likely to interrupt others—for example, by failing to wait their turn in games and intruding on others' space and activities—and are therefore often disliked by other children. Indeed, hyperactivity appears to set in motion a negative spiral of peer problems (i.e., rejection at the group level and lack of friendships at the dyadic level), net of inattention, conduct problems, and lack of prosocial skills (Andrade & Tannock, 2014). In turn, these negative social experiences often lead to delinquent behavior because hyperactive children, who are rejected by their peers, are deprived of normative socialization experiences and therefore more likely to affiliate with other socially excluded and potentially deviant peers (Mrug et al., 2012; Dodge et al., 2006).

Aggression-opposition

The same pathways may also play a role in the link between aggression-opposition and future earnings, although such a link has not always been found. Indeed, the total effect of aggression-opposition was not significant in the Vergunst, Tremblay, Nagin, Algan, Beasley, Park, Galera, et al. (2019) study that used the same inner-city low-income sample as the present study, whereas it was significant (for males only) in a population-based study of long-term welfare receipt (Vergunst et al., 2021). How might these diverging results be explained? As suggested by Moffitt's (1993) "snare hypothesis," children with aggressive-oppositional behavior problems are more likely to become trapped in harmful lifestyles—such as substance use, low education attainment, teenage parenthood, or criminal convictions—that undermine the accumulation of personal and career capital, including wealth, when compared with their non-aggressive-oppositional counterparts. Children with aggressive-oppositional tendencies might thus be indirectly at risk for low employment earnings because they get involved in delinquent behaviors and substance use during adolescence, which in turn put them at risk for dropping out of school and encountering problems with the justice system (Krohn et al., 1995; Pingault et al., 2011). However, there may also be an adaptive

side to aggressive behavior in tough social environments. Although children with aggressive-oppositional tendencies are often rejected by their normative peers, they may actually enjoy social benefits (e.g., increased status) in some contexts that tolerate the use of violence, such as disadvantaged inner-city environments. Indeed, there is empirical evidence that the association between aggression-opposition and social acceptance in the peer group varies depending on local descriptive or injunctive norms toward aggression. For example, Stormshak et al. (1999) found that aggression and peer preference were positively correlated among boys in classrooms in which aggression was normative. There is also evidence showing that children with aggressive-oppositional tendencies sometimes have as many friendships as non-aggressive-oppositional counterparts, thus reinforcing further their status in the peer group and their sense of self-worth (Deptula & Cohen, 2004). In sum, it is possible that these pathways are all significant but do not necessarily point in the same direction in the context of a disadvantaged environment—a so-called opposing mediation (Kenny, 2021)—and this would explain why the total effect of aggression-opposition on later earnings was non-significant in the Vergunst, Tremblay, Nagin, Algan, Beasley, Park, Galera, et al. (2019) study.

Low prosociality

Finally, the pathways examined in this study may also help explain why and how low prosociality during early childhood is related to lower employment earnings in adulthood. Prosociality is defined as a dispositional trait related to having sympathy for others (i.e., sharing, helping, cooperating, consoling), respecting the rules (Mikolajewski et al., 2014), and being sensitive to social reward (Tremblay et al., 1994). Low prosociality is associated with lower future earnings (Jones et al., 2015; Vergunst, Tremblay, Nagin, Algan, Beasley, Park, Galera, et al., 2019), mediated primarily via low levels of academic performance and non-high school graduation (Cawley et al., 2001). By failing to follow the rules with respect to schoolwork, possibly as a consequence of their lowered sensitivity to rewards, children who lack prosocial skills are likely to under-perform in school (Breslau et al., 2009) and subsequently in the workplace (Knapp et al., 2011), leading to lower earnings.

Low prosociality may also contribute to low employment earnings because it hampers the development of positive relationships with peers both at the group level and at the dyad level (McDonald et al., 2011; Poorthuis et al., 2012; Wentzel, 2014). The greater social support enjoyed by prosocial individuals may also give them a sense of self-worth and self-efficacy that promotes well-being and facilitates future success (Bandura et al., 2001; Heckman et al., 2006). In line with this notion, friendship nominations received during adolescence have been

positively related to adult income, even after accounting for diverse personal, family, and work characteristics (Shi & Moody, 2017). Moreover, there is ample evidence that socially accepted youth are less at risk for truancy, absenteeism, and school dropout and show lower levels of delinquent behaviors in adolescence (Véronneau et al., 2008).

Finally, children with low prosociality are less likely to develop friendships with prosocial peers (Prinstein & Giletta, 2016), which may hamper conformity to prosocial norms that prevent the adoption of social deviancy and problems with the justice system (Vitaro et al., 2018). The importance of this pathway is strengthened by the propensity for low prosocial children to manifest less empathy and guilt—two antidotes to delinquent behaviors and their legal consequences.

The current study

Drawing on a large sample of White males from low-income backgrounds ($n=1040$), we examined pathways from problem behaviors in kindergarten to lower employment earnings at age 35–39 years, via mediators variables in early adolescence (school performance, delinquency, social acceptances) and early adulthood (non-high school graduation, criminal convictions). Although all three early adolescent and both early adulthood mediator variables could play a role in explaining at least part of the association between kindergarten behavior and future earnings, their importance could vary depending on the behavior in question. Since there are now a handful of studies documenting a link between kindergarten behaviors and future economic outcomes, but very few that report on the mechanisms, the present analysis constitutes an exploratory effort to elucidate these underlying processes, while controlling for childhood cognitive ability and socioeconomic background, which are known to be associated with both childhood behavior problems and future earnings (Bowles et al., 2001; Heckman et al., 2006).

METHODS

Participants and procedure

Participants were drawn from a longitudinal study of male antisocial behavior started in 1984 (Nagin & Tremblay, 2001). To account for cultural factors, the participants ($n=1040$) were recruited from White Caucasian French-speaking families (where both parents were born in Canada) when participants were aged 5–6 years and attending kindergarten in one of 53 schools in the poorest neighborhoods of Montreal, Canada. Baseline behavioral assessments were made by the participant's teacher at the end of kindergarten, using structured measures

described below. Participants were assessed again at age 11 and age 12 years via structured questionnaires, while information on high school graduation, criminal convictions, and employment earnings in adulthood was obtained from administrative records and linked to the participant's cohort data. At the baseline/kindergarten assessment, the mean number of years of education of participants' mother and father was 10.49 ($SD=2.80$) and 10.56 ($SD=2.31$), respectively. The mother and father's mean age at the birth of their first child was 23.30 ($SD=4.14$) and 26.38 ($SD=5.05$), respectively. Most participants (80.6%) lived in an intact family with both parents. The median family income when participants were aged 10 years (1988–1989) was CA\$30,000, compared with a median income of CA\$44,000 for Canadian couples with children in 1987 (Nagin & Tremblay, 2001). Mean scores for the parents' occupational status corresponded to jobs such as file clerk, hospital attendant, or unskilled factory worker. Informed written consent was obtained prior to participation from the participant's parents at each year of follow-up. The University of Montréal ethics board and Statistics Canada approved the study.

Measures

Outcome

Participants' *employment earnings* at age 35–39 years were obtained from government tax return records through Statistics Canada and defined as all pre-tax earnings (i.e., wages, salaries, and commissions not including income from capital gains). Earnings were calculated using the mean of the five most recent available years (2013–2017) and converted to US dollars prior to analysis using 2018 purchasing power parity (CA\$1 = US\$0.83).

Behavioral predictors

Kindergarten teachers rated the participants' toward the end of the school years, at age 6 years, using the well-validated Social Behavior Questionnaire (Tremblay et al., 1991). Behaviors were assessed using the following items. *Inattention* (4 items): poor concentration, distracted, head in the clouds, lack of persistence. *Hyperactivity* (2 items): agitated or fidgety and moves constantly. *Aggression-Opposition* (8 items): fights with other children, bullies or intimidates other children, kicks or bites, disobeys, does not share materials, blames others, inconsiderate, and irritable. *Low Prosociality* (10 items, reverse scored) assessed behaviors intended to benefit others or society, including helping, sharing, cooperating, and obeying rules, for example: the child tries to stop quarrels or disputes, will invite bystanders to join in a game, will try to help someone who has been hurt (Weir et al., 1980). Items were rated on a 3-point scale:

never or not true=0, sometimes or somewhat true=1, often or very true=2, and summed for each behavior. Alphas for inattention, hyperactivity, aggression-opposition, and low prosociality were .81, .89, .86, and .92.

Control variables

Childhood cognitive abilities and family background are known to be associated with earnings in adulthood and were controlled in the analysis (Bowles et al., 2001; Heckman et al., 2006). *Cognitive abilities*, which are relatively stable across development (Mackintosh, 2011), were assessed at age 13 years using the sentence completion task (SCT). The instrument correlates highly with other verbal and non-verbal measures of intelligence and academic performance across age, ethnic, and socioeconomic groups (Veroff et al., 1971). The correlation between the SCT and the vocabulary and block design sub-test of the Wechsler Intelligence Scale for Children-Revised, conducted on a subsample of 80 participants at age 10, was 0.67. *Family adversity* was assessed via a structured questionnaire completed by the parents when participants were aged 5–6 years using the following items: the parents' number of years of education, family structure (parents living together vs. living apart), parents' age at the birth of their first child, and occupational status based on the criteria set out by Blishen et al. (1987). Families at or below the 30th percentile for each indicator (or parents living apart) were coded as having one adversity point, otherwise they scored zero. Scores were then summed and standardized on a 0–10 scale with higher scores indicating higher adversity.

Early adolescent mediating variables

Academic performance, behavioral adjustment, and social adjustment were measured at ages 11 and 12 years and scores were averaged across the two assessments to increase reliability by reducing measurement error (the correlation between the two annual assessments was .69 for academic performance, .55 for delinquency, and .65 for social acceptance). *Academic performance* was assessed using teacher ratings of the participant's performance in reading, writing, and maths, which were ranked on a 5-point scale (1=very below average, 2=somewhat below averaged, 3=average, 4=somewhat above average, 5=very above average). Scores were averaged across the three subjects. The correlation between teacher ratings of academic performance and test scores in Maths and French obtained from the Quebec Ministry of Education for a subsample of 500 participants at age 11 years was .70. *Delinquency* was assessed using the Self-Reported Delinquency Questionnaire (SRDQ) (Tremblay et al., 1994). The SRDQ assesses the

participant's participation in delinquent behaviors over the past 12 months in four domains: physical violence (7 items), theft (10 items), vandalism (7 items), and substance use (3 items) with each item scored on a 4-point scale (never=0, once or twice=1, often=2, very often=3). The instrument has good psychometric properties and predictive validity (Vitaro et al., 1997). Cronbach's alpha for each year were .88 and .86. *Social acceptance* was assessed in the participant's classroom using the following four items from the peer-rated Pupil Evaluation Inventory (PEI): “those who everyone likes,” “those who are your best friends,” “those who are especially nice,” and “those who seem to understand everything that is going on” (Pekarik et al., 1976). In the test, the items appeared as rows down the left side of the page and the names of the children in the class were listed across the top of the page. Every student checked up to four classmates he or she believed to be best described by a particular item. The number of nominations received by each student—including study participants—in reference to the four items above were summed and *z*-standardized to account for the unequal number of students in each classroom. Participants' total scores for each year were then combined into a single final score. Alphas for the four items in each year were .90 and .89.

Early-adulthood mediating variables were failure to obtain a high school diploma or to have a criminal conviction by age 25 years. Information on *high school graduation* was obtained from the Québec Ministry of Education and *criminal convictions* were obtained from Quebec ministry of justice for all participants in 2003. Each variable was dichotomously coded: participants scored 1 if they had failed to graduate high school or had a criminal conviction, and scored zero if not.

Statistical analyses

In the hypothesized path model (Figure 1), variables measured earlier were allowed to predict later variables (i.e., kindergarten behaviors as well as control variables were allowed to predict all other variables; early adolescent mediators were allowed to predict early adulthood mediators and the outcome; early adulthood mediators were allowed to predict the outcome). Moreover, variables measured at the same time period were allowed to correlate with each other. All directional paths or concurrent correlations between variables were included in the analytical model if they significantly correlated (with a *p*-value of less than .05) in preliminary bivariate associations (decided a priori). Since kindergarten behavioral assessments were obtained from participants who were nested within classrooms nested within schools, we adjusted for the effects of clustering for the direct effects. The statistical significance of indirect effects of the participants' kindergarten behavior on earnings was calculated using linear regression for continuous mediators

(academic performance, delinquency, and social acceptance) and logistic regression for categorical mediators (non-high school graduation, criminal convictions) using maximum likelihood ratios estimates. Robust standard errors were used to adjust for the effects of clustering in the behavior predictors using the sandwich estimator. Pathways that were non-significant in the first (i.e., hypothesized) model were removed to produce a trimmed model. Missing data did not exceed 8.7% on any variable (only childhood delinquency predicted missingness in the outcome variable) and were handled using Full Information Maximum Likelihood estimation. Details of missing data patterns for each time point are given in Supplement (eTable 1). Because a sub-sample of participants ($n=69$, 6.7%) had been randomly selected to receive a social-behavioral intervention at ages 8 and 9 years, we conducted a sensitivity analysis with a dummy variable entered into the analysis (intervention=1, no intervention=0), which did not alter the results. All analyses were conducted using Mplus V7.11. Significance was set at .05 and all tests were two-tailed.

RESULTS

Participant characteristics in kindergarten, early-adolescence, early-adulthood, and mid-adulthood are shown in Table 1. Participants of this study had higher levels of behavioral problems and family adversity at age 6 years, were more likely to have no high school diploma and a criminal conviction in early adulthood, and to have lower employment earnings in their late thirties, when compared with male participants in a Canadian population-based sample (Vergunst, Tremblay, Nagin, Algan, Beasley, Park, Vitaro, et al., 2019).

Bivariate associations for all variables used in the model are shown in Table 2. All variables were correlated with each other with absolute values of $r=.07$ or higher, with p -values significant at .05 or below. Because the inclusion of two logistic regressions and adjustment for clustering at the school and classroom levels precluded the calculation of model fit statistics, only the coefficients, 95% confidence intervals (CI), and p -values are reported. The results of this model are shown in Figure 1 with standardized coefficients shown for significant pathways. Full results of the trimmed and untrimmed models, which did not substantively differ, are shown in Supplement (eTables 2 and 3).

Direct pathways

Earnings

Non-high school graduation ($b=-0.60$, $p=.001$) and criminal convictions ($b=-0.39$, $p=.001$) had direct negative associations with earnings with large and medium

TABLE 1 Sample characteristics across follow-up for low-income White males ($n=1040$).

	Mean	SD	Range
Baseline behaviors and control variables, age 6 years			
Inattention	2.68	2.33	0–8
Hyperactivity	1.40	1.45	0–4
Aggression-opposition	4.86	5.27	0–10
Low prosociality	7.99	4.95	0–20
Childhood cognitive abilities	9.03	2.13	0–13
Family adversity index	3.32	2.48	0–10
Maternal education (years)	10.49	2.80	2–24
Paternal education (years)	10.56	2.31	1–24
Maternal occupational prestige	38.32	12.0	19.92–85.75
Paternal occupational prestige	39.42	12.85	21.24–78.34
Age of mother at birth of first child	23.30	4.14	11.81–40.65
Age of father at birth of first child	26.38	5.05	13.75–50.95
Intact family	0.81	0.40	0–1
Early adolescence, age 11–12 years			
Academic performance	2.89	1.0	0–5
Delinquency	31.12	5.07	27–72
Social acceptance	−0.06	0.89	−2–2
Early adulthood, age 25 years			
Non-high school graduation	0.48	0.50	0–1
Criminal conviction	0.17	0.38	0–1
Mid-adulthood, age 35–39 years			
Annual employment earnings in US\$	33,000	27,400	0–170,200

Note: Missing data did not exceed 8.7% on any measure, except for the sub-item of family adversity “intact family,” which had 37.5% missing. In accordance with Statistics Canada data protection requirements, displayed counts are rounded to base 10 and percentages to one decimal point. Employment earnings are rounded to the nearest hundred, while income ranges are the mean of the five lowest and five highest scores, respectively, and therefore represent a conservative estimate of the upper limit.

effect sizes, respectively. Unstandardized coefficients indicated that participants with no high school diploma by age 25 years earned US\$15,465 less per year at age 35–39 years, whereas those with a criminal record by the same age earned US\$10,062 less. There was a significant direct negative association between kindergarten hyperactivity ($b=-0.08$, $p=.02$) and adult earnings and between kindergarten low prosociality and adult earnings ($b=0.05$, $p=.036$). There was also a direct positive association between social acceptance in adolescence and earnings in adulthood ($b=0.09$, $p=.01$). In dollar terms, kindergarten hyperactivity and low prosociality were associated with a reduction in annual earnings of US\$-1454 and US\$-287, respectively, whereas early adolescent social acceptance was associated with an increase in earnings of US\$2501.

TABLE 2 Bivariate associations for all variables used in the model.

	1. Ina.	2. Hyp.	3. Agg.	4. Low.	5. Cog.	6. Adv.	7. Aca.	8. Del.	9. Soc.	10. Non.	11. Cri.
1. Inattention	1										
2. Hyperactivity	.46	1									
3. Aggression-opposition	.43	.63	1								
4. Low prosociality	.23	.12	.19	1							
5. Cognitive ability	-.30	-.17	-.12	-.17	1						
6. Family adversity	.18	.23	.20	.18	-.22	1					
7. Academic performance	-.34	-.18	-.19	-.20	.44	-.30	1				
8. Delinquency	.12	.18	.22	.12	-.19	.13	-.19	1			
9. Social acceptance	-.27	-.25	-.23	-.20	.18	-.16	.43	-.19	1		
10. Non-high school graduation	.34	.21	.22	.19	-.40	.40	-.51	.21	-.31	1	
11. Criminal conviction	.14	.17	.20	.07	-.12	.21	-.18	.22	-.15	.29	1
12. Employment earnings	-.25	-.21	-.17	-.17	.23	-.23	.30	-.16	.24	-.44	-.29

Note: All variables are significant at the .05 level or below. Phi coefficients are used for correlations between two dichotomous variables.

Childhood family adversity also had a significant negative association with earnings equivalent to a US\$-659 reduction in annual earnings.

Early adulthood mediating variables

Kindergarten inattention had a direct positive association with failure to graduate high school ($b=0.31, p=.001$), whereas early adolescent academic performance was negatively associated with failure to graduate ($b=-0.87, p=.001$) with a large effect size. Early adolescent delinquency was positively associated with failure to graduate ($b=0.22, p=.024$), whereas social acceptance was negatively associated with failure to graduate ($b=-0.28, p=.007$). Early adolescent delinquency was associated with having a criminal conviction by age 25 years ($b=0.41, p=.001$). Among control variables, cognitive abilities were negatively associated with failure to graduate high school ($b=-0.57, p=.001$), while family adversity was positively associated with failure to graduate ($b=0.73, p=.001$) and with criminal convictions ($b=0.51, p=.001$).

Early adolescent mediating variables

Inattention had a negative direct association with academic performance ($b=-0.20, p=.001$) and social acceptance ($b=-0.17, p=.001$). Aggression-opposition had a positive association with delinquency ($b=0.19, p=.001$), whereas low prosociality had a negative association with academic performance ($b=-0.06, p=.034$) and social acceptance ($b=-0.12, p=.001$). Kindergarten hyperactivity was negatively associated with social acceptance in early adolescence ($b=-0.12, p=.001$). Participants with higher cognitive abilities had lower levels of delinquency in early adolescence ($b=0.16, p=.001$).

Indirect pathways

The model indirect effects are shown in Table 3. There were three significant indirect effects from inattention to employment earnings: via social acceptance and non-high school graduation ($b=-0.37, p=.031$), via academic performance and non-high school graduation ($b=-0.09, p=.001$), and simply via non-high school graduation ($b=-0.17, p=.001$). There was one significant indirect pathway from hyperactivity to earnings via social acceptance ($b=-0.27, p=.04$). There were two indirect pathways from aggression-opposition to earnings: one via delinquency and non-graduation ($b=-0.023, p=.045$) and another via delinquency and criminal convictions ($b=0.04, p=.001$). There were two indirect effects from low prosociality to earnings: one via social acceptance ($b=-0.27, p=.02$) and another via academic performance and non-high school graduation ($b=0.026, p=.026$). The sum of the indirect effects from kindergarten behaviors to earnings was significant for inattention ($b=-0.29, p=.001$), hyperactivity ($b=0.027, p=.036$), aggression-opposition ($b=-0.063, p=.002$), and prosociality ($b=-0.053, p=.012$). Adjustment for participants' participation in the behavioral intervention at age 8–9 years did not substantively alter the results when compared with the main analysis (eTable 4).

DISCUSSION

This study of White males from low-income neighborhoods of a large Canadian city examined pathways and mechanisms that could account for the association between teacher-rated behavior problems in kindergarten and lower mid-life employment earnings, independent of cognitive skills and family adversity. The results showed that failure to graduate from high school by age 25 was

TABLE 3 Significant indirect effects for the trimmed model.

	<i>b</i>	<i>B</i>	Lower 2.5%	Upper 2.5%	<i>p</i> - Value
Early adolescent mediators					
Inattention—Social acceptance—Earnings	-0.372	-160	-305	-15	.031
Hyperactivity—Social acceptance—Earnings	-0.266	-183	-357	-9	.040
Low prosociality—Social acceptance—Earnings	-0.272	-55	-101	-9	.020
Early adulthood mediators					
Inattention—Non- graduation—earnings	-0.168	-167	-259	-76	.001
Early adolescent and early adulthood mediators					
Inattention— Academic—Non- graduation—Earnings	-0.085	-36	-48	-24	.001
Low prosociality— Academic—Non- graduation—Earnings	-0.026	-5	-10	-10	.038
Aggression-opposition— Delinquency—Non- graduation—Earnings	-0.023	-43	-86	-1	.045
Aggression-opposition— Delinquency— Convictions— Earnings	-0.04	-77	-122	-32	.001
Early adolescent mediators via early adulthood mediators					
Academic—Non- graduation—Earnings	0.432	432	338	526	.001
Delinquency—Non- graduation—Earnings	-0.122	-122	-227	-18	.022
Delinquency— Conviction—Earnings	-0.218	-218	-292	-144	.001
Social acceptance— Non-graduation— Earnings	0.136	243	19	467	.033
Sum of the indirect effects					
Inattention	-0.289	-379	-540	-218	.001
Hyperactivity	-0.027	-201	-388	-13	.036
Aggression-opposition	-0.063	-121	-196	-46	.002
Low prosociality	-0.053	-65	-116	-15	.012

Note: *b* represents standardized regression coefficients and *B* represents non-standardized regression coefficients.

the most important proximal predictor of lower mid-life employment earnings, accounting for most of the variance in the indirect pathways. Having a criminal conviction by the same age was also an important proximal predictor but with a smaller effect than for failed graduation. The link between kindergarten behaviors and lower mid-life earnings was mainly explained by lower school performance and peer acceptance in childhood, and by non-high school graduation in early adulthood, although there was also a significant indirect effect via delinquency in early adolescence and criminal convictions

in early adulthood. There were also four indirect effects from the early adolescent mediators to earnings: one from academic performance via non-graduation, two from delinquency (via non-graduation and via criminal convictions), and a fourth from social acceptance via non-graduation. Finally, after accounting for the mediator variables, there were two “residual” direct effects from hyperactivity and low prosociality to lower earnings. Taken together, the results support the idea that multiple empirically independent psychosocial mechanisms—especially lower educational attainment—link early behavior problems to lower future employment earnings.

Inattention

In line with Converse et al.' (2014) findings, educational achievement played an important role in linking inattention to employment earnings via academic performance and then via non-high school graduation. The central role of inattention is unsurprising, as it is a foundational precursor to academic success—-independent of cognitive skills, family adversity, mastery of early math and literacy concepts, and other behavioral skills (Duncan et al., 2007; Pingault et al., 2011; Vitaro et al., 2014)—and academic success, in turn, is a strong predictor of economic success (Watts, 2020). However, contrary to Converse et al.' (2014) findings, delinquency and criminal convictions did not play a role in linking inattention to later earnings. This discrepancy may be explained by the fact that Converse and colleagues used a composite self-control measure derived from the 21 items of the Behavior Problems Index (Zill, 1990), including aggression-opposition items, whereas the present study used sub-scales to distinguish between inattention, hyperactivity, and aggression-opposition. This allowed us to show that the pathways to earnings differ depending on the specific behavior in question.

Instead, the present study revealed an unprecedented social cascade linking inattention to later earnings, via social acceptance. As mentioned previously, children with attention problems are more likely to be admonished by teachers and rejected by their peers, and, consequently, to have fewer friends (Mrug et al., 2012). This social ostracism could erode children's school motivation and nudge them toward academic underachievement and school dropout (Véronneau & Vitaro, 2007). It could also erode their sense of self-worth and foster depressive symptoms, two important ingredients for personal and economic success (Fontaine et al., 2014; Rubin et al., 2015).

Hyperactivity

Contrary to expectations, the association between kindergarten hyperactivity and lower earnings was not

mediated by deviancy (i.e., delinquency and criminal convictions). This is a surprising finding because hyperactivity has been previously linked with increased risk of police arrests (Babinski et al., 1999) and, albeit weakly, criminal convictions in adulthood (Pingault et al., 2013). Instead, hyperactivity was linked to lower social acceptance and indirectly to lower earnings through psychological dynamics similar to those described for inattention. However, explanations for the link between hyperactivity and low social acceptance might be different from explanations for the link between inattention and low social acceptance. For example, hyperactive children may be disliked and socially rejected by their peers because they engage in behaviors that violate social norms, as has been shown for children with conduct problems (Olson, 1992), in ways that inattentive children are not.

The residual direct hyperactivity pathway is intriguing and in need of a tentative explanation. First, it should be noted that Vergunst, Tremblay, Nagin, Algan, Beasley, Park, Galera, et al. (2019) found a borderline significant direct effect of hyperactivity on earnings at age 35–36 years ($p = .06$) in the same cohort of low-income White males, whereas the present study examined earnings at 35–39 years, and the inclusion of new long-term follow-up data could have created additional variance to detect a significant effect. Second, although childhood hyperactivity symptoms decline with age in population-based samples (Vergunst, Tremblay, Galera, et al., 2019), for a sub-population they can remain elevated across childhood and adolescence and may persist into adulthood (Caspi et al., 2005). This could hamper economic participation in several ways. For example, hyperactivity could lead to poor task performance in certain roles (e.g., negative reactive interactions with clients), strain relationships with colleagues through repeated interruptions, or increase the likely of quitting work on a whim—all of which could undermine employment tenure and earnings across early adulthood. We emphasize here that many questions about the contribution of hyperactivity to future life outcomes remain, and further work to help characterize its unique contribution—net of other behavior difficulties—is required. This includes improving understanding of the putative mechanisms that underlie the observed associations.

Aggression-opposition

As expected, we found a significant indirect effect from kindergarten aggression-opposition to earnings via delinquency and criminal convictions. There was also a significant indirect effect from aggression-opposition to earnings via delinquency and failure to graduate high school. This indirect multi-level cascade is important because it emphasizes the relevance of early aggression-opposition, despite having no direct effect on future earnings. Consistent with Moffitt's snare hypothesis

(Moffitt, 1993), aggression-opposition was indirectly linked to low employment earnings because participants with aggressive-oppositional tendencies were at risk for delinquent behaviors and substance use during adolescence, which, in turn, increased the risk of dropping out of school and of having contact with the criminal justice system. There were also two additional significant indirect effects from delinquency in early adolescence, one via non-graduation and the other via criminal convictions. One possibility is that some participants without kindergarten behavior problems embarked on a late-onset delinquent trajectory, possibly under the influence of deviant peers (Moffitt, 1993). As with their early-onset counterparts, late-onset children could also become trapped in social deviancy, especially in the context of harsh socioeconomic environments, where academic attainment is under-valued and attractive job opportunities are scarce.

One unanswered question is why aggression-opposition did not predict lower future earnings through low peer acceptance, as this was often found in past studies (Dodge et al., 2006). As suggested earlier, aggressive-oppositional behavior could be adaptive in certain adverse contexts, such as the low-income inner-city environment that characterized the present study (Stormshak et al., 1999), and thus be positively associated with social acceptance in early adolescence. Such an effect could therefore considerably reduce or even “cancel out” the mediating effects of the delinquency pathways and thus partly explain the failure to find a direct (total) effect between aggression-opposition and earnings in the earlier analysis produced by Vergunst, Tremblay, Nagin, Algan, Beasley, Park, Galera, et al. (2019). Instead, we found that aggression-opposition was not significantly associated with social acceptance. This suggests that some unmeasured—and currently unknown—opposing mediator could be responsible for counterbalancing the observed effects of the behavioral and academic mediators linking aggression-opposition to lower earnings.

Low prosociality

Low prosociality was indirectly associated with lower future earnings via social acceptance and educational achievement (i.e., academic performance and non-high school graduation). Studies of prosocial behavior show that highly prosocial children are typically liked and well-accepted by their peers and enjoy good quality friendships (Mrug et al., 2012). These social benefits may facilitate educational achievement through instrumental or motivational processes, especially in males from low-socioeconomic status environments, who are more at risk for school-drop out than males from higher socioeconomic backgrounds (Fischer & Kmec, 2004; Furrer & Skinner, 2003). Prosocial traits may also contribute to academic attainment by fostering self-worth and

self-confidence (Shi & Moody, 2017). Prosocial children are also sensitive to social and non-social rewards for normative behaviors (Tremblay et al., 1994). They also enjoy positive relationships with their teachers, which is a well-established source of cognitive engagement in the classroom (Roorda et al., 2011), and a possible additional explanatory factor for the observed indirect effect of prosociality on lower future earnings via low early adolescent academic performance and subsequent failed high school graduation (Coulombe & Yates, 2018).

The promotional role of prosocial behaviors—via social acceptance, academic performance, or other interpersonal processes not examined in the present study—have been stressed as an important non-cognitive pathway to personal well-being and economic success (Bandura et al., 2001; Heckman et al., 2006; Vitaro et al., 2005). The present results concur with and extend these findings in two ways: (1) by revealing a double cascade stemming from prosociality, that is, an academic cascade, likely supported by motivational processes, and a social cascade, likely supported by interpersonal abilities and (2) by showing that the social dynamics engendered by prosociality may affect children academically and economically, independent not only of behavior problems but also of low cognitive abilities and family adversity.

There was also a small “residual” direct pathway from kindergarten low prosociality to lower future earnings. Prosocial behaviors observed during childhood are relatively stable across development (Flynn et al., 2015) and low prosocial traits that persist into adulthood could harm employment participation by, for example, impacting collegial relations, employment tenure, and promotion opportunities, and thus lowering earnings. This idea is supported by studies showing that trait conscientiousness and agreeableness in adults—which significantly predict prosociality in meta-analysis (Kline et al., 2019)—are associated with higher income and wealth, after adjustment for cognitive and socioeconomic background factors (Duckworth et al., 2012; Wilmot & Ones, 2022).

Effect sizes

The standardized effect sizes in Figure 1 show that school performance and high school graduation were especially important in explaining future earnings when compared with social acceptance, delinquency, or criminal convictions. Indeed, the effect size for the direct association with earnings was $-.60$ for failure to graduate high school compared with $-.39$ for having a criminal conviction. These effects may be in the “medium” range according to Cohen's criteria, but in concrete terms, they amounted to \$15,465 and \$10,062 in lost annual earnings for non-graduation and convictions, respectively, by the time participants were in their late thirties. The

outside role of educational attainment could reflect the fact that obtaining a high school diploma is often a minimum requirement for accessing more complex and better paid jobs. A criminal conviction could likewise delay education and training and bar individuals from certain higher-paid occupations.

Standardized effect sizes for the indirect effects again show the importance of the education pathway in explaining lower future earnings, although the role of social deviancy (i.e., delinquency and criminal convictions) and social acceptance is also evident. Among kindergarten behaviors, inattention played an especially large role, arguably due to the overall importance of educational attainment in explaining future earnings. This is evidenced by the considerably larger sum of the indirect effect for inattention when compared with the other kindergarten behaviors (Table 3). With respect to the early adolescent mediators, social acceptance emerged as the next most important factor on the pathway to earnings—accounting for significant indirect pathways from inattention, hyperactivity, and low prosociality—while the effect sizes for delinquency were the smallest of all.

Study implications

This study has several implications. First, behavior problems evident as early as kindergarten signal increased risk of lower mid-life employment earnings. These effects appear to occur through multiple pathways in the early adolescent period—including low academic performance, delinquency, and social difficulties. The findings confirm work by Heckman and colleagues showing that non-cognitive skills such as self-regulation, endorsing social norms, engagement in school, and prosocial behavior, drive the long-term impact of early prevention programs on adult economic, personal, and social outcomes (Heckman et al., 2006). Second, failure to graduate from high school was the most important proximal indicator of lower mid-life earnings (much more so than having a criminal conviction). This highlights the vital importance of educational attainment for future economic prospects, especially for males from low-income backgrounds (Kautz et al., 2014). Furthermore, failure to graduate from high school is influenced by academic performance, prosocial skills, and participants' level of peer acceptance, which further underscores the importance of both cognitive and non-cognitive skills development among disadvantaged children. Third, the results help to identify potential targets for intervention and suggest that males exhibiting early behavior problems should be targeted with multi-pronged support, prevention, and intervention efforts. Programs that reduce inattentive and disruptive behaviors and promote prosocial and socioemotional skills in the primary school years may improve psychosocial and academic outcomes in adolescence (Diamond & Lee, 2011; Durlak et al., 2011),

and eventually also economic outcomes in adulthood, with especially large effects for the most disadvantaged children (Kautz et al., 2014).

This study examined early childhood behavioral characteristics associated with lower mid-life employment earnings. This does not imply that it is primarily the responsibility of individuals to change their personal characteristics as a means of improving their economic situation; to the contrary, we strongly favor systemic change through progressive social and economic policies as the primary tool for improving outcomes for economically and socially disadvantaged populations. Our focus on personal characteristics is instead pragmatic: the examined intermediary outcomes, as well as the early personal predictors, may be easier to change—in the short-term—compared to broad systemic problems, making them more suitable for prevention and intervention.

Strengths, limitations, and conclusions

Strengths of the study were the prospective follow-up spanning more than three decades, the inclusion of mediators at two developmental time points, and the use of administrative tax return data to assess employment earnings. This is also the first study, to our knowledge, to examine three mediating pathways simultaneously in early adolescence and two in early adulthood, with data obtained from multiple sources, including teacher reports, self-reports, peer ratings, and administrative records. The study also had limitations. First, several other potential pathways or components—such as a problematic teacher–child relationships or affiliation with deviant peers—could explain the association between kindergarten behavior and future earnings but were not examined because such variables were unavailable in our dataset. Second, participants' cognitive ability was assessed at age 13 years and therefore lies on the causal pathway to adult earnings, which could have biased model estimates (earlier IQ assessments were not available). We note, however, that cognitive ability is relatively stable across time, so our measure should provide a reasonable estimate of the participants' cognitive ability at baseline. Third, the study focused on White males from low-income neighborhoods, which may limit the generalizability of findings to females or participants from more affluent backgrounds or individuals with other racial or ethnic characteristics. Fourth, although financial rewards are a commonly accepted way to value an activity, many career and lifestyle choices that are traditionally associated with lower earnings can enrich the lives of individuals and society—such as prioritizing family time, pursuing creative professions, volunteer/non-profit work—and the importance of earnings as a study outcome should not be over-emphasized. Fifth, participants with

higher adolescent delinquency were more likely to have been lost to follow up, and although missing data were low and statistically managed, the study results could represent an underestimation of the actual association. Sixth, this study examined the direct and indirect effects of continuous and categorical mediators, which precluded the generation of standard model fit statistics in Mplus, including the TECH10 and WLSMV estimator. Consequently, caution is warranted in interpreting our results until they are confirmed using new methods that can generate conventional fit statistics for models of this kind. Seventh, the study is based on observational data and causal relationships cannot be assumed.

In summary, the present study helps clarify the mechanisms underlying the association between early childhood behavior problems and future employment earnings. It shows that behaviors observable in kindergarten can set in motion a cascade of maladaptive academic, behavioral, and social outcomes that unfold partly in parallel and partly through interaction with one another across development leading to lower mid-life employment earnings. Targeting these mechanisms, or their precursors, could help improve long-term economic outcomes for males from disadvantaged backgrounds.

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DATA AVAILABILITY STATEMENT

The analytic code necessary to reproduce the analyses presented here is available from the first author upon reasonable request. The data necessary to reproduce the analyses presented here are available by agreement with the Research Unit on Children's Psychosocial Maladjustment, University of Montreal, Canada.

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