Physical Aggression During Early Childhood: Trajectories and Predictors

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ABSTRACT

Introduction: This study aimed to identify the trajectories of physical aggression during early childhood and antecedents of high levels of physical aggression early in life. **Methods:** 572 families with a 5-month-old newborn were recruited. Assessments of physical aggression frequency were obtained from mothers at 17, 30, and 42 months after birth. Using a semiparametric mixture model and multivariate logit regression analyses, distinct clusters of physical aggression trajectories were identified, as well as family and child characteristics that predict high level aggression trajectories. **Results:** Three trajectories of physical aggression were identified: 1. children (28% of sample) who displayed little or no physical aggression, 2. approximately 58% followed a rising trajectory of modest aggression, and 3. a rising trajectory of high physical aggression (14%). **Conclusions:** Children who are at highest risk of not learning to regulate physical aggression in early childhood have mothers with a history of antisocial behaviour during their school years, mothers who start childbearing early and who smoke during pregnancy, and parents who have low income and have serious problems living together. Preventive interventions should target families with high-risk profiles on these variables.

Key Words: physical aggression, early childhood, trajectories, predictors.

RÉSUMÉ

Introduction: Cette étude vise à identifier les trajectoires d'agressivité physique de la petite enfance et les facteurs précurseurs de hauts niveaux d'agressivité physique à un jeune âge. **Méthodologie:** L'échantillon se compose de 572 familles avec un nouveau-né âgé de cinq mois. Les mères ont évalué la fréquence de l'agressivité physique de leur enfant à 17, 30 et 42 mois. Un modèle mixte semi-paramétrique et des analyses multivariées de régression logistique ont permis d'identifier des trajectoires d'agressivité distinctes, et des caractéristiques familiales ou chez l'enfant qui prédisent des trajectoires d'agressivité physique élevées. **Résultats:** Trois trajectoires d'agressivité physique ont été identifiées: 1) les enfants (28% de l'échantillon) qui ont peu ou pas recours à l'agressivité physique, 2) 58% des enfants qui s'inscrivent sur une pente ascendante d'agressivité physique moyenne, et 3) une trajectoire ascendante d'agressivité physique élevée dans 14% des cas. **Conclusion:** Les enfants les plus à risque de ne pas apprendre à contrôler leur agressivité physique à la petite enfance ont des mères qui ont elles-mêmes eu des comportements antisociaux durant leurs années scolaires, qui sont devenues mères tôt dans leur vie et qui ont fumé durant la grossesse. Les parents de ces enfants ont aussi de faibles revenus et éprouvent de sérieux problèmes dans leur vie conjugale. Les efforts de prévention devraient se centrer sur ces familles à risque élevé.

Mots-Clefs: agressivité physique, petite enfance, trajectoires, prédicteurs.

Longitudinal studies show that violence later in life is rarely an isolated event in the perpetrator's life. Children who show high levels of physical aggression during the elementary school years are at greatest risk of physical violence during adolescence and adulthood.[1] Developmental research also shows that the spontaneous onset of physical aggression in school-aged children is highly unusual.[1, 2, 11] Instead, the developmental precursors of chronic physical aggression are present before school entry. Although it is unusual for young children to harm seriously the targets of their physical aggression, studies of physical aggression during infancy indicate that by 17 months of age, the large majority of children are physically aggressive toward siblings, peers, and adults.[12, 13, 14, 15, 16]

Because most children seem to learn to inhibit physical aggression during the preschool years, this period of life may be the most appropriate for preventive interventions. Olds et al[17] showed that although the nurse home visitation program can prevent child abuse and neglect, as well as juvenile delinquency, it did not have an impact on families with high levels of domestic violence.[18] These results suggest that we need better knowledge of the early development of physical aggression to guide preventive interventions with families at high risk of physical violence. Yet, although much work has been done on developmental precursors of physical aggression in school-aged children, comparable evidence on the developmental course of physical aggression in preschool-aged children is extremely limited.

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This article reports results from a longitudinal study of children's physical aggression development from 17 to 42 months after birth. Our aims were: 1) to identify the trajectories of physical aggression during early childhood and 2) to identify antecedents of high levels of physical aggression early in life. Such antecedents could help us to understand better the developmental origins of violence later in life and to identify targets for preventive interventions. Antecedents selected as putative predictors were shown in other studies to predict antisocial behaviour in school-aged children, adolescents, and adults.[19, 20, 4, 6, 7, 8, 21, 22-26, 5, 27, 28, 29, 30, 31]

METHODS
Subjects

A total of 504 children selected using the Quebec Ministry of Health and Social Services registry of new births were followed from 5 to 42 months of age to assess the developmental course of physical aggression.

Mothers were interviewed at home 4 times, when their child was 5, 17, 30, and 42 months of age. A random sample of single births was selected with a stratified procedure on the basis of the mother's area of residence and gender of the child. Area of residence was limited to a 1-hour drive by car from the 2 main urban centers in the province of Quebec; also, families were excluded when parents did not understand French or English. Demographic characteristics of the 572 families, first assessed in 1996 when the target child was 5 months of age, differed slightly from a population sample (N = 2223) representing 5-month-olds in the province of Quebec in the fall of 1997 and the spring of 1998. Compared with the latter, mothers and fathers of the 1996 sample had higher educational attainment (10.3% vs 16.0% did not finish high school; 57.1% vs 50.4% had a postsecondary education), and mothers were slightly older (29.9 vs 28.8 years). The samples did not differ on variables such as the father's age (32.3 vs 31.8 years), family income <$30 000 (Canadian; 25.5% vs 29.3%), and the number of children in the family (42.0% with 1, 37.8% with 2, 20.3% with 3 or more, in the present sample). A signed informed consent was obtained from mothers when they were visited at home by the interviewer. Ethical approval for the study was obtained from the Ethics Board of Santé Québec, the governmental agency responsible for data collection.

Measures
Physical Aggression at 17, 30, and 42 Months after Birth

To assess physical aggression, we selected 3 items that were sufficient to assess reliably physical aggression in children.[1,32] Mothers were asked whether the child never (0), sometimes (1), or often (2) hits, bites, kicks; fights; and bullies others (scores on this 3-item scale may range from 0 to 6). The internal consistency value (α) was .55, .61, and .76 at 17, 30, and 42 months, respectively. Using father ratings at 42 months, the intraclass correlation among mothers and fathers was .61 (N =355).

Child Temperament at 5 Months after Birth

The interview with the mother at 5 months included 7 items from the difficult temperament scale of the Infants Characteristics Questionnaire[33]: 1) easy to calm or soothe; 2) how often fussy per day; 3) how much does he cry or fuss in general; 4) easily upset; 5) general mood; 6) stability of mood; and 7) overall degree of difficulty. Mothers were asked to respond on a scale from 1 (easy temperament) to 7 (difficult temperament). The internal consistency (α) was .84. Intraclass correlation between mother and father ratings of temperament at 5 months was .60 (N = 452).

Mothers' Quality of Parenting at 5 Months after Birth

After the 5-month interview, mothers were asked to complete a questionnaire on parenting behaviours. Mothers answered using a scale from 0 (not at all what I did or think) to 10 (exactly what I did or think). The questionnaire was developed for the present study.[34] The coercive parenting and self-efficacy scales had internal reliabilities (α) above the .70 level. The coercive parenting scale measures the tendency to respond in a negative and restrictive manner to the child with a 7-item scale: 1) I have been angry with my infant when he was particularly fussy; 2) I have raised my voice or shouted at my infant when he was particularly fussy; 3) When my infant cries, he gets on my nerves; 4) I have spanked my infant when he was particularly fussy; 5) I have lost my temper when my infant was particularly fussy, 6) I have left my infant alone in his bedroom when he was particularly fussy; and 7) I have shaken my infant when he was particularly fussy. The parent self-efficacy scale has 5 items that measure the mother's perception of her ability to fulfill her role as a parent: 1) I am very good at keeping my infant amused; 2) I am very good at calming my infant when he is upset, fussy, or crying; 3) I am very good at keeping my infant busy while I am doing housework; 4) I am very good at attracting the attention of my infant; and 5) I am very good at feeding my infant, changing his diapers, and giving his bath.

Parent Background and Family Characteristics

Fathers and mothers were asked to complete a questionnaire during the 5-month interview. The questionnaire included items on antisocial behaviour exhibited before they had left high school.[35] Fathers were asked whether before the end of high school they had often been in fights that they had started, stolen more than once, been involved with youth protection or the police because of their misbehaviour, or been expelled or suspended from school. Mothers were asked whether before the end of high school they had been in >1 fight that that they had started, stolen more than once, been involved with youth protection or the police because of their misbehaviour, skipped school more than twice in 1 year, or ran away from home overnight. Responses were transformed into dummy variables that distinguished mothers and fathers who acknowledged engaging in 2 or more of these behaviours. Mother's age at birth of first child, level of education, cigarette and alcohol consumption during pregnancy, and postpartum depression were obtained during the interview when the child was 5 months of age. For each pregnancy trimester, mothers were asked how many cigarettes they smoked daily and how much alcohol they drank daily. Mothers were also asked whether they experienced postpartum depression and for how long in days, weeks, and months. Family composition, household income, and family functioning were also assessed during the interview. Household income was measured as an ordinal variable that takes integer values between 1 (<$10 000 CAN) and 8 (>$80 000 CAN). Level of education was transformed into a dummy

variable indicating whether the mother had (= 0) or not (=1) a high school diploma. Family composition at birth was also treated as a dummy variable when both parents were living with the child (= 0) or not (= 1). Family functioning was assessed with an 8-item scale (α.83, N =546) measuring the functionality of the family (e.g., there are lots of bad feelings in our family; in times of crises, we can turn to each other for support; we don't get along well together).[36] Mothers answered on a scale from 1 (strongly agree) to 4 (strongly disagree). Higher values indicate less functional households. A dummy variable indicated whether the mother reported smoking (=1) or not (=0) during pregnancy; a dummy variable also indicated whether the mother reported having >5 drinks on 1 occurrence during pregnancy (=1) or not (=0).

DATA ANALYSIS

A developmental trajectory describes the course of behaviour across ages. The analysis proceeded in 2 stages.

First, the distinctive clusters of developmental trajectories were identified using a semiparametric, mixture model described in Nagin[37] and Roeder et. al.[38]

For each such trajectory group, the model defined the shape of the trajectory (rising, falling, stable, or hump-shaped) and the estimated proportion of the population belonging to the trajectory group. A key step in model estimation was selection of the number of trajectory groups that best fit the data. Model selection was based on the Bayesian Information Criterion. Specifically, models with 2 to 5 groups were estimated. The model with the maximum Bayesian Information Criterion was selected as the optimal model.

In the second stage of the analysis, an examination of the predictors of trajectory group membership was conducted. The "posterior probabilities of group membership" were central to this aspect of the analysis. For each individual in the sample, the posterior probabilities estimate the probability of the child's belonging to each trajectory group. For example, consider a child whose mother persistently rated him as highly physically aggressive. For this individual, the posterior probability estimate of the child's belonging to a low trajectory group would be near 0, whereas the probability estimate of the child's belonging to a high-aggression group would be high. Each child was assigned to the group for which he or she had the largest posterior probability estimate. This is the group that best conforms to the child's observed behaviour.

Two types of analyses were conducted. Chi-squared tests of joint significance (α = .05) and t-tests were used to identify parental and child characteristics and to examine whether prevalence levels were significantly higher for the high-aggression group compared with the low and medium groups combined. Multivariate logit regression was then used to examine the capacity of the risk factors to distinguish membership in the high physical aggression trajectory group as opposed to the other 2 trajectory groups, controlling for the levels of the other risk factors. Two models were estimated, one including only the at-birth risk factors and another including both the at-birth and the at-5-months variables. For the logit-based analyses and the t-tests of difference in means, 1-tailed tests of significance were conducted (α = .05) because we had a priori prediction about

the direction of the effect for each predictor variable. All risk factors were measured as binary variables. The results of the analysis were substantively identical when risk factors based on nonbinary scales were entered in their nonbinary form.

RESULTS

Three trajectories of physical aggression were identified (Fig 1; plot of means and standard errors by trajectories). The first was composed of children who displayed little or no physical aggression. These individuals were estimated to account for 28% of the sample. The largest group, estimated at 58% of the sample, followed a rising trajectory of modest aggression. Finally, a group, estimated to comprise 14% of the sample, followed a rising trajectory of high physical aggression.

Table 1 reports the prevalence of each risk factor by trajectory group. Most were statistically significant predictors of trajectory group membership. Also, prevalence levels of significant predictors generally increased from the low- to the medium- to the high-aggression trajectory groups. For all significant predictors, the high group had the highest prevalence level. Of the 16 predictors, only 6 were non significant: young mother now, mother has no high school diploma, mother depressed, mother drank during pregnancy, mother feels ineffective, and father antisocial before end of high school. Furthermore, the t-tests contrasting the high group versus the low and medium groups combined showed that these 3 predictors (young mother now, mother depression, mother has no high school diploma) significantly distinguished the groupings.

Table 2 reports the results of the analysis aimed at identifying risk factors that distinguish the relatively small group of children (13.9%) in the high-aggression trajectory group from the other 2 groups in the context of a multivariate model. The largest risk was for the presence of other young siblings in the household. Having another sibling as a target for physical aggression increased the odds of membership in the high-aggression group by more than a factor of 4. Several mother characteristics were also associated with large and significant increases in the risk for high aggression. Early motherhood was associated with a 3-fold increase in the odds ratio (OR) of high aggression group membership. The counterpart increase in the OR for mother antisocial behaviour before end of high school was even larger, 3.6. Combined, these 2 predictors increased the OR of high aggression by a factor of 10.9. Other significant risk factors were mother smoking during pregnancy, postpartum maternal depression, and low income.

Each of these risks factors increased the OR of high aggression by at least a factor of 2.

The addition of the risks present at 5 months of age to the previous step had little impact on the antecedent risk factors described above. With the exception of maternal postpartum depression, which falls just below significance, all variables that were significant remain significant and all those that were nonsignificant remain non significant. The high family dysfunction and coercive parenting risks at 5 months of age each were significant, with both increasing the OR of membership in the high-aggression group by approximately a factor of 2. Neither maternal feelings of ineffectiveness nor the child's having a difficult temperament at 5 months of age was a significant predictor. However, because the difficult temperament risk factor

is a significant predictor without controls for the at-birth risk factors, it seems that some combination of these risks accounts for its discriminating power.

DISCUSSION

Our findings show that the traditional predictors of antisocial behaviour during preadolescence, adolescence, and adulthood also predict high levels of physical aggression from 17 to 42 months of age.

These results support growing evidence that chronic physical aggression during childhood, which, in some cases, becomes serious violence during adolescence and adulthood, starts with high levels of physical aggression during infancy and toddlerhood.[13, 15, 39]

Our analyses attempted to address the issue of intergenerational transmission of antisocial behaviour. Results clearly show that girls' high level of antisocial behaviour before the end of high school tends to be followed by their children's high levels of physical aggression in early childhood. These results confirm earlier studies that had shown that mothers' criminal history was associated with their children's criminal behaviour.[10, 40] However, for the first time, we show that the intergenerational transmission of antisocial behaviour probably starts as early as infancy with high levels of physical aggression. The strength of the relationship with fathers' antisocial behaviour was weak, but this could be a measurement problem, because we had to rely on mothers' reports when fathers were not living with their children and could not be located or convinced to participate. These fathers may have been among the most antisocial before the end of high school. However, it would not be surprising that mothers' antisocial behaviour history plays a more important role than fathers' antecedents in teaching infants to regulate physical aggression.

Age of the mother at the birth of her first child was a better predictor than age of the mother at birth of the child targeted for the study. It remained a significant predictor after having controlled for many concurrent variables that are correlated with young motherhood: antisocial behaviour, low education, smoking, drinking, single parent, poverty, and depression.

It also remained a significant predictor after having controlled for more proximal variables that are often considered mediators of young parenthood: parenting practices and family dysfunction. These results suggest that women who start to have children at a much earlier age than the majority do not learn to help their child regulate physically aggressive behaviour, even if they have children at a later age, and/or, for some yet unknown reason, that it is more difficult to teach most of their children alternatives to physical aggression.

Smoking during pregnancy has been shown to predict antisocial behaviour during later childhood and adolescence.[22-26] Our results show that it predicts high levels of physical aggression in infancy after having controlled for many of the confounding variables that could explain the association, e.g., antisocial behaviour, low education, postpartum depression, and early parenthood. We clearly need good studies of the physiologic mechanisms during pregnancy that could explain the impact of smoking on infants' problems with behavioural regulation.

Low income and single parenthood are classic predictors of youth antisocial behaviour. In some studies, both of these predictors tend not to be significant once other variables have been controlled, e.g., parents' education, depression, parenting, family dysfunction.[4, 5, 19] Our results show that poverty remains a significant predictor after control of other variables, whereas single parenthood does not. However, these 2 variables are correlated. Poverty and single parenthood, which start at birth, may have a stronger impact on regulation of physical aggression than poverty and separation that occur later in life.[19, 41] We clearly need studies that will identify the mechanisms by which these 2 factors have an impact on the development of physical aggression in early childhood.

Our results show that presence of a sibling had the largest impact on level of physical aggression during early childhood. This is not surprising because, by definition, to be physically aggressive, one needs to have a target. Few studies have focused on physical aggression among siblings during early childhood. Dunn and Munn[12] reported that between ages 14 and 24 months, younger siblings tended to be physically aggressive toward older siblings more often than the reverse. This finding may be explained by the fact that when the younger sibling starts to be physically aggressive, the older sibling has started to learn not to be physically aggressive.[39] Also, parents of human children, like parents of nonhuman primates, probably punish more severely older sibling physical aggression because it is more likely to result in injury than the younger sibling aggression.[42] Although presence of a sibling had the largest OR, it should be remembered that all of the other significant predictors were obtained after having statistically controlled for presence of a sibling.

The bivariate analyses showed that boys were more likely than girls to be in the high physical aggression trajectory. However, this association disappeared once we entered the other independent variables in the regression. Most studies of physical aggression indicate that girls have lower frequencies than boys.[16, 32, 43, 44, 45] It will be important in future studies to investigate why girls have lower frequencies of physical aggression already in early childhood, although the mechanisms that lead to control over physical aggression seem to be the same for girls and boys.

Family dysfunction and coercive parenting were the best "5 months old" predictors of a high physical aggression trajectory measured initially 12 months later. These 2 variables are classic predictors of antisocial behaviour in older children and adolescents.[5, 31] It is clear from our results that, if they are causal factors, they are having their impact within the first year after birth. They may have a strong impact because they start early but also because they tend to remain part of the child's environment throughout childhood and adolescence. In the bivariate analyses, difficult temperament measured at 5 months was strongly associated with the high physical aggression trajectory initially measured 1 year later. As expected, difficult temperament and coercive parenting at 5 months of age were associated ($r = .30$). This association probably reflects the day-to-day transactions between mother and child that start in utero and probably have both genetic and environmental inputs. We need to study more closely the mechanism that leads to these

associations. The method that we used cannot rule out the reciprocal effect of temperament on mothers' coercive behaviour and on later physical aggression.

It is also important to remember that our results are limited by the fact that mothers provided the information on the predictors and the outcome under study. Mothers who are more inclined to notice or report the physical aggressions of their children may be more inclined to report other problems that they have, such as smoking, family dysfunction, and negative reactions to their child. It is extremely difficult to find other observers of young children's daily aggressions, except for those who go to child care. However, many children do not go to child care, and many of those seem to be among the more aggressive.[46]

The ideal study would include independent observers of children's behaviour over long periods of time. Unfortunately, such studies with large epidemiologic samples over many years are difficult to organize and even more difficult to finance. Also note that the internal consistency of the aggression assessments at 17 and 30 months of age was low. The impact of this measurement problem and the other biases that could be related to the use of mother ratings, however, are reduced by the fact that the aggression trajectories are based on 3 different ratings over a 3-year period. The increase in physical aggression that we described corresponds to the increase reported by observational studies on small samples[47, 48] and the predictors correspond to those observed in studies with older children in which aggression was assessed by other means than mother reports.[3, 6, 49]

CONCLUSION

Results from the present study indicate that children who are at highest risk of not learning to regulate physical aggression in early childhood have mothers who have a history of antisocial behaviour during their school years, who start childbearing early, and who smoke during pregnancy and have parents who have low income and serious problems living together. All of these variables are relatively easy to measure during pregnancy. Preventive interventions should target families with high-risk profiles.

Experiments with such programs have shown long-term impacts on child abuse and child antisocial behaviour.[17, 50] However, these impacts were not observed in families with physical violence.[18] The problem may be that the prevention programs that were provided did not specifically target the parents' control over their physical aggression and their skills in teaching their infant not to be physically aggressive.

Most intervention programs to prevent youth physical aggression have targeted school-aged children.[51] If children normally learn not to be physically aggressive during the preschool years, then one would expect that interventions that target infants who are at high risk of chronic physical aggression would have more of an impact than interventions 5 to 10 years later, when physical aggression has become a way of life.

FIGURE 1
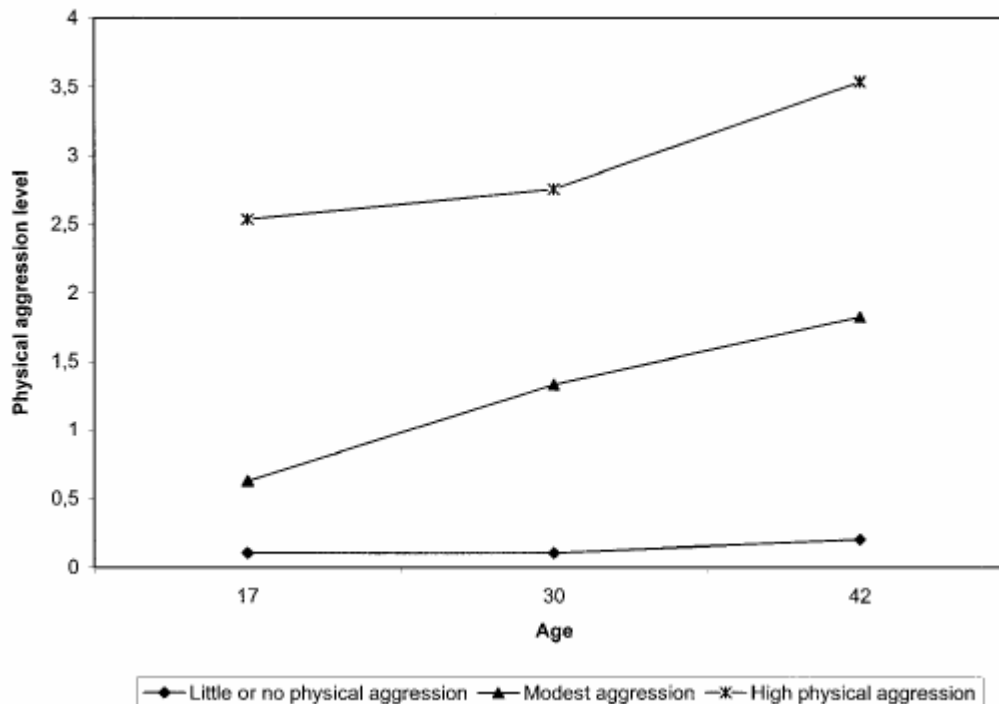**Trajectories of Physical Aggression From 17 to 42 Months Of Age**

TABLE 1
Parental and Child Characteristics by Trajectory Group

Variable	Trajectory Group			P Value on χ^2 Joint Test of Significance (df = 2)	P Value on t Tests of High vs Low and Medium (df = 1)
	Low	Medium	High		
N	140	294	70	N/A	N/A
At birth, %					
Male	38.6	50.3	58.6	.012	.032
Young siblings	16.4	40.8	57.1	<.001	<.001
Low income	20.5	20.2	43.9	<.001	<.001
Parents separated	3.7	3.2	11.8	.025	<.001
Early motherhood	22.8	22.2	42.4	.004	<.001
Young mother now	26.2	20.0	31.3	.094	.048
Mother no high school diploma	5.3	9.7	15.4	.071	.036
Mother antisocial (before end of high school)	.1	4.9	14.0	.016	.003
Mother smoked (during pregnancy)	20.1	22.1	38.2	.014	.003
Mother drank alcohol (during pregnancy)	3.0	5.0	4.4	.93	.479
Maternal postpartum depression	17.9	16.6	29.4	.067	.008
Father antisocial (before end of high school)	13.6	11.2	12.9	.768	.418
At 5 mo of age, %					
High family dysfunction	32.8	29.2	53.8	.001	<.001
Mother coercive parenting	8.1	12.1	31.3	.001	<.001
Mother feels ineffective	18.3	17.5	20.9	.814	.271
Difficult temperament	25.4	21.2	40.0	.010	.003

TABLE 2
Predictors of High Aggression Trajectory: Multivariate Logit Model

Variable	At-Birth Variables Only		At-Birth and 5 Months Old Variable	
	OR	90% CI	OR	90% CI
At birth, %				
Male	1.6	(0.9–2.8)	1.4	(0.8–2.6)
Young siblings	4.1*	(2.3–7.5)	4.0*	(2.2–7.4)
Low income	2.7*	(1.4–5.4)	2.6*	(1.3–5.2)
Parents separated	3.5	(0.9–14.3)	3.1	(0.7–12.9)
Early motherhood	3.0*	(1.4–6.6)	3.1*	(1.4–6.8)
Young mother now	0.8	(0.3–1.8)	0.7	(0.3–1.8)
Mother no high school diploma	0.7	(0.3–1.8)	1.0	(0.4–2.5)
Mother antisocial (before end of high school)	3.6*	(1.4–9.5)	3.1*	(1.1–8.6)
Mother smoked (during pregnancy)	2.7*	(1.5–4.9)	2.2*	(1.1–4.1)
Mother drank alcohol (during pregnancy)	1.0	(0.2–5.9)	0.9	(0.1–5.3)
Maternal postpartum depression	2.0*	(1.0–3.7)	1.7	(0.9–3.3)
Father antisocial (before end of high school)	0.8	(0.3–1.8)	0.7	(0.3–1.7)
At 5 mo of age				
High family dysfunction	—	—	2.2*	(1.2–4.1)
Mother coercive parenting	—	—	2.3*	(1.1–4.7)
Mother feels ineffective	—	—	0.6	(0.3–1.4)
Difficult temperament	—	—	1.5	(0.7–3.1)

CI indicates confidence interval.
* significant for α = .05 (1-tailed test).

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