

**THE CRACOW INSTRUMENT FOR MULTI-PROBLEM VIOLENT YOUTH:  
EXAMINING THE POSTDICTIVE VALIDITY WITH A SAMPLE OF  
PRESCHOOLERS**

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**Abstract:** The Cracow is an assessment tool used to identify the risk/need factors in youth at various developmental stages, with the goal of developing individual, familial, and community interventions for violent youth. The Cracow is comprised of three sections measuring the risk/needs of the youth, treatment and intervention options, and externalizing behaviours. The current postdictive validity study of the first section of the Cracow examines the extent to which risk/need factors identify the most physically aggressive preschoolers. The study is based on the first 100 children (boys,  $n = 58$ ; girls,  $n = 42$ ) recruited as part of the Vancouver Longitudinal Study on the Psychosocial Development of Children conducted in Vancouver, British Columbia, Canada. A series of latent class analyses (LCA) suggests the presence of three groups of physically aggressive children: a low-, medium-, and high-level group. Subsequent analyses suggest that children in the highly physically aggressive profile were more likely to have risk/need factors in the following five domains: (a) pre/perinatal, (b) socio-economic, (c) family environment, (d) child psychological functioning, and (e) parenting. Findings are discussed in light of the scientific literature on the early prevention of antisocial and aggressive behaviour.

**Key Words:** aggression, assessment, early childhood, parenting, pre/perinatal, prevention, risk factors, violence

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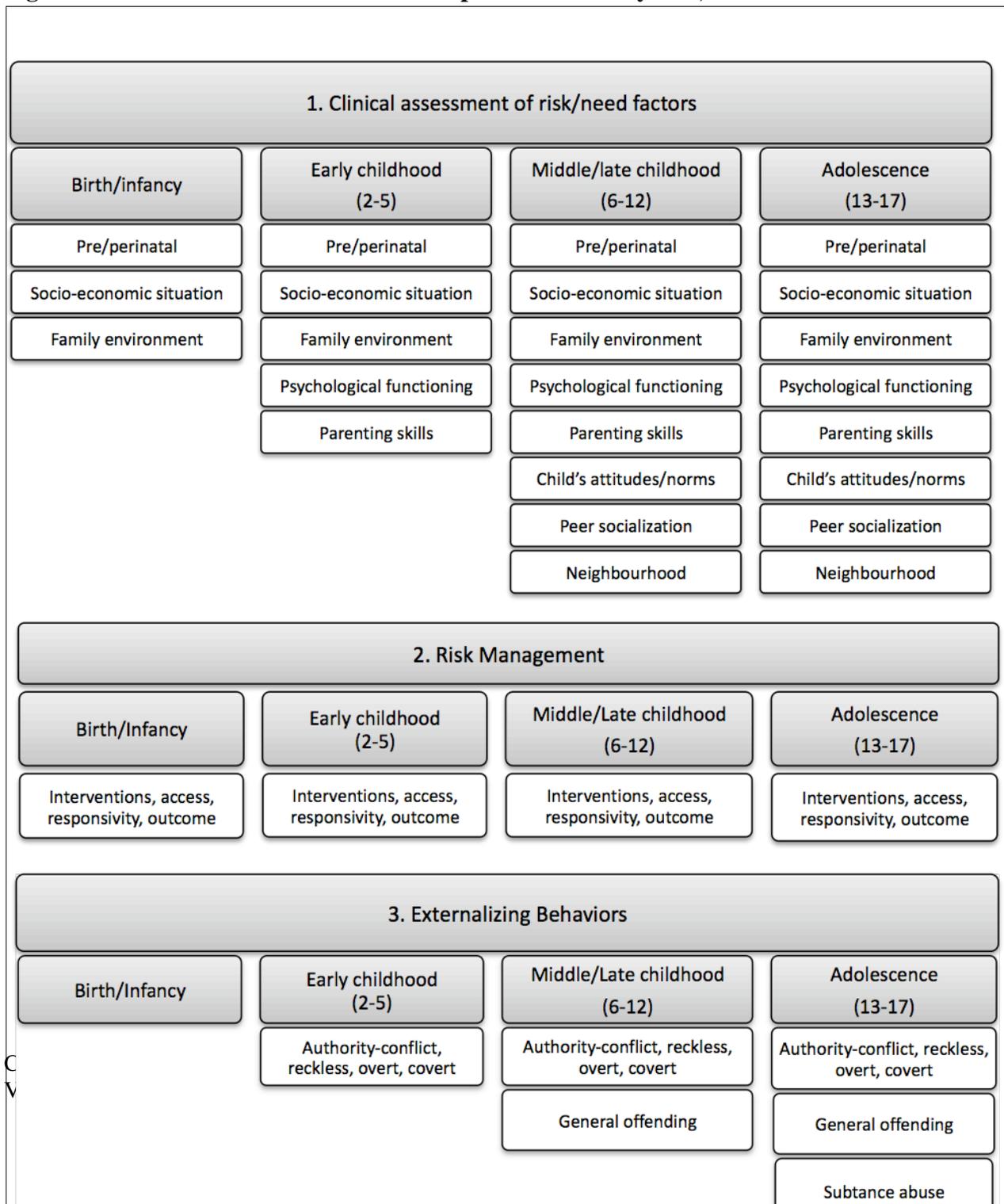
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The Cracow in its earlier form originated from an advanced research workshop funded by the Scientific Affairs Division of the North Atlantic Treaty Organization (NATO). This research workshop involved more than 30 scholars from 16 different countries and was held in the summer of 2000 in Cracow, Poland (Corrado, Roesch, Hart, & Gierowski, 2002). The purpose of the workshop was to create a procedure for assessing the risks and needs factors of violent youth. Although specific risk instruments were available at the time, researchers felt that these instruments failed to address multiple developmental periods and were not comprehensive enough in either their nature or scope (Corrado et al., 2002). Following the discussions and presentations held at the workshop, a comprehensive instrument, named the Cracow, was proposed. The instrument was designed to assist and guide government and community agencies in developing individual, familial, and community interventions intended to reduce the risk of youth violence. Youth violence was defined as the actual, attempted, or threatened physical harm of another person perpetrated by a child or an adolescent (Corrado, 2002). While the instrument's aim was to inform policy-makers about the risk/needs factors of youth violence, it was recognized that the instrument would lack some degree of specificity considering that violent youth also tended to be involved in serious but nonviolent delinquency. Not surprisingly, there is some overlap between the risk factors of youth violence and those of chronic offending (Capaldi & Patterson, 1996), serious offending (Loeber & Farrington, 1998), and sexual offending (Van Wijk et al., 2005). The instrument, however, was neither designed nor intended for the assessment and management of youth involved in minor forms of antisocial, criminal behaviours (e.g., drug use, minor property crimes, truancy, etc.). Rather, the instrument was specifically designed for assessment (i.e., evaluation of the individual and his or her environment for the purpose of determining the risk for future violent behaviour) and management purposes (i.e., intervention to reduce the risk of violence). The current study examines the postdictive validity of the Cracow framework with a small sample of preschoolers as part of the Vancouver Longitudinal study on the psychosocial development of children.

***Developmental risk/needs assessment tool.*** The Cracow instrument aimed to be multi-stage by representing the risk/needs factors in youth at various developmental stages, starting at the pre/perinatal period. Most of the current instruments used for assessing youth, such as the Structured Assessment of Violence Risk in Youth (SAVRY) (Bartell, Borum, & Forth, 1999), the Youth Level of Service/Case Management Inventory (YLS-CMI) (Hoge & Andrews, 1999), and the Measure of Social and Personal Adaptation for Adolescents in Québec (MASPAQ) (LeBlanc, 1995) were developed for a population aged 12 to 18 years. More recent studies have proposed instruments designed for the 6- to 12-year-old population (EARL-20) (Augimeri, Koegl, Webster, & Levene, 2001). These instruments are developmentally informed, reflecting developmental factors that are specific to the developmental stages they target. While these instruments are developmentally-informed, they are limited to one particular developmental period, that is, the current period of the youth (i.e., middle/late childhood; adolescence). As a result, some aspects of the dynamic development of aggression and violence are not incorporated in the instruments. Of importance, these instruments may be missing the risk/needs factors that are present in the earliest stages of the child's development, which are associated with aggression and violence (Corrado, 2002). The Cracow aims to address this limitation by incorporating the risk factors that are salient at various life stages during childhood and adolescence. The Cracow was designed to recognize the fact that the aging child is exposed to an increasing number of risk factors that may influence the risk of youth violence.

The instrument recently changed from its original framework (Odgers, Vincent, & Corrado, 2002) to reflect current developments in the field of aggression and violence. More specifically, the latest version of the Cracow is organized to include risk/needs factors that encompass birth to the end of adolescence. The Cracow was also designed to characterize the dynamic development in youth, to incorporate a wide array of risk/needs factors of youth violence, and to be in line with a developmental perspective on youth violence. The instrument was thus designed to be comprehensive and parsimonious, while being theoretically and empirically guided. These are all important components of sound assessment tools for youth (LeBlanc, 2002).

**Figure 1. CRACOW instrument for multi-problem violent youth, revised model**



### **The Theoretical/Empirical Rationale of the Cracow**

*Aggression/violence involves a dynamic process.* In its current and revised version, the Cracow (Figure 1) incorporates four developmental periods: birth/infancy, early childhood, middle/late childhood, and adolescence. This conceptual framework is built around five organizing and overarching principles about the risk/needs of violent youth that are embedded in the developmental-life-course perspective of offending. These principles suggest that the risk of aggression and violent behaviour entails a dynamic process, involving qualitative and quantitative behavioural changes over time that are multi-determined as a result of the accumulation of a series of age-graded risk factors. We review these principles and how they relate to the assessment of risk/needs. The relation between childhood aggression and violence during adolescence and adulthood is well established but not completely understood (Farrington, 1994; Huesman & Eron, 1992; Loeber & Stouthamer-Loeber, 1998). Aggression and violence are dynamic and a developmental process best describes their occurrence.

Three key processes characterize the development of aggression: (a) activation phase (i.e., the level at which the behaviour is manifested from its onset); (b) persistence phase (i.e., continuity of the behaviour over time); and (c) desistance phase (i.e., the slowing down and the termination of the behaviour over time). In other words, aggressive and violent behaviours can be plotted as a trajectory that can increase, reach a plateau, then decrease over time. Longitudinal studies show that the general trend of physical aggression can be represented by an increase from 17 to 30 months, followed by a gradual decline up to the school entry (Tremblay et al., 1999; Tremblay & Nagin, 2005). There are individual differences characterizing patterns of activation, persistence, and desistance, which can be represented by developmental trajectories. Different trajectories have been identified for the early to middle childhood period typically characterized by four to five groups: one or two groups of low-level; one group of moderate desisters; one group of high-level desisters; and one group of high-level persisters (Shaw, Gilliom, Ingoldsby, & Nagin, 2003; National Institute of Child Health & Human Development [NICHD], 2004). Similar patterns have been observed for the middle to late childhood period (i.e., 6 to 12 years old) where three to four trajectories are typically reported (Broidy et al., 2003). Using data from six different studies collected in three different countries, Broidy et al. (2003) found that the prevalence of a high-level or chronic group varied between 4% and 11% in samples of boys and 0 to 10% in samples of girls. During early childhood, the group of high-level physically aggressive children have been found to constitute 16.6% of a representative sample of Canadians from ages 2 to 11 (Côté, Vaillancourt, LeBlanc, Nagin, & Tremblay, 2006) and 14% in a sample of boys and girls followed from 5 to 42 months (Tremblay et al., 2004). All trajectories of aggression and violence can be characterized by an onset, a plateau, and desistance, but at different levels. Risk assessment should account for the presence of different trajectories as well as the three main mechanisms characterizing its development – activation, persistence, and termination.

*Aggression/violence is relatively predictable from past behaviours.* While there are quantitative changes in aggression and violence characterized by different patterns of activation,

persistence, and termination, there are also important qualitative changes over time (LeBlanc & Loeber, 1998; Loeber & LeBlanc, 1990). From a developmental perspective, manifestation of aggression and violence develops along a continuum with behaviours constantly evolving as the child ages and persists. Hence, there is a series of age-graded manifestations of aggressive and violent behaviours that follows a relatively predictable path. These manifestations change as the aging child is exposed to different social contexts, settings, and opportunities (Moffitt, 1993; Patterson, 1993). This process has been referred to as heterotypic continuity, or the persistence of conceptually similar but different behaviours over time. The qualitative changes in aggression and violence have been extensively described and documented by Loeber and colleagues (Loeber et al., 2003; Loeber & Hay, 1997). These researchers found evidence of a three-pathway model that can account for most delinquent patterns: (a) authority-conflict pathway, (b) covert pathway, and (c) overt pathway. Most children will not go through all the stages as termination of the behaviour tends to occur at the earliest stages for most children. Hence, as aggression and violence develops along a developmental pathway, past behaviours may inform risk assessors about the behaviour that may follow if the child persists in being aggressive and violent. We concur with LeBlanc (1999) in saying that the best predictor of future behaviour is past behaviour. Trajectories of physical aggression are linked to those of violent and nonviolent delinquency during adolescence (Brame, Nagin, & Tremblay, 2001; Broidy et al., 2003). In fact, physical aggression has been shown to be linked to violent and non-violent juvenile delinquency, even after controlling for potentially confounding factors such as nonaggressive conduct problems, and being oppositional and hyperactive (Broidy et al., 2003).

***Aggression/violence is multidetermined.*** The risk of aggressive and violent behaviours involves a combination of individual and environmental factors. This is often referred to as the principle of equifinality or the possibility of various causes leading to the same outcome. This idea is consistent with the observation that a single risk factor typically shows a small-to-modest effect size (Hawkins et al., 1998; Lösel, 2002). Generally speaking, criminologists have emphasized the role of six key developmental processes. A comprehensive risk assessment tool should include items tapping these six key mechanisms:

1. Biological vulnerabilities: genetic and/or biological deficits that may affect the neuropsychological development of children (e.g., Moffitt, 1993);
2. Economic deprivation: the low socio-economic situation – a poor educational background, difficulties finding a job, or low family income – that may have several negative influences on the child's development, such as causing stress on the family and disrupting the quality of parenting (e.g., Farrington, 2005; LeBlanc, 2005);
3. Personality development: the movement away from a purely egotistic and self-centred perspective to one characterized by prosociality, empathy, and concern for others (e.g., Lahey & Waldman, 2005; LeBlanc, 2005);
4. Bonding: the psychological and social attachment between the child and parents, as well as the child and social institutions (e.g., Farrington, 2005; LeBlanc, 2005);
5. Modelling: exposure to aggressive and violent models which may reinforce the use of such behaviours in the child, especially when these aggressive or violent manifestations lead to compliance of the person being coerced or victimized (Patterson & Yoerger, 1993); and

6. Constraining of the behaviours: the development of adequate cognitive and behavioural skills to self-control urges to act in an aggressive or violent way (e.g., Gottfredson & Hirschi, 1990; LeBlanc, 2005).

***Aggression/violence is the result of an accumulation of risk factors.*** Aggression and violence are the results of an accumulation of risk factors starting at the earliest developmental stages (Farrington, 2005; Lösel & Bender, 2006). Hence, the risk of elevated levels of activity, persistence, or delayed termination of aggression/violence should be understood as the accumulation effect of multiple risk factors and not the result of one specific risk factor. Individuals vary in terms of the number of risk factors they are exposed to, the number of risk factors that accumulate from one developmental period to another, but also the strength of these risk factors (Loeber, Slot, & Stouthamer-Loeber, 2008; Thornberry & Krohn, 2005). In line with Caspi and Roberts (2001), we understand the accumulation of risk along three dimensions: the genetic makeup (i.e., biological vulnerabilities, personality development); the social environment (i.e., economic deprivation, modelling, bonding, constraining); and the person-environment transactions.

Person-environment transactions involve three facets of developments that may impact the likelihood of aggression and violent behaviours (Caspi & Roberts, 2001; Lahey & Waldman, 2005; Moffitt, 1993). The first facet, reactive transactions, refers to how an individual's temper, in combination with life experiences, will favour the emergence of particular interpretations or scripts of social situations and interactions (Caspi, 2000; Caspi & Roberts, 2001; Crick & Dodge, 1996). Evocative transactions refer to the process by which the child evokes certain reactions from the environment. As the child ages and behaviours and attitudes persist, these reactions may be experienced in different contexts and settings (e.g., daycare, home, school, workplace). Proactive transaction involves the process by which the aging child selectively chooses settings, contexts, and social environments that may reinforce rather than change his or her current behaviours, such as delinquent peers, gangs, organized crime, etc. The aggressive child, therefore, might come to interpret social interactions as negative and hostile, evoke negative reactions from others that may confirm these scripts, and, as a result, select specific environments that may entrench his or her disposition towards aggression and violence. These processes influence how risk factors are maintained over time, but also how new risk factors may be added.

***Risk should be developmentally-informed.*** Developmentalists such as Loeber et al. (2008) understand development as comprising a series of life transitions to which the aging child is gradually exposed. As such, developmentalists typically distinguish the following life transitions: (a) birth, (b) preschool, (c) elementary school, (d) middle/secondary school, and (e) early adulthood. Each of these periods has been associated with specific risk factors associated with aggression and violence (Loeber & Hay, 1997; Lösel & Bender, 2006; Farrington, 2005). The domains of risk may change from one developmental period to another (Thornberry, 2005; Loeber et al., 2008). Therefore, the aging child is exposed to an increasing number of risk factors over time (Thornberry & Krohn, 2005). Similarly, life-course theorists understand life transitions as opportunities for change that may be more powerful than the developmental history (Sampson & Laub, 2005). In this regard, Elder (1998) argued that individual differences are minimized in life transitions when the new circumstances resemble a total institution, that is, for example, reform school, military service, or prison (see also, Sampson & Laub, 2005). Developmentalists,

however, have challenged this view by stressing the importance and the role of cumulative deficits (Caspi, 1998; Moffitt, 1993). The child's difficulties and deficits are likely to spill over and influence his or her ability to confront new risk factors and adapt to the new transitions, a process often referred to as cumulative deficits. Hence, children exposed to a higher number of adversities from birth may have more difficulties in developing the set of skills necessary to prepare for school entry. While long-term prediction of violent behaviours is far from being perfect, as a result of the dynamic processes associated with the development, it still shows that early childhood risk factors are linked to violent behaviours 40 years later (Lussier, Farrington, & Moffitt, 2009). The persistence and accumulation of new risk factors across developmental periods should be an integral part of an assessment tool. The reverse is also true as life circumstances might change from one period to another and certain risk factors might be removed or stopped.

### *Aim of the Study*

The aim of this study is to provide baseline information about the validity of the Cracow instrument at the earliest developmental stages. More specifically, this study is focused on the concurrent validity of the assessment tool in the identification of highly aggressive children. The study examines the convergent and postdictive validity of five domains of risk/protective factors: (a) pre/perinatal; (b) social structure; (c) family environment; (d) child's psychological functioning; and (e) parenting skills. In doing so, the study will examine the validity of each of those domains but also the effect of the accumulation of risk factors through the total score on the Cracow instrument.

## **Methodology**

### *Sample*

The study is based on the first 100 children (boys,  $n = 58$ ; girls,  $n = 42$ ) recruited as part of the Vancouver Longitudinal Study on the Psychosocial Development of Children (KD-BEAR Project) conducted in Vancouver, British Columbia (B.C.), Canada. The KD-BEAR Project (i.e., Kids' development of behavioural, emotional and aggression regulation) is an ongoing longitudinal project that aims to inform policy-makers about the key early risk and protective factors of aggression and violence in at-risk children from the earliest developmental periods. This project was initiated by the B.C. Ministry of Children and Family Development and the B.C. Ministry of Health, in collaboration with researchers affiliated with the B.C. Children's Hospital and the School of Criminology at Simon Fraser University. All children included in the study were recruited between February 2008 and April 2009. Two samples were recruited for this study. First, a clinical sample ( $n = 14$ ) was recruited from the Infant Psychiatric Clinic at the B.C. Children's Hospital. Clinical practitioners informed the primary caregiver about the KD-BEAR project. The inclusion criteria were as follows:

1. The child is currently being assessed and/or treated for any externalization spectrum disorder.
2. The child is between 3 and 5 years old.

3. Both the child and the primary caregiver have a reasonable understanding of English.
4. The child and the primary caregiver reside in and around the city of Vancouver and the Greater Vancouver Regional District (GVRD).

For the majority of this sample (58.3%), concern over the child's aggressive behaviour was one of the main reasons cited for referral to the clinic for assessment/treatment. Based on the clinical assessment conducted at the clinic, this sample of children was mainly characterized by Attention-Deficit-Hyperactivity Disorder (ADHD, 63.6%) and Oppositional Defiant Disorder (ODD, 18.2%).

Second, the research program also includes a community sample ( $n = 86$ ) for comparative purposes. The community sample was recruited within vulnerable neighbourhoods in the city of Vancouver and the GVRD. More specifically, the recruitment took place in seven cities: Burnaby, Coquitlam, New Westminster, Port Coquitlam, Port Moody, Vancouver, and Surrey. In each of these cities, the neighbourhoods ranked in the lowest 25% by two provincial surveys were selected for those studies (Kershaw, Irwin, Trafford, & Hertzman, 2005). This survey ranks the neighbourhoods according to various indicators related to the socio-economic status of the family and the psychosocial development of preschoolers. Based on the results of this survey, we established a catchment area of daycares in vulnerable neighbourhoods. Local managers of community daycares were contacted to participate in the study. In each of the participating daycares, the research team put up posters informing parents about the study. The inclusion criteria were similar for the community and the clinical samples with the exception that having been referred for an externalizing spectrum disorder was not a requirement for the community sample. It is important to stress the fact that the neighbourhoods, not the families or the children, were sampled for the study. It was therefore expected that, in spite of targeting vulnerable neighbourhoods, the community sample would still get a reasonable range of families in terms of risk factors (i.e., low-risk, medium-risk, high-risk).

### *Procedures*

The present study focused on the first wave of data. One in-person interview was conducted with each research participant. Simultaneous interviews with the primary caregiver and the child were conducted as part of the wave 1 data collection. The vast majority of primary caregivers interviewed were the biological mothers of the children (88.1%). In rare instances, the biological father (7.0%) or an adoptive parent (5.0%) was interviewed. On average, the primary caregiver interview lasted about two and a half hours. The interview protocol was standardized across research participants and the data were collected using a computerized questionnaire. The child interview protocol was also standardized and lasted between 45 and 90 minutes. The interview protocol included a series of tasks and tests to assess the child's cognitive and self-regulation abilities. Both the primary caregiver interview and the child interview were conducted by trained research assistants. The study was conducted according to the ethical guidelines set by Simon Fraser University, the University of British Columbia, and the B.C. Children's Hospital. Participants were either referred from The Child Infant Psychiatry Clinic at B.C. Children's Hospital or they responded to posters describing the project distributed in the community. Because of the unsolicited nature of the sampling procedure, refusal rates are unknown.

Participation in the study was voluntary and the participants were informed that they could withdraw from the study at any time. The primary caregivers were paid \$40 for their participation in the study. They all signed a consent form indicating that the information was confidential and collected for research purposes only.

### **Measures**

**Covariates.** Several covariates were included in the study to explore possible individual differences in the level of aggression. Two sets of characteristics were examined. First, child characteristics included four general individual characteristics: (a) gender (0 = male, 1 = female); (b) age (i.e., coded as the child's age at the time of the interview); (c) ethnic origin (0 = Caucasian, 1 = non-Caucasian); and (d) sample (i.e., whether the child was a clinical referral or recruited from the community; 0 = clinical, 1 = community). Second, we also included socio-demographic characteristics of the family environment: (a) a variable controlled whether the biological mother was interviewed (0 = no, 1 = yes); (b) the annual familial income was examined; (c) the covariates also included a variable measuring whether or not single parenthood reflected the family structure of the child (0 = no, 1 = yes); and (d) the study controlled for the presence of one or more siblings (0 = no, 1 = yes).

**Cracow.** The Cracow (Corrado, 2002; Lussier & Corrado, 2009) was coded based on an interview with the primary caregiver. The section referring to the risk management of aggression/violence was not included for the current study. The risk/needs section of the Cracow was completed by the interviewers. For preschoolers, the section includes five domains or risk/needs factors: (a) pre/perinatal (Mean = 2.10, Standard Deviation = 1.57, Range = 0-8); (b) socio-economic situation ( $M = 2.06$ ,  $SD = 2.73$ , Range = 0-9); (c) family environment ( $M = 2.84$ ,  $SD = 2.18$ , Range = 0-9); (d) child psychological functioning ( $M = 3.90$ ,  $SD = .230$ , Range = 0-10); and (e) parenting ( $M = 1.21$ ,  $SD = 1.24$ , Range = 0-5).

The pre/perinatal domain (five items) includes factors that may lead to or are associated with neuropsychological deficits of the child (i.e., maternal substance use during pregnancy, pregnancy-related complications, birth-related complications, low birth weight, and premature birth). The socio-economic situation (five items) measures the presence of socio-economic deprivation in the family (i.e., low occupational status, low family income, poor parental education, familial adversities such as large family size or high residential mobility, and economic dependency). The family environment (six items) taps the criminogenic aspect of the family of origin (i.e., mental health problems of one or both parents, antisocial behaviours of one or both parents, criminal history of one or both parents, presence of intimate partner violence, poor familial support, and antisocial parental attitudes). The child psychological functioning (six items) refers to the following: low verbal intelligence, callousness, negative emotionality, daring and risk taking, attention deficits, and hyperactivity. The parenting domain (four items) includes risk/needs factors that measure: the presence of a hostile parenting style, the lack of consistent discipline, the lack of positive involvement with the child, and the presence of inadequate norms or rules.

Each of the items for the five domains of risk/needs factors were scored using a three-point scale: (0) absence of the risk factor; (1) risk factor is somewhat present; and (2) the risk factor is definitely present. Each domain was completed and scored by a research assistant using

the information collected during the interview and following the scoring procedure of the instrument (Lussier & Corrado, 2009). The score of the risk/needs factors were summed to create the total score of the Cracow scale (26 items, Alpha = .77) for the preschool period (Mean = 12.11; Standard Deviation = 6.19; Range = 3-29).

**Physical Aggression.** In line with earlier studies on physical aggression in childhood (Broidy et al., 2003; Lussier & Healey, 2009; Tremblay et al., 2004), four indicators were used to measure the level of physical aggression: (a) kicked, bitten, or hit anyone; (b) shoved, pushed; (c) fought (physically); and (d) thrown things at other people. The primary caregiver was asked to determine the frequency of each of those four manifestations using a four-point scale: (0) never; (1) a few times; (2) several times; (3) very often. The majority of the children sampled for this study had kicked (64%), shoved (68%), fought (22%), or thrown things at someone (51%) at least once in the past year. As a group, this sample of children had been physically aggressive only a few times in the past year: kicked (Mean = 1.13, Standard Deviation = 1.03, Range = 0-3); shoved ( $M = 1.22$ ,  $SD = 1.03$ , Range = 0-3); fought ( $M = .42$ ,  $SD = .85$ , Range = 0-3); and thrown things ( $M = .83$ ,  $SD = .93$ , Range = 0-3). These averages, however, masked the fact that about one-third of our sample had, at least on several occasions, kicked (38%), shoved (32%), fought (16%), or thrown things at someone (28%) in the past year. Preschoolers were more likely to kick/shove than to fight ( $p < .001$ ) or to throw things at someone ( $p < .001$ ). They were also more likely to throw something at someone than to fight ( $p < .001$ ).

### **Analytical strategy**

**Latent-class analysis.** A series of latent-class analyses (LCA) were used to identify the presence of latent profiles of physically aggressive children. LCA is a statistical technique used to identify a set of mutually exclusive classes of individuals based on their responses to a series of categorical observations (Goodman, 1974). LCA analyses allowed the computation and estimation of two sets of parameters: (a)  $\Gamma$  (gamma) parameters representing class membership probabilities, and (b)  $P$  (rho) which refers to item-response probabilities conditional on group membership. More specifically, LCA predicts subjects' subgroup membership based on their responses to a set of observed categorical variables and produces mutually exclusive and exhaustive (non-overlapping) latent classes of individuals (Dayton, 2008; Goodman, 1974). The aim of this study was to examine the presence of mutually exclusive classes of preschool children based on their level of physical aggression in the past year. Four items were used to examine the presence of profiles of physically aggressive children, that is, the frequency of kicking, shoving, fighting, and throwing objects. Those items are in line with previous empirical studies on the trajectories of physically aggressive children (e.g., Côté et al., 2006). The correlation between those four indicators of physical aggression was first screened and did not reveal the presence of redundant information (i.e., range  $r = .26$ -.66) for LCA. Considering the small sample size for this study, only a baseline model was created with no covariates included. Based on previous empirical studies on the presence of trajectories of physically aggressive children (e.g., Broidy et al., 2003), a two-to-six group solution was examined. In other words, a model with two groups was first examined, followed by a model with three groups, then a model with four groups, and so on. The optimal solution was then determined using the likelihood-ratio  $G^2$  statistics, Akaike's Information Criterion or AIC (Akaike, 1974), and the Bayesian Information Criterion or BIC (Schwarz, 1978), along with class size probability and

interpretability of each class identified. The analyses were conducted using PROC LCA, a procedure developed for SAS 9.2 by Lanza, Collins, Lemmon, and Schafer (2007).

## Results

### *Profiles of Physically Aggressive Preschool Children*

Table 1 presents the results of a series of latent class analyses. The goodness-of-fit information was examined for models with a two-to-six solution. For each solution, the likelihood  $G^2$ , the degrees of freedom, the AIC, and the BIC are presented. The likelihood ratio  $G^2$  statistic dropped substantially from a two-group solution to a three-group solution, then declined more gradually relative to the degree of freedom. Furthermore, the AIC was the lowest for the three-group solution. The BIC, however, suggested a two- or a three-group solution. Following recommendations by Lanza et al. (2007), the estimation was then repeated using different seeds ( $n = 4$ ) to try different sets of starting values. The three-group model was identified as the dominant solution that was arrived at most frequently among the various sets of starting values. Taken together, these findings suggested that a solution consisting of three groups of physically aggressive children was the optimal solution for this dataset. An inspection of the parameters estimates from the three-group model suggested that the classes are distinguishable and non-trivial (i.e., no class with a near-zero probability of membership), and that meaningful labels can be assigned to each class found. The final three-group model selected presented high classification accuracy (entropy) based on posterior probabilities (see Table 2), confirming its stability and relevance.

**Table 1. Latent Class Analysis of Physical Aggression in Early Childhood**

No. of Latent Classes	Likelihood Ratio $G^2$	Degrees of Freedom	AIC	BIC
2	129.94	230	179.94	245.56
3	98.56	217	174.56	274.31
4	80.01	204	182.01	315.88
5	68.79	191	196.79	364.79
6	63.01	178	217.01	419.14

Note. AIC refers to the Akaike Information Criterion. BIC refers to the Bayesian Information Criterion.

**Table 2. Average Assignment Probabilities based on Posterior Probability**

Latent Classes	Number Assigned  % (n)	Groups			Range
		Low- Level	Medium- Level	High- Level	
Low-level group	36% (36)	<b>.96 (.11)</b>	.02 (.09)	.01 (.07)	.57-1.00
Medium-level group	34% (34)	.04 (.06)	<b>.94 (.10)</b>	.02 (.07)	.67-1.00
High-level group	30% (30)	.01 (.04)	.13 (.18)	<b>.86 (.18)</b>	.51-1.00

Note: **Boldfaced** type indicates the entropy, referring to the average classification accuracy when assigning participants to classes. Values closer to 1.00 indicate greater precision.

The differences between the three groups of preschoolers were significant and easily interpretable (Figure 2). The first group, the low-level, consisted of 36% of the sample and showed a low frequency of kicking, pushing, fighting, and throwing objects at people, with all scores on these four items being close to 0 (i.e., never). The second group, the medium-level, represented 34% of the sample. This group included preschoolers who were occasionally physically aggressive in the past year, especially in terms of kicking and pushing others. Their average scores for these two behaviours were higher than 1.00. Finally, the third group, the high-level, represented 30% of this sample. The preschoolers included in this group were regularly physically aggressive in the past year, with average scores close to or higher than 2.0 for three of the four items of physical aggression (i.e., kicking, pushing, and throwing objects at people).

**Figure 2. Average Level of Physical Aggression in Early Childhood**



The three groups of preschoolers were then compared on a series of socio-demographic and descriptive factors relating to the child and his or her family (Table 3). The low-, medium- and high-level groups were compared as to the child's gender, ethnic group, the composition of the family and the presence of siblings, whether the biological mother was interviewed, the family annual income, and most importantly, whether the child was a clinical referral or not. The group comparison analyses revealed few significant differences across the three groups of children. In fact, the three groups differed only on two of these characteristics. First, the low-level was the only group where children were not mainly Caucasians. Second, and not surprisingly, a significantly more important proportion of children recruited at the infant psychiatry clinic of B.C. Children's hospital were included in the highly aggressive children. Still, the clinical referrals represented only 30% of this group, meaning that children recruited from the community characterized the majority of those included in the high-level group. The high-level group was not more likely to include boys, children with siblings, children living in a single-parent family setting, or children living in families with a lower annual family income.

**Table 3. Descriptive statistics of the three groups of children**

	Groups			Group Comparison
	Low-Level	Medium-Level	High-Level	
1. Gender (male)	50.0%	61.8%	63.3%	$X^2(2)= 1.49, ns$
2. Ethnicity (Caucasian)	33.3%	54.5%	63.3%	$X^2(2)= 6.40, p<.05$
3. Biological mother interviewed	91.7%	91.2%	93.3%	$X^2(2)= .11, ns$
4. One of more siblings (yes)	66.7%	67.6%	70.0%	$X^2(2)= .87, ns$
5. Single-parent family (yes)	13.9%	23.5%	23.3%	$X^2(2)=1.31, ns$
6. Source (clinical referral)	8.3%	5.9%	30.0%	$X^2(2)=9.20, p<.05$
7. Annual family income	\$90,142.86	\$68,951.52	\$62,666.67	$F(2,99)=2.08, ns$

**Items of the Cracow Instrument and Physically Aggressive Children**

A series of analyses of variance were then conducted to determine whether the Cracow instrument could help in identifying highly aggressive preschoolers. The three groups of preschoolers were compared on all the items of the five domains of risk/needs factors (i.e., pre/perinatal, socio-economic situation, family environment, child psychological functioning, and parental skills) included in the Cracow. Under conditions of heterogeneity of variance across groups, the Welch statistic was analyzed followed by a non-parametric test (i.e., Kruskal-Wallis one-way analysis of variance) to confirm or not the presence of group differences. When significant differences were found, a stringent post-hoc test (Scheffe) was performed to determine which groups significantly differed from one another. The results are presented in Table 4. First, we examined the pre/perinatal section of the Cracow instrument. Two of the five risk factors helped discriminate the three groups of children: the scores on the maternal substance use during pregnancy and on the birth-related complications scales. Post-hoc analyses showed that the high-level group was more likely to have been exposed to maternal substance use than the low-level group ( $p < .05$ ). Furthermore, the high- and medium-level groups were more likely to have had birth-related complications than the low-level group ( $p < .07$  and  $p < .05$ , respectively).

**Table 4. Level of physical aggression and items of the Cracow instrument**

1. Pre/perinatal items	Low-level ( $n=36$ )	Med-level ( $n=34$ )	High-level ( $n=30$ )	F-Test (2, 99)	Post-hoc test	Partial Eta squared
1.1. Maternal substance use	.64 (.72)	.76 (.78)	1.13 (.78)	3.66*	H>L	.075
1.2. Pregnancy related complications	.61 (.77)	.62 (.65)	.87 (.68)	1.35	-	.024
1.3. Birth related complications	.14 (.42)	.56 (.70)	.50 (.73)	4.57*	H, M>L	.087
1.4. Low birth weight	.06 (.23)	.12 (.41)	.10 (.31)	0.34	-	.012
1.5. Premature birth	.11 (.32)	.09 (.29)	.10 (.31)	0.49	-	.001
<hr/>						
2. Socio-economic situation items						

2.1. Low occupational status	.39 (.60)	.44 (.70)	.57 (.77)	.56	-	.009
2.2. Low family income	.25 (.50)	.35 (.60)	.47 (.68)	1.08a	-	.019
2.3. Poor parental education	.14 (.35)	.35 (.64)	.43 (.63)	3.37*a	H>L	.057
2.4. Familial adversities	.22 (.48)	.38 (.60)	.37 (.56)	0.90	-	.042
2.5. Economic dependency	.50 (.61)	.65 (.74)	.97 (.85)	3.43*	H>L	.068
<hr/>						
3. Family environment items						
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3.1. Parents mental health problems	.50 (.84)	.44 (.70)	.67 (.88)	0.65	-	.011
3.2. Parents antisocial behaviours	.53 (.61)	.62 (.65)	1.07 (.69)	6.28**	H>M,L	.107
3.3. Criminal background of parents	.28 (.57)	.35 (.64)	.60 (.81)	1.99a	-	.044
3.4. Intimate partner violence	.42 (.73)	.29 (.63)	.37 (.72)	0.27	-	.008
3.5. Poor familial support	.39 (.73)	.41 (.66)	.57 (.86)	0.53	-	.015
3.6. Parental antisocial attitudes	.25 (.44)	.35 (.49)	.57 (.50)	3.61*a	H>L	.076
<hr/>						
4. Child psychological functioning items						
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4.1. Low verbal IQ	.61 (.69)	.50 (.61)	.67 (.55)	0.60	-	.016
4.2. Callous	.37 (.55)	.56 (.56)	.80 (.61)	4.55*	H>L	.090
4.3. Negative emotionality	.60 (.65)	.91 (.62)	1.03 (.76)	3.60*	H>L	.071

4.4. Daring/risk taking	76. (.61)	.91 (.67)	1.30 (.65)	5.83**	H>M,L	.092
4.5. Attention deficits	.20 (.53)	.47 (.75)	.90 (.84)	7.80**a	H>L	.146
4.6. Hyperactivity	.31 (.53)	.47 (.66)	.63 (.72)	2.08a	-	.043

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5. Parenting skills items

5.1. Hostile parenting	.11 (.40)	.15 (.36)	.50 (.63)	4.50*a	H>M,L	.122
5.2. Lack of consistent discipline	.29 (.57)	.65 (.64)	.60 (.67)	3.32	M>L	.055
5.3. Lack of positive involvement	.19 (.47)	.35 (.60)	.23 (.43)	0.77a	-	.024
5.4. Inadequate norms/rules	.11 (.32)	.29 (.52)	.20 (.41)	1.63a	-	.040

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Note: Post-hoc analyses were conducted using Sheffe's test. H refers to the high-level group, M to the medium-level group and L to the low-level group.

\* $p < .05$ ; \*\* $p < .01$ .

(a) Welch statistic used due to assumptions of homogeneity of variance not met.

Next, we examined the items comprising the socio-economic situation section of the Cracow. The scores of two of the five items differed across the three groups. The total scores on the parental education and economic dependency scales statistically differed across groups. Children included in the high-level group were more likely than those in the low-level group to have caregivers with poor educational background, as well as showing significant evidence of economic dependency (both at  $p < .05$ ). Looking at the family environment, two of the six items helped in discriminating the three groups of preschoolers. Analyses of variance showed that the high-level group significantly differed from the low-level group ( $p < .05$ ) on parental attitudes. They also significantly differed from both the medium- ( $p < .05$ ) and low-level groups on the measure of parent's antisocial behaviours ( $p < .01$ ). In both cases, the high-level group showed higher scores on the scales suggesting that their parents are more likely to manifest antisocial behaviours and antisocial attitudes.

The psychological functioning section of the Cracow produced some of the most important differences across the three groups of preschoolers. The analysis of variance showed that the preschoolers in the high-level group were consistently higher than those in the low-level group on the measures of callousness ( $p < .05$ ), negative emotionality ( $p < .05$ ), daring/risk taking ( $p < .01$ ), and attention-deficits ( $p < .01$ ). The high-level group was also showing a marginally higher score than the medium-group on the measure of daring/risk taking ( $p < .06$ ). No significant differences were found for low verbal IQ and hyperactivity. Finally, the last section of the Cracow examined as part of this study, the parenting skills section, also revealed significant differences across groups. First, highly-aggressive children were more likely to have been exposed to hostile parenting than the medium- and low-level groups (both at  $p < .05$ ). Second, the children in the medium-level group were somewhat more likely to have been exposed to an inconsistent form of discipline compared to those in the low-level group ( $p = .55$ ). The difference was marginally significant and the interpretation of this result should be made accordingly.

**Table 5. Domains of risk factors and total score on the Cracow**

Domains of risk/needs factors	Low-level (n=36)	Med-level (n=34)	High-level (n=30)	F-Test (2, 99)	Post-hoc test	Partial Eta squared
1. Pre/perinatal section	1.56 (1.32)	2.15 (1.69)	2.70 (1.51)	4.72*	H>L	.080
2. Socio-economic situation	1.39 (1.61)	2.09 (2.43)	2.80 (2.57)	3.96*a	H>L	.060
3. Family environment	2.36 (2.22)	2.47 (1.64)	3.84 (2.41)	4.81*	H>M, L	.095
4. Psychological functioning	2.79 (1.63)	3.82 (2.07)	5.33 (2.52)	11.88***	H>M, L	.206
5. Parenting skills	.72 (.91)	1.44 (1.42)	1.53 (1.22)	4.71*	H, M>L	.095
Total score Cracow	8.83 (4.46)	11.97 (5.76)	12.11 (6.19)	14.84***	H>M>L	.228

Note: Post-hoc analyses were conducted using Sheffe's test. H refers to the high-level group, M to the medium-level group and L to the low-level group.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

(a) Welch statistic used due to assumptions of homogeneity of variance not met.

### ***Sections of the Cracow***

Next, we examined group differences on the total scores for each of the five sections of the Cracow. Findings of the analyses of variance are reported in Table 5. The findings showed significant group differences on the total pre/perinatal risk scores ( $p < .05$ ). More specifically, post hoc tests showed that the high-level group had higher scores on the pre/perinatal scale than the low-level group ( $p < .05$ ). Similarly, group differences were also observed for the scores of the socio-economic situation section ( $p < .05$ ). More specifically, the high-level group showed higher scores than the low-level group ( $p < .05$ ), thus suggesting their dependency to be exposed to a higher number of social risk factors. Furthermore, the three groups were also significantly different on the total score of the family environment ( $p < .05$ ). The analysis of variance and post hoc tests revealed that the preschoolers in the high-level group were showing more risk factors representing a criminogenic family environment than those in the medium- and low-level groups (both at  $p < .05$ ). Significant group differences were also found for the psychological section ( $p < .001$ ). The high-level group showed a significantly higher score than both the medium- ( $p < .05$ ) and the low-level groups ( $p < .001$ ), thus suggesting that highly aggressive children were more likely to exhibit early deficits in this area of functioning. Finally, the analysis of variance also indicated significant group differences for the parenting section of the Cracow instrument ( $p < .05$ ). Indeed, both the high- and medium-level groups had higher scores than the low-level group ( $p < .05$ ) on the parenting section. In other words, the highly and occasionally aggressive children were more likely to have been exposed to parents showing inadequate/poor parenting skills than the low aggressive children. Not surprisingly, considering previous results, when looking at the total score for the Cracow scale, significant differences were found between the three groups ( $p < .001$ ). The high-level group had more risk/needs factors than the medium-level ( $p < .05$ ) and the low-level group ( $p < .001$ ). Note that the medium-level group also showed a marginally higher score on the Cracow than the low-level group ( $p < .07$ ).

### ***Screening Highly Aggressive Preschool Children***

The postdictive screening accuracy of the Cracow was examined in two ways. First, the total scores of each of the five domains of the Cracow and the total score of the instrument were analyzed separately with respect to their correlation with the level of physical aggression. The aim of this procedure was to determine whether the scores on the instrument were related in a linear way to the frequency of physical aggression in the past year. To do so, the frequencies of the four items of physical aggression (i.e., kick, push, fight, throw things) were totalled to create a composite scale of physical aggression. Correlations between the scores of the Cracow instrument and the composite score of physical aggression are reported in Table 6. The correlations between the domains of risk factors and physical aggression ranged between .23 for the family's socio-economic situation, and .59 for the child psychological functioning. The correlation between the total score of the Cracow and the measure of physical aggression was moderate to substantial [ $r(100) = .54, p < .001$ ].

**Table 6. Postdictive accuracy of the Cracow**

Domain	r	Postdictive accuracy		
		AUC	SE	Range
1. Pre/perinatal	.30**	.68**	.06	.56-.79
2. Socio-economic situation	.23*	.63*	.06	.52-.75
3. Family environment	.26**	.65*	.06	.53-.77
4. Psychological functioning	.59**	.74**	.06	.63-.84
5. Parenting skills	.24*	.62*	.06	.50-.75
Total Cracow score	.54***	.77***	.05	.67-.86

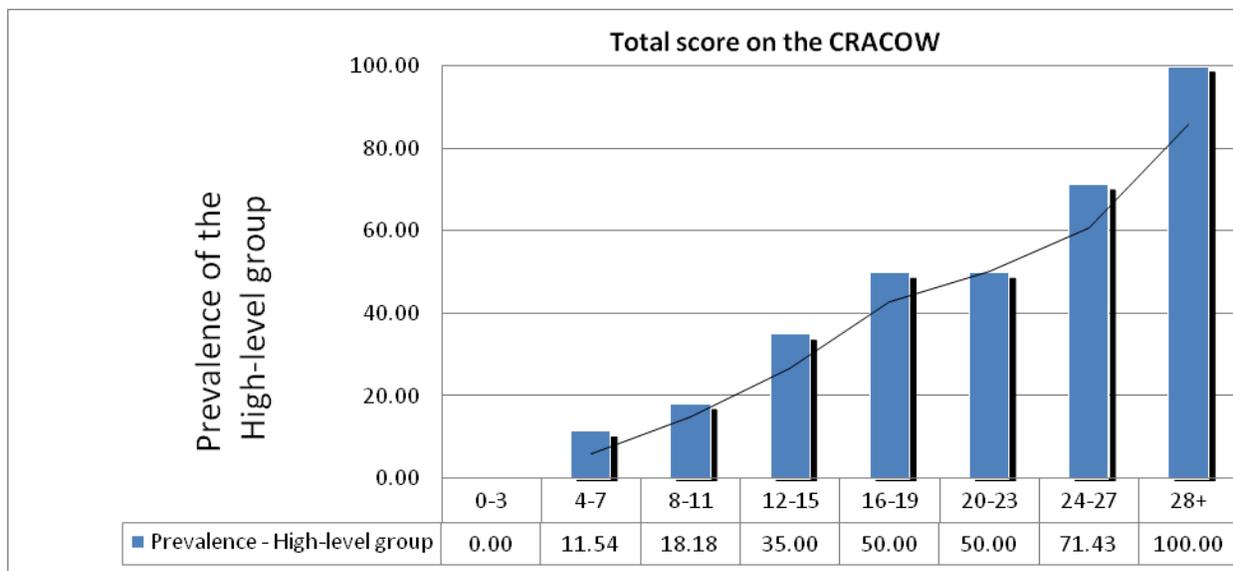
Note:  $N = 100$ . Correlation ( $r$ ) conducted by using a sum of the scores on the four items of physical aggression to create a composite measure of aggression as the criterion for these analyses. ROC curves were conducted by merging the low-level and the medium-level groups into one category and the high-level group in the other. Therefore, the ROC curves represent the ability of the items of the Cracow in screening the highly aggressive children from the other children.

AUC = Area under the ROC curve. SE = Standard error of the AUC.

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$ .

Next, the screening accuracy of the instrument was analyzed using a series of ROC (i.e., Receiver Operating Characteristics) curves. The total scores for each of the five domains and the total score of the Cracow instrument were plotted individually against group membership to the high-level category of physical aggression. In order to conduct these analyses, the low-level and the medium-level groups were merged together. Therefore, the ROC curves were aimed at examining the postdictive screening accuracy of the instrument in identifying the highly aggressive children from the other preschoolers. Results are presented in Table 6. Most of the domains of risk factors included in the Cracow instrument showed ROC curves in the .60s, suggesting modest predictive accuracy taken individually. The child psychological functioning section was revealed to be the most accurate domain by itself with an AUC in the mid-.70s. Not surprisingly, the total score of the Cracow instrument showed the highest screening accuracy with an AUC of .77, thus showing modest-to-good postdictive accuracy. These results suggest that as the scores on the Cracow are increasing, so are the probabilities of the child being highly physically aggressive toward others (Figure 3).

**Figure 3. Prevalence of the highly aggressive children and scores on the Cracow**



We then tested whether the total scores and the screening ability of the Cracow instrument might be influenced by possible confounding factors (Table 7). Therefore, a logit regression model was conducted by examining the predictive accuracy of the total score of the Cracow tool, while adjusting for the following covariates: (a) child’s gender; (b) child’s ethnic origin; and (c) whether the child was a clinical referral. The logit model produced a good-fit of the data [ $-2LL = 86.09$ ,  $df = 4$ ,  $p < .001$ , Nagerfelke = pseudo  $R^2 = .32$ ]. This model showed that the Cracow total scores can efficiently screen highly aggressive children, even after adjusting for those covariates. In fact, for every one-unit change on the scores of the Cracow tool, the

probabilities of the child being highly aggressive increased by a factor of 1.18 ( $p < .001$ ; range: 1.07-1.30), regardless of the child's gender, ethnic origin, and source (clinical referral or not). None of the three covariates were statistically significant at  $p < .10$ .

**Table 7. Postdictive accuracy of the Cracow, adjusting for covariates**

Predictors	Log (b)	Odds ratio	95% (C.I.)	P value
Cracow (total score)	.17 (.05)	1.18	1.07-1.30	.001
Child's gender (male)	.09 (.52)	1.09	.39-3.02	.867
Source (clinical)	-.87 (.70)	.42	.11-1.66	.215
Ethnic origin (Caucasian)	-.78 (.51)	.46	.17-1.25	.129
Model goodness of fit	Nagelkerke R <sup>2</sup>	-2LL	Df	P value
	.32	86.09	4	.000

Note:  $N = 100$ .

## Discussion

The current study examined some of the properties of the Cracow instrument with a small sample of at-risk preschoolers. The purpose of the study was to examine the level of physical aggression in two different at-risk samples (clinical, community) and to determine whether the Cracow could identify the preschoolers showing the highest level of physical aggression before school entry. The inclusion of a clinical sample enabled the examination of the nature and frequency of physically aggressive behaviours in children characterized by an externalizing spectrum disorder. In addition, the inclusion of an at-risk community sample permitted the assessment of physical aggression in children exposed to environmental adversities. In doing so, the research was designed to oversample children with a diversity of risk/needs factors thus allowing an examination of the role of various items of the Cracow that may otherwise have a base rate too low to be analyzed with general populations of preschoolers.

### *What can we tell about the physical aggression of at-risk children?*

This study did not investigate trajectories of physical aggression, but did examine the frequency of the behaviours at a specific time point early in development. From that point on, the findings from longitudinal studies have suggested that, albeit within-individual changes, between-individual differences (or the rank-ordering of children in terms of their level of aggression) in physical aggression remain relatively stable during childhood, (Tremblay et al., 1999; Tremblay & Nagin, 2005). Therefore, with a short follow-up period of a few years, it is expected from prior studies that the high-level group would remain the group showing the highest level of physical aggression. In the current study, the high-level group was more important in prevalence (30%) than typically reported in earlier investigations with general population data or samples drawn from low socio-economic neighbourhoods (e.g., Broidy et al., 2003; Côté et al., 2006; Tremblay et al., 2004). This is probably a result of our sampling, which includes clinical cases and children from at-risk neighbourhoods. Furthermore, the majority of the clinical cases, not surprisingly, were found in the high-level cases.

This result somewhat overshadows the fact that 70% of the high-level group consisted of preschoolers recruited in at-risk neighbourhoods. The high-level group of preschoolers recruited in the community showed the same level of physical aggression as the clinical cases without having been referred to or assessed for their physical aggression. Note that the Cracow assessment tool was not affected by the overrepresentation of clinical cases in the high-level group. In fact, after controlling for Cracow scores in multivariate analyses, the differences between the clinical and the community groups were no longer statistically significant, suggesting that the between-individual differences responsible for the overrepresentation of clinical cases within the high-level group might have been accounted for by the items included in the Cracow instrument. It also suggests that the tool might have promising properties that would allow the assessment of both clinical and at-risk community cases of children. Further studies, however, will be needed to inspect these aspects of the Cracow.

### ***What are the most promising risk/needs factors of the Cracow?***

The current findings were generally in line with previous longitudinal studies looking at the developmental risk factors of youth violence (Hawkins et al., 1998; Farrington, 2005; Lösel & Bender, 2006; Loeber et al., 2008; Repucci, Fried, & Schmidt, 2002). Considering that aggression is multidetermined, we would not expect large effect sizes from single items of the Cracow assessment tool (see Lösel, 2002). Taken individually, these between-individual differences accounted for a small but significant proportion of the level of physical aggression in early childhood. As such, the average partial eta squared (partial  $\eta^2$  – i.e., percent of variance uniquely accounted by the risk/needs factor) of the 26 items examined was .05 ( $SD = .04$ ), and varied between .00-.15. The most significant risk/needs factors were: the presence of attention-deficits characteristics (partial  $\eta^2 = .15$ ), hostile parenting (partial  $\eta^2 = .12$ ), parents' antisocial behaviours (partial  $\eta^2 = .11$ ), birth-related complications (partial  $\eta^2 = .09$ ), child's callousness (partial  $\eta^2 = .09$ ), child's daring/risk-taking characteristics (partial  $\eta^2 = .09$ ), child's parents' antisocial attitudes (partial  $\eta^2 = .08$ ), and maternal substance use during pregnancy (partial  $\eta^2 = .08$ ).

These findings, therefore, depict the highly physically aggressive child as someone having been exposed to multiple risk factors before birth, coming from a criminogenic family environment characterized by poor parenting skills, having self-regulation difficulties, and lacking concerns for others. Other significant factors were associated with physical aggression with effect sizes ranging from .06 to .07 – that is, economic dependency, poor parental education, lack of a consistent discipline, and the child's level of negative emotionality. Therefore, both the individual and familial risk/needs factors of the Cracow tapped aspects of the highly physically aggressive children. In sum, these findings might not come as a surprise to most developmental criminologists. While previous longitudinal studies have shown the role and importance these risk/needs factors have in middle to late childhood and adolescence, the current study shows that these risk items are operating sooner and can be detected early in the child's development with a sound risk/needs assessment tool. Furthermore, these risk/needs factors are operating on physical aggression in childhood, a significant and important precursor of youth violence.

### ***Is the Cracow capturing risk factors at the earliest developmental stages?***

From its onset, a rationale of the Cracow was to capture the risk/needs factors of children at risk of youth violence at the earliest developmental stages (Corrado et al., 2002; Corrado, 2002). More specifically, the Cracow was designed to bridge gaps between the scientific literature from different disciplines (i.e., criminology, health, and child psychiatry). The current study shows promising findings supporting the value of a multidisciplinary perspective to approach the issue of youth violence. In that regard, the pre/perinatal risk/needs domain of the Cracow was shown to help, albeit in conjunction with other risk domains, in the identification of the most physically aggressive children. The overall predictive accuracy, however, was relatively modest, but similar to those observed for the familial environment domain of the Cracow. Two items of the pre/perinatal showed value that is more promising in discriminating at-risk children in terms of their level of physical aggression. Maternal substance use refers to a series of

unhealthy behaviours during pregnancy such as the use of tobacco, alcohol, soft/hard drugs, as well as non-prescribed medication. Birth complications, on the other hand, refer to problems occurring at the time of labour and delivery (e.g., the umbilical cord around baby's neck, the baby not breathing, convulsions, etc.). Although the causal mechanisms remain unclear, such pre/perinatal factors can affect the brain development of the foetus resulting in subtle neuropsychological deficits.

The use of nicotine, alcohol, and drugs (Brennan, Grekin, & Mednick, 2003; Gibson & Tibbetts, 2000; Orlebeke, Knol, & Verhulst, 1999; Tremblay et al., 2004), birth complications (Arsenault, Tremblay, & Boulerice, 2002), and low birth weight (Piquero & Tibbetts, 1999) have all been shown to be linked to characteristics associated to a large array of negative outcomes such as aggression, antisocial behaviours, and criminal behaviours. The effect sizes found, while significant, are not large (e.g., Hodgins, Kratzer, & McNeil, 2002; Lussier, Tzoumakis, Healey, Corrado, & Reebye, 2011; Pratt, McGloin, & Fearn, 2006). One way to address this issue is to look at potential mediator and moderator factors (Rutter, 2003). Pre/perinatal risk factors might prove more detrimental on the child's development when acting in combination with adversarial family factors (Arsenault et al., 2002; Hodgins et al., 2002; Piquero & Tibbetts, 1999; Raine, Brennan, & Mednick, 1997). This is consistent with the hypothesis that aggression and violence are better understood as an accumulation of risk factors than the result of a single set of risk factors operating. Maternal substance use and birth complications, therefore, might characterize at-risk pregnancies for highly aggressive children.

### *Is the Cracow capturing familial risk/needs factors of physical aggression?*

Several aspects of the familial environment captured by the Cracow helped in distinguishing the highly physically aggressive children from the others. The highly physically aggressive children were exposed to more risk factors tapping into the economic deprivation of the family environment. They were also more likely to have been exposed to a criminogenic family environment characterized by poor parenting skills. Previous studies on the early familial risk factors of physical aggression have focused on the socio-economic characteristics and the parenting skills of the home environment. The presence of specific familial risk/needs factors have been shown to be related to high levels of physical aggression during childhood, even when measured at the time of the child's birth (Tremblay et al., 2004). For example, low maternal education has been shown to be linked to a high level of physical aggression (Benzies, Keown, & Magill-Evans, 2009; Côté et al., 2006; Nagin & Tremblay, 2001; NICHD, 2004; however, see Tremblay et al., 2004; Shaw et al., 2003), and also to distinguish the children who remained highly aggressive throughout childhood and adolescence (Nagin & Tremblay, 2001). Those factors, therefore, might have an effect on both the onset and the persistence of high levels of physical aggression.

Previous studies also suggest that socio-economic risk factors have a main effect that is not mediated by other family risk factors such as parenting (Nagin & Tremblay, 2001; Côté et al., 2006), something not explored in the current study. Furthermore, and in line with our findings, previous reports have shown that hostile (e.g., being annoyed or getting easily and promptly angry at the child) and coercive (e.g., raising voice, shouting, spanking or shaking the child) parenting are typically associated with higher levels of early aggression (Benzies et al., 2009; Côté et al., 2006; Tremblay et al., 2004; Romano, Tremblay, Boulerice, & Swisher, 2005).

Observational measures of maternal rejecting parenting (e.g., harsh, hostile, lack of warmth) have not been shown to be linked to initial levels of overt antisocial behaviour, but helped distinguishing high-level desisters and chronic, with the latter group more subject to this type of parenting (Shaw et al., 2003; NICHD, 2004). This result suggests that rejecting parenting behaviours might play a distinct role in the persistence of aggression. The criminogenic aspect of the family environment has not been the subject of many empirical investigations. Tremblay et al. (2004) have shown that antisocial mothers are more likely to have highly aggressive children, which is in line with our findings. Based on these results, we can then conclude that the highly aggressive children are those exposed to a multitude of risk/needs familial factors. These risk/needs identified are both structural (i.e., socio-economic situation) and dynamic (i.e., parenting skills) and may facilitate the intergenerational transmission of aggression and violence through the role and importance of the presence of a criminogenic environment.

### *Is the Cracow capturing individual risk/needs factors of physical aggression?*

Not all children respond in the same way to their environment. Our study suggests that highly physically aggressive preschoolers present with a constellation of psychological functioning difficulties. The child psychological functioning section of the Cracow appeared as one of the most significant in distinguishing highly aggressive children from the other preschoolers. Our study indicates that highly aggressive children tend to show high levels of negative emotionality, daring/risk taking behaviours, and callousness. This constellation of difficulties is reminiscent of the propensity for disorderly conduct behaviours as proposed by Lahey and Waldman (2005). Negative emotionality refers to the tendency to experience, intensively and without provocation, negative mood/states and having difficulties in regulating those moods (Caspi et al., 1994). Daring/risk taking refers to behavioural disinhibition and the child's tendency for sensation and novelty-seeking behaviours (Farrington, 2005; Lahey & Waldman, 2005). Callousness, consistent with Lahey and Waldman's (2005) conception of prosociality, refers to the child's tendency to disregard other people's feelings and emotions and to show less concern for others. This constellation of psychological functioning dimensions may lead to situations where children's interactions can quickly escalate to acts of physical aggression.

While these three dimensions have been examined with older children and have been shown to be related to conduct disorder and antisocial behaviours (Farrington, 2005; Lösel & Bender, 2006), few studies have examined whether these three features relate to physical aggression in preschoolers. Previous studies have shown that the presence of a difficult temperament (e.g., easily upset, easy to calm, unstable mood) measured at five months can distinguish, with some reliability, highly aggressive children in early childhood (Tremblay et al., 2004). Furthermore, observational measures of low behavioural inhibition have been shown to be linked to high levels and persistence of overt antisocial behaviour during early childhood (Shaw et al., 2003). Taken together, these behavioural manifestations suggest that these children might be more demanding, more subject to anger outburst, and, as a result, might exacerbate more hostile, negative reactions from the environment, including parents. This might explain why physically aggressive children are more likely to be subject to maternal hostility compared to their siblings (Romano et al., 2005).

### ***Limitations***

This empirical study is not without methodological limitations and the results should be interpreted accordingly. First, the analyses were based on a small sample of at-risk Canadian preschoolers. These results, therefore, cannot be generalized to preschoolers at large. While this may be interpreted as a limitation, the research design was not intended to capture a general representation of the population, but to oversample families and children at risk of showing high-levels of aggression, especially at the earliest developmental stages. Moreover, the current study was based on retrospective data, albeit using a short recall period (one year) to minimize biases caused by poor memory recall with respect to the parent's assessment of physical aggression. Furthermore, due to the cross-sectional nature of the data (at this point), the current study only examined the between-individual differences associated with physical aggression. Longitudinal studies with repeated measures of aggression will follow to determine the predictive validity of the instrument while inspecting its ability to detect within-individual changes in the level of aggression over time. Also, only one informant (i.e., the primary caregiver) was used to measure the frequency of aggression. Consequently, some aggressive behaviour might have been overlooked, minimized, or simply not observed by the informant. Finally, the statistical power of the current study was characterized by the small sample size. As a result, only a few covariates were analyzed. Therefore, replication of these findings with a large sample of preschoolers using longitudinal data with multiple informants will be important in future studies to better understand the properties of the Cracow assessment tool.

### **Conclusion**

In contrast to screening methods (LeBlanc, 2002; Van Domburgh, Vermeiren, & Doreleijers, 2008), assessment tools such as the Cracow aim to present a more extensive, comprehensive, and individualized description of a youth. When looking at the aggressive behaviours in the past year of two selected at-risk samples of preschoolers, the Cracow performed relatively well at identifying the most physically aggressive children. The findings further suggest that the instrument performed as well for the clinical and the at-risk community samples of children. The focus on preschoolers was pivotal in examining the properties of the Cracow with this population as it characterizes a period when children learn to inhibit their aggressive behaviours and, as such, are likely to manifest some level of physical aggression before school entry. Therefore, the ability to screen and assess children at risk of future aggression at this developmental stage is a challenge but has crucial implications for both prevention and intervention. There are currently no risk/needs assessment tools designed to assess the likelihood of future violent behaviour that can be applied at these earliest developmental stages. Preliminary findings of this study suggest that the Cracow shows some promise in filling this gap. In fact, the Cracow identified risk/needs factors that have been shown to be related to serious and violent delinquency during adolescence. It would seem, therefore, that certain of these risk/needs factors are indeed operating earlier than many criminologists might have believed relative to the research, which has concentrated its focus for understanding the prevention of youth violence upon the period of adolescence. These findings therefore should give encouragement to those who are exploring early intervention strategies in the prevention of later youth violence.

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