Parental and Early Childhood Predictors of Persistent Physical Aggression in Boys From Kindergarten to High School

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Background: In a prior study, we identified 4 groups following distinct developmental courses, or trajectories, of physical aggression in 1037 boys from 6 to 15 years of age in a high-risk population sample from Montréal, Québec. Two were trajectories of high aggression, a persistently high group and a high but declining group. The other 2 trajectories were a low group and a moderate declining group. This study identified early predictors of physical aggression trajectories from ages 6 to 15 years.

Methods: In this study, logistic regression analysis was used to identify parental and child characteristics that distinguished trajectory group membership.

Results: For boys displaying high hyperactivity and high opposition in kindergarten, the odds of membership in the 2 high aggression groups were increased by factors of 3.0 (95% confidence interval [CI], 2.0-4.3) and 2.7 (95% CI, 1.9-3.8), respectively, compared with boys without these risks. Counterpart odds ratios for the risk factors of mothers' teen-onset of parenthood and low educational attainment were 1.6 (95% CI, 1.1-2.2) and 1.8 (95% CI, 1.3-2.4), respectively. Only the maternal characteristics distinguished between the trajectory of persistently physical high aggression and the trajectory starting high but subsequently declining. For the 2 maternal risk factors combined, the odds ratio of persisting in high level physical aggression was 9.4 (95% CI, 2.9-30.4).

Conclusions: Kindergarten boys displaying high levels of opposition and hyperactivity are at high risk of persistent physical aggression. However, among kindergarten boys who display high levels of physical aggression, only mothers' low educational level and teenage onset of childbearing distinguish those who persist in high levels of physical aggression.

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YOUTH WHO persistently violate the basic rights of others are classified in the *DSM-IV*[1] as having conduct disorder (CD). Four categories of behavior can lead to a CD diagnosis: physical aggression, property destruction, deceitfulness or theft, and serious rules violations. However, youth with childhood-onset CD (*DSM-IV,* CD before age 10 years) have been found to exhibit more physical aggression than those with a later age of onset.[2]

This study reports on the parental and early childhood predictors of the developmental course of physical aggression, hereafter called a *developmental trajectory*. It is a follow-up to our prior study[3] of the same 1037 boys, from low socioeconomic neighborhoods in Montréal, Québec, in which we identified 4 distinctive developmental trajectories of physical aggression from ages 6 to 15 years: a *chronic physical aggression trajectory* (4%) composed of boys displaying persistently high levels of physical aggression; a *high*

level declining trajectory (28%) composed of boys who displayed a high level of physical aggression in kindergarten but whose aggression thereafter declined; a *moderate level declining trajectory* (52%) composed of boys who displayed modest physical aggression in kindergarten but whose aggression thereafter declined to virtual cessation; and a *low trajectory* (17%) composed of boys who rarely displayed physical aggression. Similar trajectories were observed in 2 large samples from New Zealand and in another sample from Canada.[4]

All trajectories were basically stable or declining from age 6 years and older. Self-reported physical violence, theft, and serious delinquency at age 17 years and court-recorded infractions before age 18 years all increased sequentially from the low aggression to the chronic aggression groups. These results suggest that children with the highest levels of physical aggression in kindergarten were most prone to follow the path of chronic violence. Physical aggression problems that lead to

SUBJECTS AND METHODS

SUBJECTS

The subjects in this study were part of a longitudinal study that started in the spring of 1984, when all teachers of kindergarten classes in the 53 schools of the lowest socioeconomic areas in Montréal were asked to rate the behavior of each boy in their classroom. The mean and median family income when the boys were age 10 years (1988) was between Can $25000 and Can $30000 (US $19000 and US $23000) compared with a median income of Can $44000 for Canadian couples with children in 1987.[31] Eighty-seven percent of the kindergarten teachers agreed to participate, and 1161 boys were rated. To control for cultural effects, the boys were included in the longitudinal study only if both of their biological parents were born in Canada and their parents' mother tongue was French. Thus, a homogeneous white, French-speaking sample was created. The sample was reduced to 1037 boys after applying these criteria and eliminating those who declined to participate and those who could not be located. Informed consent was regularly obtained from mothers and the youth throughout the study.

Participation rates in follow-up interviews were high but still short of 100%. The trajectory estimation procedure used to identify the groups, described in the introduction, is designed to accommodate missing data in an individual's assessment record.

When in kindergarten, 67% of the boys lived with both of their parents, 24% lived with only their mothers, and 5% lived with their mother and a man other than their father; the rest lived in other family arrangements. The mean±SD age of the parents at the birth of their child was 25.4±4.8 years for the mothers and 28.4±5.6 years for the fathers. The mean±SD age at the birth of their first child was 23.8±4.1 years for the mothers and 26.4±5.1 years for the fathers. The mean±SD number of school years completed by the parents was 10.5±2.8 years for the mothers and 10.7±SD years for the fathers. The mean score on the

Canadian socioeconomic index for occupations was 38.15 for mothers and 39.19 for fathers. This index ranges from 17.81 for the lowest status to 101.74 for the highest, with a mean±SD of 42.74±13.28.[32] The mean scores for the mothers and fathers in this sample correspond to jobs such as file clerk, hospital attendant, or unskilled factory worker.

MEASURES

Parental and Family Characteristics

Interviewers with postsecondary education were trained to interview mothers by telephone after the initial teacher assessments in kindergarten. Questions included years of school completed by the mother and the child's father; their birth dates; the date of birth of each of their children; their employment status, including the type of job held or type of last job if they were not presently working; and whether she was living with the child's father. From these data, the following binary indicator variables were constructed: *Teenage mother* and *teenage father* identify whether the boy's mother and father first became parents as teenagers. *Low education mother* and *low education father* indicate mothers and fathers who completed 9 or fewer years of schooling. For both sexes, this put them in the lower quartile of the parental education distribution for the sampled boys. *Low SES mother* and *low SES father* define mothers and fathers who were in the lower quartile of the sample distribution of the Canadian socioeconomic index of occupations for each sex. *Not intact* identifies natural parents who separated or divorced before the boy's sixth birthday.

Behavior Ratings

Physical aggression, opposition, hyperactivity, inattention, anxiety, and prosocial behavior were rated by the teacher most knowledgeable about the child at ages 6 and 10 to 15 years using the Social Behavior Questionnaire.[33] The teachers were given a list of statements describing children's behavior and were asked to rate how often (often, 2; sometimes, 1; never, 0) the child behaved according to

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adolescent violence develop before school entry,[5-10] and a search for risk factors should target prenatal, perinatal, and early childhood factors.[11]

This study aimed to identify variables established early in the boys' lives that (1) differentiated the chronic and high declining aggression groups from the more normative, low level, and moderate level declining groups and (2) discriminated the high (but) declining group from the chronic group. The latter comparison is of special interest because predictors of the cessation of violence have not been adequately investigated.

Two categories of variables were examined, characteristics of the parents and of the boy. Parental characteristics included low educational attainment, first becoming a parent as a teenager, low socioeconomic status (SES), and separation or divorce before the boy's sixth birthday. Based on prior research,[12-21] each of these is predicted to increase the risk of a child's membership in the 2 high physical aggression trajectories compared with the 2 lower level groups. Except for the separation and di-

vorce variables, all parental risk factors were established before the boy's birth. However, because genetically informative data were not available, we cannot determine whether their association with the boy's behavior is due to shared genes or environmental conditions.

Regarding the boy himself, based on research showing that cognitive[22-24] and behavioral[25-28] characteristics are associated with physical aggression, a child's low IQ, high hyperactivity, high opposition, and high inattention were expected to increase the risk of membership in the 2 high aggression trajectories. Also, high anxiety and high prosocial behavior were included as protective factors.[29,30]

RESULTS

Table 1 reports the prevalence of each risk and protective factor by trajectory group. The teenage mother, low maternal education, household not intact, low IQ, high

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the description. Physical aggression at ages 6 and 10 to 15 years was assessed with 3 items: fights with other children; kicks, bites, or hits other children; and bullies or intimidates other children (Cronbach α=0.78-0.87; mean, .84). Opposition in kindergarten was assessed with 5 items: does not share materials, irritable, disobedient, blames others, and inconsiderate (Cronbach α=0.84). Hyperactivity in kindergarten was assessed with 2 items: squirmy, fidgety; and does not keep still (Cronbach α=0.87). Inattention in kindergarten was assessed with 2 items: inattentive and has poor concentration (Cronbach α=0.74). Anxiety in kindergarten was assessed with 5 items: is worried; tends to do things on his own, solitary; miserable, unhappy; fearful, afraid of new things; and cries easily (Cronbach α=0.76). Prosocial behavior in kindergarten was assessed with 10 items: tries to stop quarrels, invites bystanders to join in, tries to help someone who is hurt, helps pick up things someone else dropped, praises work of less able children, shows sympathy toward someone who made a mistake, helps children having difficulty with a task, helps children who are sick, comforts crying or upset child, and helps clean up mess made by someone else (Cronbach α=0.92).

From these measurements, the binary variables *high hyperactivity*, *high opposition*, *high inattention*, *high anxiety*, and *high prosociality* were constructed. Each identifies boys in about the upper quartile of each of the respective sample distributions.

Verbal IQ Assessment

Verbal IQ was assessed at age 13 years with the Sentence Completion Test.[34] Intelligence quotient is generally relatively stable from kindergarten to adolescence.[35] The assessment at age 13 years should give an estimate of the relative ranking of the boys on cognitive performance when they were in kindergarten. A correlation of 0.67 was found when the Sentence Completion Test score at age 13 years for a subsample of subjects (n=80) was correlated with an IQ assessment at age 10 years using the vocabulary and block design subtest of the Wechsler Intelligence Scale for Children–Revised. *Low IQ* identifies boys in the lower quartile of the sample verbal IQ distribution.

DATA ANALYSIS

The analysis was designed to identify risk and protective factors distinguishing the 4 trajectory groups described in the introduction. The technical details of the semiparametric, mixture model used to identify these groups are described elsewhere.[36] One key output of the model, called the *posterior probabilities of group membership*, was central to the analyses reported herein. For each individual in the sample, these probabilities estimate the probability of the individual's belonging to each trajectory group. For example, consider an individual who persistently received high physical aggression ratings by teachers. For this individual, the posterior probability estimate of his belonging to the low trajectory group would be near zero, whereas the estimate of his belonging to the chronic group would be high. Individuals were assigned to the group with the largest posterior probability estimate. This is the group that best conforms to a boy's observed behavior. These group membership designations form the point of departure for this analysis. Multinomial and binary logistic regression analyses were performed to identify parental and early childhood characteristics that distinguish membership in the various trajectory groups.

The analysis proceeded in 2 stages. First, χ^2 tests of joint significance were used to identify parental and early childhood risk and protective factors that were statistically significant in distinguishing membership across the 4 trajectory groups. The second-stage analysis examined the capacity of these statistically significant risk and protective factors to distinguish membership in the 2 lower physical aggression trajectories, the low and the moderate declining groups, from the 2 high physical aggression trajectories, the chronic and the high declining groups. We also examined the capacity of these factors to distinguish between the chronic and the high declining groups alone. Results of the analysis were substantively identical for models in which the risk variables were entered in their nonbinary form. Throughout, 2-tailed tests of significance were conducted for α=.05.

hyperactivity, high opposition, high inattention, and high prosociality variables significantly distinguished group membership. Furthermore, except for the prosociality factor, their prevalence increases sequentially from the low group to the chronic group. This accords with expectations. For the prosociality variable, the pattern is reversed, which is also as expected. However, neither mother's nor father's low SES was significant, nor were the early parenthood or low education factors for the father significant. Thus, in toto, the fathers' characteristics did not distinguish trajectory group membership. In addition, child high anxiety was no significant predictor.

The second column of **Table 2** reports the results of the multivariate logistic regression analysis aimed at distinguishing boys (69%) who follow the 2 low physical aggression trajectory groups from their counterparts in the 2 high trajectory groups. Entries in the table are the odds ratios for each of the risk or protective factors found to be significant in Table 1. The results show that the magnitudes of the impacts are substantial. Maternal

risk factors of low education and teenage motherhood increased the odds of a high aggression trajectory by 77% and 57%, respectively. The largest impacts were for the behavioral and cognitive risk factors of the child himself. Low verbal IQ was associated with a nearly 2-fold increase in the odds of a high aggression trajectory, while high hyperactivity and high opposition increased the odds by nearly 3-fold. In contrast, prosociality decreased the odds of high aggression by more than half. In combination, the 2 largest risk factors, high hyperactivity and high opposition, increased the odds of high aggression by a factor of 8.0 (95% confidence interval [CI], 5.2-12.2). Only the high inattention risk factor was statistically insignificant in this multivariate model.

Odds ratio calculations do not measure the absolute risk of the behavior for persons with and without the risk factor. As would be expected from the odds ratio analysis, the highest rate of absolute discrimination was for the high hyperactivity risk factor; 63% of the high hyperactivity boys belonged to a high aggression group,

Table 1. Parental and Child Characteristics by Trajectory Group*

| | Trajectory Groups | | | | | |
Variable	Low (n = 191)	Moderate Declining (n = 518)	High Declining (n = 298)	Chronic (n = 30)	χ^2†	P‡
Parent variable						
Teenage mother	12.6	20.7	28.9	53.3	33.28	<.001
Teenage father	4.2	5.6	7.3	13.3	4.49	.21
Low education						
Mother	23.6	28.2	40.9	66.7	35.74	<.001
Father	27.7	31.7	38.3	40.0	7.15	.07
Low SES						
Mother	19.9	20.0	23.2	30.0	2.54	.47
Father	12.6	13.3	17.1	10.0	3.21	.36
Family not intact at age 6 y	15.1	26.6	38.3	43.3	35.82	<.001
Child variable						
Low IQ	19.9	22.6	36.5	43.3	27.19	<.001
High hyperactivity	1.6	16.0	43.6	46.6	161.01	<.001
High opposition	1.6	26.8	51.7	63.6	187.85	<.001
High anxiety	33.5	27.4	27.2	36.6	3.74	.29
High prosocial	28.8	25.9	12.1	10.0	31.73	<.001
High inattention	7.9	16.0	32.6	40.0	59.29	<.001

*Data are given as percentages unless otherwise indicated. SES indicates socioeconomic status.
†df = 3.
‡Joint test of significance.

Table 2. Predictors of High Physical Aggression and of Chronic Physical Aggression*

| | Trajectory Groups | |
Variable	High (n = 328) vs Low Aggression (n = 709)†	Chronic (n = 30) vs High Declining (n = 298)‡
Low education mother	1.8 (1.3-2.4)	3.2 (1.4-7.4)
Teenage mother	1.6 (1.1-2.2)	2.9 (1.3-6.4)
Family not intact at age 6 y	1.4 (1.0-2.0)	1.1 (0.5-2.5)
Low IQ	1.8 (1.3-2.5)	1.1 (0.5-2.6)
High hyperactivity	3.0 (2.0-4.3)	0.6 (0.2-1.5)
High opposition	2.7 (1.9-3.8)	2.1 (0.9-5.4)
High inattention	1.1 (0.8-1.7)	1.1 (0.4-3.0)
High prosocial	0.5 (0.3-0.7)	1.0 (0.3-3.6)

*Data are given as odds ratio (95% confidence interval).
†Low aggression combines the low and moderate declining groups, and high aggression combines the high delinquency groups. df = 1028.
‡df = 319.

compared with only 23% of the boys without this risk factor. Still, even for hyperactivity, it is clear that no single risk factor is decisive in predicting trajectory group membership.

Only 2 factors distinguished between the high level declining and chronic trajectories, and both measured maternal characteristics. The low education and teenage mother risk factors increased the odds of following the chronic trajectory by factors of 3.2 (95% CI, 1.4-7.4) and 2.9 (95% CI, 1.3-6.4), respectively. In combination, they increased the odds by a factor of 9.4 (95% CI, 2.9-30.4). Thus, whereas the individual-level psychological and cognitive variables have the largest impacts on the risk of a boy following a high vs low physical aggression trajectory, the mother-related variables seem to be most important in distinguishing the boys who de-

sist from high levels of physical aggression from those who persist in it. Still, these 2 maternal characteristics fall well short of definitively identifying the chronic group from the high declining group. For this subset of boys, 9.1% were in the chronic group. For those with the low education and teenage mother risk factors, the percentage belonging to chronic groups is 14.0% and 15.7%, respectively. For those with both these risk factors, 21.3% are in the chronic group.

COMMENT

The focus of this analysis was establishing risk factors for the various trajectories of physical aggression in boys from 6 to 15 years of age. A host of risk factors were identified that distinguish the 2 low physical aggression trajectories from the 2 high trajectories. Concerning these risk factors, 2 findings stand out. The most powerful predictors of membership in a high aggression trajectory group were high levels of hyperactivity and opposition assessed in kindergarten. Individually, these risk factors increased the odds of membership in a high physical aggression trajectory by about a factor of 3. In combination, the increase is more than 9-fold. Individually, these risks are comparable in magnitude to the impact of high serum cholesterol levels on risk of coronary heart disease.[37] In combination, they far exceed it.

A second prominent finding concerned the predictive power of parental characteristics: only characteristics of the mother have predictive power. Whereas teen onset of parenthood and low educational attainment for mothers were significant predictors of their son's high aggression, these characteristics in the father had no predictive power.

The prominent predictive power of maternal characteristics again revealed itself in the analysis of factors

that distinguished between the 2 high physical aggression groups, the high declining and the chronic trajectories. Here, we were concerned with identifying characteristics that distinguish the modestly large fraction (28%) of boys who start off displaying high levels of physical aggression but subsequently desist, from the small but prominent group (4%) of boys who continue their physical aggression unabated. Only 2 such characteristics were identified, mother's low educational attainment and teenage onset of childbearing. The odds of male offspring of poorly educated teenage mothers not desisting from a high level of physical aggression at age 6 years are 9.3 times greater than those of their counterparts without such mothers.

Although ours is the first analysis to document that these 2 maternal characteristics distinguish persistence in from desistance of chronic physical aggression, there is a large body of evidence linking teen onset of childbearing with a litany of unfavorable behaviors and outcomes for the offspring. These include CD and other problem behaviors in childhood,[38,39] delinquency and school dropout in adolescence,[40-42] and criminality as an adult.[43]

This study does not explain why teen onset of motherhood and low maternal education are risk factors for chronic physical aggression in a mother's offspring. These 2 maternal factors are likely markers of maternal problem behaviors and circumstances that give rise to bad outcomes for her offspring rather than the causes per se. For example, more-aggressive young women are more likely to become teen mothers, to drop out of school, and to be unresponsive parents. There is also evidence that women who begin childbearing early are more likely to use harsh and erratic discipline. These mothers may also be more prone to birth complications, which have been shown to be related to subsequent conduct problems in the child.[44,45] These findings suggest that the mothers themselves may be the agents of the intergenerational transfer of chronic physical aggression. The results are not nearly definitive about the specifics of the transfer mechanism in terms of the separate and interactive roles of biology, parenting practice (including the father), and the larger social environment. Notwithstanding, they suggest that the intergenerational transfer mechanism may have profound consequences for the child and society.

There are limitations to this study. Key findings pertain to 2 maternal characteristics, early onset of childbearing and low educational attainment, which are probably markers of causal factors active long before the study began (ie, when the boys were attending kindergarten). We have speculated that adolescent mothers with low educational attainment tend to lack the skills needed to create a context in which children learn to regulate physical aggression. Future research should directly test this contention. Such studies should also control for genetic, prenatal, and perinatal factors, which have all been associated with the development of antisocial behavior.[44-48] Understanding the causal processes will have important implications for designing interventions aimed at preventing chronic physical aggression. Finally, the trajectories of physical aggression studied herein end in midadolescence. As such, they may not reflect behavioral changes resulting from important developmental shifts in biological and contextual factors during the transitions into and out of adolescence. Gains in physical size and strength accompanying puberty, coupled with reductions in parental and other adult supervision and increases in the amount and importance of peer interaction, could all trigger sudden increases in violence not captured in these analyses. Moreover, potential changes in the manifestation of these behaviors that may accompany development might not be adequately captured by the school-based assessments of teachers. Thus, it would be desirable to replicate our analyses with alternative, non–school-based measures extending later into life.

Our findings have implications for clinical practice and public policy. Special priority should be given to identifying and helping children at greatest risk for chronic physical aggression. By the end of kindergarten, there are several powerful predictors of such risk—high opposition and high hyperactivity, low IQ, family breakup, teen motherhood, and low maternal education. Interventions for these children have been shown to have some long-term impact.[49-51]

Furthermore, even earlier identification and intervention may have a greater preventive impact because learning to regulate physical aggression appears to start in the first few years after birth. Maternal characteristics are potentially powerful markers for identifying children at greatest risk of not learning such regulation. The findings suggest that special attention should be given to targeting women with low education and those who begin childbearing early. Prepartum and postpartum programs for reducing risk-taking behaviors (eg, use of cigarettes, alcohol, and other drugs) and improving parenting skills should be targeted toward these high-risk mothers. High-quality day-care programs should also be administered to their children. There is a growing body of persuasive experimental evidence demonstrating that such programs have salutary impacts on targeted children's level of behavior problems, success in school, and degree of antisocial behavior during adolescence and early adulthood.[52-57] However, it is important that the mother's participation in these programs be fully voluntary, not only to gain her full cooperation but also out of recognition that most children of poorly educated women who begin childbearing early are not destined to follow a trajectory of chronic physical aggression. Although our results show that the risk of such children being persistently violent is greatly heightened by these maternal risk factors, most of them do not follow this developmental trajectory.

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