Université **nn**
de Montréal

Direction des bibliothèques

Université de Montréal

Les failles dans la prédiction des troubles de comportements externalisés et internalisés à la période préscolaire : l'utilité des résidus standardisés dans l'identification de sous-groupes hétérogènes

par

Carl Bouchard

Département de psychologie

Faculté des arts et sciences

Thèse présentée à la Faculté des études supérieures

en vue de l'obtention du grade de

Philosophiae Doctor (Ph.D.)

en psychologie

Février 2008

Université de Montréal

Faculté des études supérieures

Cette thèse intitulée :

Les failles dans la prédiction des troubles de comportements externalisés et internalisés à la période préscolaire : l'utilité des résidus standardisés dans l'identification de sous-groupes hétérogènes

.

présentée par :

Carl Bouchard

a été évaluée par un jury composé des personnes suivantes :

Daniel Paquette, Président-rapporteur

Linda S. Pagani, Directrice de recherche

François Bowen, Membre du jury

Michal Perlman, Examinatrice externe

Sophie Parent, Représentante du doyen de la FAS

Résumé

Malgré l'essor des méthodes de recherche et l'augmentation constante de nos connaissances concernant la psychopathologie développementale, les modèles théoriques et statistiques utilisant les facteurs de risque reconnus empiriquement n'arrivent toujours pas à identifier certains sous-types d'enfants présentant des caractéristiques parfois inattendues, et empruntant des trajectoires développementales défiant les attentes. Afin de mieux comprendre ces trajectoires du développement, et particulièrement les différences individuelles qui les caractérisent, le recours à une approche centrée sur la personne devient nécessaire. L'objectif de cette thèse est d'explorer l'utilisation d'une méthodologie permettant l'identification de sous-groupes hétérogènes d'individus en utilisant les résidus standardisés générés par des équations de régression.

Dans le cas du premier article, des facteurs de risque associés au développement de l'agression physique durant la période préscolaire sont utilisés afin d'identifier ces individus ne réagissant pas comme la norme. La méthodologie employée a permis l'identification de deux regroupements d'enfants : (1) un premier dont la trajectoire est caractérisée par une augmentation croissante de l'agressivité physique pendant la période préscolaire, (2) et un second dont la trajectoire montre une augmentation croissante des comportements hyperactifs entre 17 et 56-68 mois. En ce qui concerne le deuxième article, des variables validées théoriquement et empiriquement en regard de leur association avec le développement de l'anxiété sont employées pour identifier ces sous-groupes hétérogènes d'individus. Les résultats montrent une fois de plus deux regroupements d'enfants dont les trajectoires s'éloignent des attentes initiales. D'abord, un premier sous-groupe d'enfants dont la trajectoire est marquée par une augmentation croissante de comportements hyperactifs et de détresse émotionnelle, et enfin, un autre constitué d'individus montrant de l'anxiété de séparation à l'âge de 56-68 mois.

Mots-clés: agression physique, anxiété, résidus standardisés, trajectoires développementales, prédictions, préscolaire.

Abstract

Traditionally, most longitudinal studies have employed variable-oriented designs restricting all children to a single group pathway yielding contradictory results about developmental trends throughout childhood. The identification of heterogeneous groups of individuals might provide a better understanding of the change processes and early childhood variables that tend to deflect life-course trajectories away from a hypothesized pathway. These are characterized by residual cases, or more concretely, the differences between observed and expected values predicted by substantive and statistical methods in the social science literature. The main objective of this thesis was to explore the use of a counterintuitive person-oriented approach in order to better characterize these clusters of individuals within a developmental psychopathology perspective.

For the first article, an expected pathway model of aggression, guided by a theoretical framework, was generated to obtain standardized residuals. Results indicate the presence of two clusters of individuals following different pathways from the majority of the studied sample. The first is constituted of individuals with increasing physically aggressive behavior from early infancy to school entry. The second unexpected cluster is characterized by individuals with increasing hyperactive behavior throughout childhood. In the second article, we analyzed residual cases from a prediction equation driven by previous empirical work emphasizing the role of individual and parental characteristics in the development of anxiety by school entry. Once again, our findings indicate the presence of two clusters of individuals following unexpected pathways. The first is constituted of individuals with increasing hyperactive and emotionally distressed behaviors from early infancy to school entry. The second unexpected cluster is characterized specifically by separation anxiety around kindergarten and school entry years.

Keywords: physical aggression, anxiety, standardized residuals, developmental pathways, preschool.

Table des matières

Liste des tableaux

Liste des figures

Remerciements

J'aimerais d'abord remercier ma directrice Linda S. Pagani pour cette opportunité qu'elle m'a offerte un beau jour de printemps de terminer ma thèse de doctorat sous sa supervision. C'est très généreusement que celle-ci a partagé avec moi foule d'informations méthodologiques, scientifiques et empiriques m'ayant donné l'occasion de réfléchir et de me construire une compréhension du développement de l'enfant par l'entremise des études longitudinales. Encore plus important, elle m'a fait comprendre l'importance de parfois faire fi des obstacles du quotidien afin d'atteindre ses objectifs. J'aimerais également souligner le rôle très important qu'à tenu ma première directrice, Monica O'Neil-Gilbert, pendant la réalisation de ma scolarité doctorale et de mon examen général de synthèse. Sans elle, je n'aurais jamais même débuté d'études doctorales. De plus, sans ordre particulier, j'aimerais faire mes sincères remerciements aux personnes suivantes pour avoir partagé avec moi une part de leur précieux temps ainsi que leurs connaissances, réflexions, et talent : Sylvie Normandeau, Frank Vitaro, Mark Freeston et Alain Lesage.

La réalisation d'une thèse de doctorat ne serait pas possible sans l'apport des membres de sa famille. Voici donc en rafale le témoignage de mon appréciation à toutes ces personnes : À Carole pour son sens de l'humour et m'avoir si souvent accueilli pour le repas du soir alors que je faisais mes travaux tard sur son ordinateur, à François pour son vin rouge et sa fierté d'avoir éventuellement un docteur dans la famille, à Sylvie pour sa sensibilité à mon égard et pour m'avoir aidé à développer ma curiosité lorsque j'étais petit, à Claude pour sa passion du travail bien fait et l'importance des connaissances générales, et enfin, ma mère pour mes habiletés sociales.

Enfin, une large partie de cette thèse revient à celle qui m'a appris à étudier et organiser ma pensée, celle dont je recherche constamment la présence, et sans qui toute cette démarche n'aurait aucune valeur, Caroline. Je dédie cette thèse à mon père qui m'a transmis sa persistance et l'importance de gravir pas à pas les échelons de la vie.

Introduction

Contexte théorique

Les efforts de prévention sont basés principalement sur l'analyse des facteurs de risque présents dans la vie du jeune enfant ainsi que les facteurs pouvant potentiellement protéger ce dernier du développement de divers troubles de l'adaptation pendant la période préscolaire. Toutefois, malgré l'augmentation de nos connaissances en regard de la psychopathologie développementale et leur raffinement, les modèles théoriques et statistiques utilisant les facteurs de risque n'arrivent toujours pas à identifier certains sous-types d'enfants présentant des caractéristiques parfois inattendues (Cicchetti, 2006). Cet état de fait est important pour ces derniers car ils ne profiteront peut être pas d'une intervention dont ils auraient pu tirer profit afin d'assurer un sain développement pendant la période préscolaire et une vie scolaire pleine de promesses. Ce problème s'explique, entre autre, par le fait que les meilleures études longitudinales ont principalement utilisé des devis de recherche dont l'approche était centrée principalement sur les variables. Les hypothèses sont ainsi formulées en terme de variables, et conséquemment, les résultats interprétés en terme de variables pour lesquels les individus diffèrent entre eux exclusivement de façon quantitative. Malgré leur utilité, les analyses statistiques basées uniquement sur les variables font face à des problèmes conceptuels et empiriques importants et limitent notre compréhension du développement humain (Block, 1971; Magnusson, 1999). Dans cette optique, les variables définissant les problématiques des individus se distribuent donc de façon normale dans la population, et le sens et la force des relations entre ces variables ainsi que leurs mécanismes d'action s'appliquent à tous les individus, et ne peuvent être que linéaires. Enfin, la nature des processus intra-individuels est laissée pour compte et seules la moyenne de l'échantillon et notre capacité de généralisation dictent la formulation des hypothèses de recherche.

Selon Bergman et Trost (2006), tout être vivant est en interaction fonctionnelle avec son environnement et les divers processus associés au développement des individus sont plus souvent qu'autrement discontinus et non linéaires à travers la vie. Dans sa critique des méthodes utilisées en psychologie afin de comprendre la diversité du

développement humain, Richters (1997) propose d'élaborer les objectifs de la recherche scientifique en adoptant une perspective de « système ouvert » tenant compte de cette interaction fonctionnelle individu-environnement. Selon cette dernière, le développement de divers problèmes comportementaux peuvent provenir de facteurs de risque identiques, traçant ainsi une multitude de trajectoires développementales possibles pendant la période préscolaire (Cicchetti et Tucker, 1994). Ainsi, afin de mieux comprendre ces trajectoires du développement et les différences individuelles qui les caractérisent, l'approche centrée sur la personne semble toute désignée (Bergman, Cairns, Nilsson, & Nystedt, 2000; Magnusson, 1998). Le premier postulat de cette approche soutient que le développement de la personne constitue une organisation ordonnée et prédéterminée à l'intérieur de différents sous-sytèmes biologiques, cognitifs, comportementaux et sociaux. Des facteurs opérants spécifiques à chacun de ces sous-systèmes se regrouperaient en profils cohérents et propres à chaque organisation de la personnalité. Le second postulat stipule que l'organisation de la personnalité aurait une capacité d'auto-organisation caractéristique des systèmes ouverts permettant l'émergence de nouveaux patrons comportementaux en réponse aux divers changements internes et externes pouvant survenir pendant le développement. Enfin, le troisième postulat, important à la réalisation de cette thèse, précise qu'il existe autant d'organisation de la personnalité qu'il y a de personnes, et que ces différentes organisations présentent des patrons complexes et cohérents se différenciant entre eux tant qualitativement que quantitativement. Ainsi, il devient important d'étudier ces différences qualitatives et tenter d'identifier les sous-groupes d'individus présentant des caractéristiques comportementales, cognitives et sociales les distinguant de la norme.

L'analyse des résidus standardisés provenant de modèles corrélationnels représente l'un des moyens par lequel l'identification de ces individus devient possible. Un résidu représente l'écart entre les observations attendues d'un modèle de prédiction et celles réellement observées. De façon générale, les observations inattendues sont facilement détectables car elles représentent des anomalies quant aux comportements attendus et prédits par les modèles statistiques et théoriques existants. Bien que certains chercheurs semblent rejeter le résidu comme une distraction ou même une nuisance

devant être ignorée, d'autres considèrent ce dernier comme une clé ouvrant la voie au progrès et développement de modèles théoriques innovateurs à l'explication de divers phénomènes. A cet effet, Herschel (1871) souligne que beaucoup de grandes découvertes en astronomie sont issues d'une analyse plus approfondie de ce qui était généralement appelé les phénomènes résiduels. Les exemples de découvertes provenant de l'analyse des résidus abondent dans l'histoire de la science. Ainsi, lors de ses travaux de recherche au milieu du $18^{\text{ième}}$ siècle, Cavendish a fréquemment observé un résidu de gaz inconnu une fois qu'il avait retiré l'azote de l'air. Environ un siècle plus tard, Ramsay et Raleigh portant leur intérêt sur ce résidu découvrirent l'argon. Cet exemple illustre non seulement la valeur potentielle des résidus mais témoigne également de l'importance d'utiliser des modèles théoriques permettant d'encadrer ces découvertes, et ce, malgré leurs lacunes. Comme le disait Bacon, la vérité émerge plus facilement de l'erreur que de la confusion (Kuhn, 1970).

Dans le cadre de cette thèse, afin d'examiner et caractériser plus qualitativement les sous-groupes d'individus représentés par les résidus d'équations de régression, une approche centrée sur la personne sera utilisée (von Eye et Bergman, 2003). Celle-ci devrait faire ressortir les différences individuelles par l'identification de regroupements (clusters) d'individus partageant des caractéristiques communes ne réagissant pas aux attentes des modèles théoriques et statistiques, et conséquemment, à la norme d'une population donnée (Bergman, Magnusson, et El-Khouri, 2003). De plus, la prédiction et l'identification de ces regroupements hétérogènes d'individus devraient fournir de plus amples informations quant aux divers processus impliqués dans le développement de l'enfant ainsi que leurs changements qualitatifs pendant la période préscolaire.

Présentation des articles de la thèse

Les deux articles de la présente thèse devraient permettre de mieux documenter l'identification de sous-groupes (regroupements) d'individus représentés par les résidus d'équations dans la prédiction de troubles externalisés et internalisés à la période préscolaire. Ceci représente une étape préalable à l'établissement plus rigoureux de

trajectoires développementales produites par des analyses sophistiquées telles que latent growth modeling.

Article 1 « When predictions fail to match theoretical expectations: The case of unexpected pathways toward physical aggression at school entry»

Ce premier article de nature empirique a pour objectif d'identifier des sous-groupes d'individus ne pouvant être prédits par l'utilisation de trois facteurs de risque reconnus empiriquement dans la littérature comme étant associés au développement de l'agression physique au début de la période scolaire. Spécifiquement, le tempérament difficile, les comportements hyperactifs, l'anxiété et les habiletés prosociales mesurés à l'enfance sont utilisés comme prédicteurs de l'agression physique à la fin de la période préscolaire, vers environ 6 ans. Plusieurs études supportent l'utilisation de ces prédicteurs comme étant parmi les facteurs de risque les plus importants au développement de comportements agressifs chez l'enfant (Côté, Tremblay, Nagin, Zoccolillo, & Vitaro, 2002; Lacourse, Nagin, Vitaro, Côté, Arseneault, & Tremblay, 2006; Tremblay, Vitaro, Nagin, Pagani, & Séguin, 2003). L'équation de prédiction construite avec les facteurs de risque précédent a pour but de caractériser qualitativement les sous-groupes d'individus qui ne sont pas prédits par cette dernière en faisant l'analyse des résidus standardisés. Il deviendra ainsi possible d'identifier de potentielles trajectoires développementales menant vers des comportements (externalisés et/ou internalisés) autres que le développement de l'agression physique. Tel que préciser par Cicchetti (2006), les désordres du comportement ne sont pas dus à un ensemble linéaire de causes, mais plutôt à un enchevêtrement complexe de facteurs de risque et de protection influençant le développement de multiples trajectoires développementales. Pour ainsi dire, les mêmes facteurs de risque tôt dans l'enfance peuvent produire ultérieurement une multitude de difficultés d'adaptation. Tous les détails concernant la méthodologie permettant cette analyse des résidus standardisés, les résultats obtenus, ainsi que leur interprétation se retrouvent dans l'article.

Ma contribution comme premier auteur à cet article concerne la recherche documentaire à la rédaction du cadre théorique, la réalisation des analyses statistiques, ainsi que la production écrite de toutes les parties de ce manuscrit. Cet article sera soumis pour publication au *Journal of Abnormal Child Psychology*.

Article 2 « When the expected are not the observed: Failed predictions of child anxiety at school entry »

Ce deuxième article de nature empirique a pour objectif d'identifier des sous-groupes d'individus ne pouvant être prédits par l'utilisation de trois facteurs de risque reconnus empiriquement dans la littérature comme étant associés au développement de l'anxiété au début de la période scolaire. Spécifiquement, l'anxiété de séparation, la dépression maternelle, et les pratiques parentales coercitives mesurés à l'enfance sont utilisés comme prédicteurs de l'anxiété à la fin de la période préscolaire, vers environ 6 ans. Wood, McLeod, Sigman, Hwang & Chu, (2003) précisent que ces prédicteurs de l'anxiété doivent être étudier autrement que par les approches corrélationnelles traditionnelles. À leur avis, les devis de recherche utilisant des données longitudinales devraient être utilisés afin d'identifier plus clairement les trajectoires développementales potentielles et les variables parentales associés au développement de l'anxiété pendant la période préscolaire. Comme pour le premier article, l'équation de prédiction construite avec les facteurs de risque précédent a pour but de caractériser qualitativement les sous-groupes d'individus qui ne sont pas prédits par cette dernière en faisant l'analyse des résidus standardisés. Tel que recommandé par Wood et ses collègues (2003), il deviendra ainsi possible d'identifier de potentielles trajectoires développementales menant vers des comportements anxieux ou d'autres types, incluant les troubles externalisés. Tous les détails concernant la méthodologie permettant cette analyse des résidus standardisés, les résultats obtenus, ainsi que leur interprétation se retrouvent dans l'article.

Ma contribution comme premier auteur à cet article concerne la recherche documentaire à la rédaction du cadre théorique, la réalisation des analyses statistiques, ainsi que la production écrite de toutes les parties de ce manuscrit. Cet article sera soumis pour publication au *Journal of Child Psychology and Psychiatry*.

Bibliographie

Bergman, L.S., Cairns, R.B., Nilsson, L.-G., & Nystedt, L. (Eds.) (2000). Developmental science and the holistic approach. Mahwah, NJ: Lawrence Erlbaum.

Bergman, L. R., Magnusson, D., & El-Khouri, B. M. (2003). *Studying the individual development in an interindividual context: A person-oriented approach.* Mahwah, NJ: Lawrence Erlbaum Associated Publishers.

Bergman, L. R., & Trost, K. (2006). The person-oriented versus the variable-oriented approach: Are they complementary, opposites, or exploring different worlds? *Merrill-Palmer Quarterly, 52*, 601-632.

Block, J. (1971). *Lives through time.* Berkeley, CA: Bancroft.

Cicchetti, D. (2006). Development and psychopathology. In D. Cicchetti, & C. J. Donald (Eds.), *Developmental psychopathology: Vol. 1. Theory and method* (2nd ed., pp. 1-23). Hoboken, NJ: John Wiley & Sons Inc.

Cicchetti, D., & Tucker, D. (1994). Development and self-regulatory structures of the mind. *Development and Psychopathology, 6*, 533-549.

Côté, S., Tremblay, R. E., Nagin, D., Zoccolillo, M., & Vitaro, F. (2002). The development of impulsivity, fearfulness, and helpfulness during childhood: Patterns of consistency and change in the trajectories of boys and girls. *Journal of Child Psychology and Psychiatry, 43*, 609-618.

Herschel, J.F.W., Bart. K.H. (1871). *Outlines of Astronomy.* London: Longmans, Green.

Kuhn, T.S. (1970). *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.

Lacourse, E., Nagin, D. S., Vitaro, F., Côté, S., Arseneault, L., & Tremblay, R. E. (2006). Prediction of early-onset deviant peer group affiliation: A 12-year longitudinal study. *Archives of General Psychiatry, 63*, 562-568.

Magnusson, D. (1998). The logic and implications of a person-oriented approach. In R.B. Cairns, L.R. Bergman & J. Kagan (Eds.), *Methods and models for studying the individual* (pp. 33-64). Thousand Oaks, CA: Sage Publications.

Magnusson, D. (1999). Holistic interactionism: A perspective for research on personality development. In L.A. Pervin, & O.P. John (Eds.), Handbook of personality: Theory and research (2nd. ed.; pp. 219-247). New York: Guilford Press.

Richters, J. E. (1997). The hubble hypothesis and the developmentalist's dilemma. *Development and Psychopathology, 9*, 193-229.

Tremblay, R. E., Vitaro, F., Nagin, D. S., Pagani, L., & Séguin, J. R. (2003). The Montreal longitudinal and experimental study: Rediscovering the power of descriptions. In T. P. Thornberry, & M. D. Krohn (Eds.), *Taking stock of delinquency: An overview of findings from contemporary longitudinal studies* (pp. 205-254). New York: Kluwer Academic/Plenum.

Von Eye, A., & Bergman, L. R. (2003). Research strategies in developmental psychopathology: Dimensional identity and the person-oriented approach. *Development and Psychopathology, 15*, 553-580.

Wood, J. J., McCleod, B. D., Sigman, M., Hwang, W.-C., & Chu, B. C. (2003).

Parenting and childhood anxiety: Theory, empirical findings, and future directions.

Journal of Child Psychology and Psychiatry, 44, 134-151.

Article 1

When predictions fail to match theoretical expectations: The case of unexpected pathways toward physical aggression at school entry

Abstract

Using the Quebec Longitudinal Study of Child Development data set, this study examines early childhood variables that tend to deflect life-course trajectories away from a hypothesized physical aggression pathway using a developmental psychopathology framework. The analysis of residuals from a prediction equation, driven by a developmental operationalization of previous empirical work, indicates the presence of two clusters of individuals following different pathways from the majority of the studied sample. The first is made up of individuals with increasing physically aggressive behavior from early infancy to school entry. The second unexpected cluster is characterized by individuals with increasing hyperactive behavior throughout childhood. Our overall findings highlight the importance of specific factors in child's home environment combining to modulate many pathways to different behavioral outcomes.

Introduction

The present study investigates the prediction of physical aggression in kindergarten. More specifically, we examine childhood variables that tend to deflect life course trajectories away from expected outcomes, as predicted by a cumulative risk paradigm. In this paper, unexpected outcomes represent a deflection from a hypothesized pathway. These are characterized by residual cases, or more concretely, the differences between observed and expected values predicted by substantive and statistical methods in the social science literature. This task will be accomplished by using the Québec Longitudinal Study of Child Development. Given that individual development does not exactly follow the same patterns of mental, biological, and behavioral components throughout the life course, we expect to find many cases of such developmental inconsistencies.

Thomas and Chess (1977) were among the first to elaborate an empirically-based typology of temperament. Using clinical interviews with parents, they first identified nine specific dimensions, from which three larger dimensions of temperament were derived. Children with an easy temperament show a regular routine and tend to adjust easily to new experiences or to the presence of strangers. Slow to warm up children are typically less active, react poorly to environmental stimuli, show negative emotions and adjust slowly to new experiences. Finally, children with a difficult temperament are typically irregular in their daily routine, very active and react negatively to unknown environmental stimuli or strangers.

Lending support to Chess and Thomas (1977) typology, Caspi (2000) found three types of temperaments using cluster analysis with data from the Dunedin

longitudinal study. The well-adjusted cluster type closely matches the Chess-Thomas easy type, while the undercontrolled and inhibited types resemble Chess-Thomas difficult and slow-to-warm-up types of temperament, respectively. In a previous analysis of the same data set, support was reported for the association linking lack of control between ages of 3 and 5 and later delinquency in early adolescence (Caspi, Henry, McGee, Moffitt, & Silva, 1995). Results from several other studies suggest that children with difficult temperaments are at higher risk for later conduct problems (Frick & Morris, 2004). Moreover, such conduct problems are more likely to begin early in childhood, often in the form of physical aggression (Tremblay, Pihl, Vitaro, & Dobkin, 1994).

Data from longitudinal studies show that physical aggression in childhood represents a good predictor of antisocial behavior in adolescence (Côté, Tremblay, Nagin, Zoccolillo, & Vitaro, 2002; Broidy et al., 2003; Nagin & Tremblay, 1999). Early physical aggression does not always lead to later aggression and antisocial behavior. Results from several studies show that anger outbursts and physical aggression have high frequency between 24 and 36 months of age but then decrease as most children learn to control their difficult temperament and aggressiveness in more socially appropriate ways (Tremblay & Nagin, 2005). This suggests that some children experience something in early development that places them on a more adaptive development pathway.

The term "temperament" is often used in reference to the measurement of personality at preschool age (Roberts & DelVecchio, 2000). Although there is no consensus on the definition of temperament, most authors generally agree that

behavioral dispositions appear early in life and remain stable across time and situations (Cloninger, 1987; Shiner, 1998). The literature suggests that physical aggression from kindergarten to adulthood is based, in large part, on behavioral dispositions that are, in part, genetically inherited and appear acquired very early in life (Cloninger, Svrakic & Svrakic, 1997). Other biological factors, such as low birth weight, have also been associated with behavioral problems. Not only children born preterm have greater difficulty completing tasks involving reading and math, but they also tend to be more inattentive, aggressive, and hyperactive than their full-term peers (Anderson, Doyle, & the Victorian Infant Collaborative Study Group, 2003).

Among the theoretical interpretations available, Cloninger (1987) proposes a systematic method for the classification of both normal and abnormal personality dimensions and their relationship to later antisocial behavior. His general biosocial theory of personality includes three genetically determined dimensions of temperament: novelty seeking, harm avoidance, and reward dependence. Novelty seeking is associated with the dopaminergic system. Individuals obtaining high scores on this dimension have a greater tendency toward being impulsive, highly excitable, quick-tempered, and lack emotional self-regulation. Harm avoidance, in relation to the serotonergic system, is characterized by elevated scores on cautious, apprehensive, shy, and easily fatigable nature. Individuals with lower scores (than average) on this dimension are more confident, uninhibited, relaxed, and energetic. Cloninger's reward dependence dimension, bound to the noradrenergic system, is characterized by higher scores on industrious, warmth and sympathy, sensitivity to social cues, and eagerness to help others. Individuals who are lower than average on reward dependence are practical,

emotionally cool, insensitive to verbal signals and social reinforcement, and independent in decision-making.

Cloninger (1987) suggests that the interaction between these three neurobiological systems determines individual personality profiles. As such, individuals showing elevated or weak scores at any given time on the three measurements would correspond to one of eight extreme profiles that would be more susceptible to personality disorders and the development of specific psychopathology later in life. For example, individuals who score high on novelty seeking, low on harm avoidance, and low on reward dependence are likely to show second-order traits of impulsive-aggressive, oppositional, and opportunistic behavior.

Cloninger's (1987) focus was not specifically developmental. Nevertheless, his classification method of these temperament dimensions influenced subsequent research studying antisocial behavior using a developmental psychopathology framework. By testing the Cloninger typology, several studies have empirically supported the combined role of higher levels of hyperactive behavior, lower levels of anxious behavior, difficult temperament, and lack of prosocial behavior for others in early life as enduring individual differences that predict antisocial behavior later in life, with hyperactive behavior as the major contributor (Côté, Tremblay, Nagin, Zoccolillo, & Vitaro, 2002; Lacourse et al. 2006; Tremblay, Vitaro, Nagin, Pagani, & Séguin, 2003).

The developmental preschool literature also suggests that the combined features of a difficult temperament and anxiety could play a determining role in the development of social skills (Kochanska, 1993; Kochanska, Murray, & Harlan, 2000). Specifically, findings from these studies show that a child's receptivity to internalize rules governing

social conduct is influenced by such substantive features of temperament. For example, low levels of anxiety associated with lack of sensitivity to punitive situations could explain the development of aggression and antisocial behavior.

Although many findings indicate that difficult temperament is associated with a greater likelihood of behavioral problems and aggression, more attention needs to be given to the links between early difficult temperament and aggression and potential risk factors that may mediate behavioral pathways throughout childhood (Rothbart, 2004). As noted by Shiner and Caspi (2003), a complex behavior such as child aggression is the product of several temperament factors that may interact with each other and with other contextual variables. Consequently, the effects of such factors accumulate over the years, and the focus on a single outcome measure may underestimate the contribution of temperament to the developmental course of behavioral trajectories.

Among factors interacting with temperament, parent-child interactions appear to influence children's social problem-solving skills by teaching children effective strategies for initiating interactions and resolving conflicts in peer situations (Weiss, Dodge, Bates, & Pettit, 1992). For example, intrusive parent-child interactions predict aggressive behavior at school entry, whereas responsive and warm parental practices forecast better prosocial problem-solving strategies with peers (Pettit, Harrist, Bates, & Dodge, 1991). Also, children demonstrating antisocial and aggressive traits are often punished by their parents for their misbehavior, which can lead to increased levels of emotional distress, like child anxiety (Frick, Christian, & Wootton, 1999). Crick and Dodge (1994) argue that emotional distress can influence children's interpretations of social situations in ways that contribute exhibiting aggressive responses toward others.

Moreover, according to frustration models of aggression (Berkowitz, 1993), this type of negative feelings is likely to increase the likelihood of an aggressive response toward others. In a study designed to evaluate attributions of intent and feelings of emotional distress of relationally and physically aggressive children, Crick, Grotpeter & Bigbee (2002) found that physically aggressive children are more likely to respond to instrumental provocations with distress. Preceding findings suggest a possible developmental pathway of aggression linking parenting with child social adjustment. More specifically, parenting practices would affect child representations of parents and peers, thereby impacting on child feelings of security (and distress) and their problem-solving capacities in social contexts.

Other behavioral and contextual factors can contribute differently to the prediction of physical aggression and other behavioral pathways. For example, some developmental findings suggest that while physical aggression frequency tends to decrease after 36 months of age (Tremblay & Nagin, 2005), the frequency of indirect aggression increases substantially from 48 to 72 months of age (Vaillancourt, Brendgen, Boivin, & Tremblay, 2003), and that girls are generally more relationally aggressive (indirect aggression) than boys (Crick & Grotpeter, 1995; Ostrov & Keating, 2002). Moreover, physically aggressive children demonstrate higher levels of indirect aggression, and hostile parenting is generally associated with higher levels of physical aggression (Côté, Vaillancourt, Barker, Nagin & Tremblay, 2007). This result is supported by Jester and colleagues (Jester et al., 2005) in a study using latent growth model to classify children with inattention / hyperactivity and aggressive behaviour problems into four trajectory classes. Conflict and lack of cohesiveness in the family

environment predicted a developmental trajectory characterized by aggression, even when inattention / hyperactivity was maintained constant. Interestingly, lower parental emotional support predicted to a trajectory characterized by inattention / hyperactive behavior. The evidence suggests that family and home environment factors which predict development of inattention / hyperactive problems are likely independent from those predicting the development of aggression problems. Thus, it is important to consider a multitude of home environment factors to disentangle the development of early aggression, hyperactive behaviour, and inattention when estimating children's development longitudinally.

As proposed by Cicchetti (2006), behavioral disorders are not due to singular linear causes, but rather to a complex interplay of risk and protective factors influencing pathways to certain developmental outcomes. Given that developmental psychopathology focuses on the origins and the course of individual patterns of adjustment and maladjustment, it represents an ideal framework to study the mechanisms by which aggressive behavior evolves during childhood. It considers a multitude of potential factors that interact to determine numerous developmental pathways to children's adaptation to the environment. Thus, children exposed to similar family environments may not share the same outcome. They might evolve, deflect, or desist from a given developmental path, corresponding to vonBertalanffy's principle of multifinality (vonBartelanffy, 1968). Magnusson (2003) suggests that inter-individual differences in development are influenced of constitutional factors, maturation, and experiences. Individual development will take partly different directions because it does

not exactly develop the same patterns of mental, biological, and behavioural components throughout the life course.

The numerous fluctuations in the prediction of physical aggression seem to indicate the presence of subgroups or clusters of individuals following different pathways from the majority of the sample under study. Traditionally, most longitudinal studies have employed variable-oriented designs restricting all children to a single group pathway yielding contradictory results about the developmental trends of aggression throughout childhood. To better examine and characterized these clusters of individuals within a developmental psychopathology perspective, a person-oriented approach might provide a more qualitative depiction of the many possible pathways followed by preschoolers and allow better interpretability (von Eye & Bergman, 2003). The person approach measurement model emphasizes individual differences by studying clusters of people with similar characteristics who do not behave as estimated with respect to an expected outcome (Bergman, Magnusson, & El-Khouri, 2003). This is counterintuitive to traditional approaches that assume groups as homogeneous in nature. While mainstream research methods and paradigms tend to rely upon closed system to test their hypothesis, most social science theories rest upon a heuristically rich open system (Richters, 1997). As such, the identification of heterogeneous groups of individuals might provide a better understanding of the change processes occurring in the open system of childhood development.

In this paper, we seek to establish findings that will explore unexpected pathways deflecting from a hypothesized physical aggression pathway using a developmental psychopathology framework. Unlike traditional social research

practices, our approach seeks to illustrate inconsistencies in the developmental course of physical aggression. Our analysis of residuals cases from a prediction equation (and theoretical model) emphasizing the role of difficult temperament, hyperactivity, anxiety, and prosocial behavior will provide such inconsistencies. Given the possibility of distinct developmental courses of physical aggression in childhood, we aim to analyze the distinct characteristics of individuals forming unexpected heterogeneous clusters that do not behave as Cloninger's model would predict. Unexpected pathways in the context of this paper occur when predictors are not associated with an aggressive behavior outcome. Specifically, our goal is to determine the factors that predict membership to unexpected clusters of residuals cases, the expected cluster serving as a comparison group.

Method

Participants and procedure

This study is based on data from the Quebec Longitudinal Study of Child Development launched in 1998 with a cohort of infants from the Canadian province of Québec. Data collection was conducted by the Institut de la Statistique du Quebec on an annual basis. Infants were followed from 5 months to approximately 6 years of age. They were selected from the Master Birth Registry which, under the auspices of the Ministry of Health and Social Services, comprises records of all births by calendar year. This data was granted by the Access to Information Commission. Infants were excluded if they were living in northern Quebec and First Nations territories. They were also excluded if their gender could not be determined from the Master Birth Registry or if the duration of their mother's pregnancy was impossible to calculate.

A sample of 2694 infants (and their families) was included, representative of 94.5% of the target population. Among those, 1997 infants made up the second wave of the longitudinal study (8 became ineligible and 689 were untraceable). From this sampling procedure, 1820 cases were retained. Biological parents were present in the household. Table 1 shows that the sub-sample is evenly represented of girls and boys and that 39.3 % of these children were firstborn. The average maternal age at birth of the target child was 26.93 years ($SD = 8.90$), and 13.4% of mothers and 16.9% of fathers did not have a high school diploma.

A computerized interview was conducted at the child's residence with the person most knowledgeable. The mother was the interviewee in 99% of cases, mainly because mothers stayed home most often with the 5-month-old infant at the first wave. The duration of the interviews was 100 minutes, on average. Interviewees were also asked to complete questionnaires.

Measures: Outcome

The physical aggression variable emanates from the Social Behavior Questionnaire (SBQ, mother report, Tremblay et al., 1991). The SBQ assesses children's behavioral adjustment and originate from the Ontario Child Health Study and the Montreal Longitudinal-Experimental Study. It comprises a number of reliable subscales with responses rated on a 3-point Likert scale: 1 = never or not true, 2 = sometimes or somewhat true, and 3 = often or very true. As our dependant variable, physical aggression represents a 12-item scale assessed at 17, 29, and 56-68 months of age (kicks others; gets into fights; takes things away from others; pushes others to get what he/she wants; threatens to hit others; gets angry when accidentally hurt; physically

attacks others; cruel to others; punches others; bullies others; bites others; hits others,

average Cronbach alpha from 17 to 68 months = .80). All scale scores were converted to

standardized scales ranging from 0 to 10 for each variable. As an early childhood

behavioral assessment, the SBQ represents a good predictor of later psycho-social

adjustment (Dobkin, Tremblay, Mâsse, & Vitaro, 1995; Haapasalo & Tremblay, 1994;

Tremblay, Pagani-Kurtz, Mâsse, Vitaro, & Pihl, 1995; Tremblay, Pihl, Vitaro, &

Dobkin, 1994).

Measures: Cloninger's theoretical variables for the expected pathway model

Difficult temperament. A 6-item scale assessed maternal perceptions of difficult

temperament when the child was 17-months-old, (difficult to calm or soothe when

upset; gets fussy and irritable; cries and fuss; gets upset easily; changeable mood;

difficulty handling the child). Responses are on a 7-point Likert scale, ranging from 1 =

changes seldom and changes slowly when he/she does change, to 7 = changes often and

rapidly. Scale scores were then transformed into a standardized scale ranging from 0 to

10 (Cronbach alpha = .80).

Hyperactive behavior. A 7-item scale assessed hyperactive child behavior at 17,

29, and 56-68 months of age (can not stay in place; consistently moves; impulsive and

acts without thinking; can not wait for his/her turn; can not remain calm when has to do

something; easily distracted; can not concentrate and maintain attention, average

Cronbach alpha from 17 to 56-68 months = .75), representing Cloninger's novelty

seeking dimension.

Anxiety. A 4-item scale assessed anxiety when the child was 17, 29, and 56-68

months of age (looks sad; too apprehensive or anxious; worried; cries a lot, average

Cronbach alpha from 17 to 68 months = .47), representing Cloninger's harm avoidance disposition.

Prosocial skills. A 3-item scale assessed prosocial skills at 29 and 56-68 months of age (will try to help someone who has been hurt; comforts a child who is crying or upset; helps other children who are feeling sick, average Cronbach alpha from 29 to 68 months = .42), representing Cloninger's reward dependence.

Measures: Behavioral explanatory variables emanating from the SBQ

Indirect aggression. A 3-item scale assessed indirect aggression when the child was between 56-68 months of age (tries to get others to dislike a person; becomes friends with another as revenge; says bad things behind others' back, Cronbach alpha = .68).

Inattention. A 4-item scale assessed inattention when the child was 17 and 29 months of age (can not concentrate; gives up easily; inattentive; easily distracted, average Cronbach alpha from 17 to 29 months = .55), and a 3-item between 56 and 68 months of age (has difficulty to pursue any activity; can not maintain his/her attention for a long period of time; inattentive, average Cronbach alpha = .66).

Separation anxiety. A 5-item scale assessed separation anxiety when the child was 17 and 56-68 months of age (preoccupied by the loss or the fact that something might happen to one of his/her parents; feels physical uneasiness when separated from the parents; clings to the adults or too dependent; do not want to sleep alone; gets very upset when separate from the parents, average Cronbach alpha from 17 to 68 months = .52).

Emotional distress. A 7-item scale assessed emotional distress when the child was 17 months of age (seems to be unhappy or sad; not as happy as other children; fearful or anxious; worried; cries a lot; nervous; has trouble enjoying him/herself, Cronbach alpha = .41).

Measures: Parental explanatory variables

Maternal overprotection. A 4-item scale assessed maternal overprotection when the child was 17-months-old (need to have my child near me all of the time; would consider myself a real mother hen; miss my child when I'm out; have trouble deciding on whether or not to use child care, Cronbach alpha = .44).

Maternal depression. A 12-item scale assessed maternal depression when child was 17-months-old (doesn't want to eat, have little appetite; not able to feel better, even with the help of family or friends; difficulty to concentrate on tasks; feel depressed; everything requires an effort; full of hope facing the future; agitated sleep; happy; feel alone; enjoy life; cry a lot; have the feeling that nobody loves him/her, Cronbach alpha = .46).

Coercive parental practices. A 5-item scale assessed coercive parental practices when the child was 41-months-old (angry at the child following a speech or a gesture that he/she is not supposed to make; hit the child when he/she is difficult; get angry when punishing the child; raise voice or shout at the child; give bodily punishments, Cronbach alpha = .41).

Measures: Control variables

Sex. Sex was controlled throughout the analyses.

Socioeconomic status. Socioeconomic status of the family was measured when the child was 17 months of age and is computed as a composite score with five variables including mother's and father's education, their employment prestige, and household revenue.

Birth weight for gestational age. This variable was computed by dividing birth weight with gestational birth age in weeks.

Data analysis strategy

There are three steps to our technique (Figure 1a and 1b). First, an expected pathway model, guided by a theoretical framework, was generated to identify those individuals showing aggressive behavior at 56-68 months in the presence of putative risk factors during early childhood. In substantive terms, early childhood risk factors for later aggression include difficult temperament, higher levels of hyperactive behavior, lower levels of anxiousness, and lack of prosocial skills. We generated such a model using stepwise multiple linear regression. In order to better estimate the impact of behavioral development, our model includes change scores of either hyperactive, anxious, or prosocial behavior. These represent the simple difference between an earlier and later data point on a specific behavior (56-68 months minus 17 months), with its behavioral baseline (17 months) serving as its control in the model. In principle, those fitting the expected pathway model are cases appearing closest to the regression line. Unexpected pathways in the context of this study occur when predictors are not associated with aggressive behavior at 56-68 months. We determined that residual scores at 1.5 standard deviation above or below the regression line would represent cases of unexpected pathways. We categorized these as upper and lower clusters,

respectively. The expected cluster represents a random selection of cases situated close to the regression line.

Next, a series of t-tests using theoretical and explanatory variables were computed in order to describe the groups. More specifically, these include hyperactive and inattentive behavior at 17, 29, and 56-68 months of age; physical aggression at 17 and 29 months of age; separation anxiety behavior at 17 and 56-68 months of age; anxious and prosocial skills at 29 and 56-68 months of age; temperament, emotional distress, maternal depression, and maternal overprotection at 17 months of age; coercive parental practices at 41 months of age; and finally, indirect aggression at 56-68 months of age. We then used a standard logistic regression to evaluate the unique contribution of variables found significant in the above t-tests to generate a characteristic profile for the two unexpected clusters.

Finally, we conducted a stepwise sequential logistic regression to predict membership in the unexpected clusters. Given that our goal is to determine the factors that predict membership to either the upper or lower clusters, the expected cluster would serve as the comparison group in the analyses (omitted). For every analysis, the content of the blocks was theoretically and longitudinally determined, with birth weight for gestational age and sex entered as controls in the first block, SES in the second block, followed by difficult temperamental and parental variables (temperament, maternal depression and overprotection, and coercive parental practices) in the third block. Theoretical and explanatory behavioral variables (hyperactive behavior, anxious behavior, prosocial skills, physical aggression, indirect aggression, inattention, separation anxiety, and emotional distress) were entered in the fourth block.

Results

Generating an expected pathway model guided by a theoretical framework

First, the results from stepwise multiple regression generating an expected

pathway model are reported in Table 2. Three risk factors were selected using a

stepwise procedure, each of which contributed significantly ($p < 0.001$) to the prediction

of physical aggression at 56-68 months. Prosocial skills (29 and 56-68 months) did not

predict physical aggression at 56-68 months significantly. Specifically, temperament

measured at 17 months, hyperactive behavior change score (56-68 months – 17 months)

and anxiety change score (56-68 months – 17 months) made a significant contribution to

the model, $F(8, 1444) = 57\,401, p < .000$. This final model accounted for 24% of the

variance in predicting physical aggression at 56-68 months while controlling for initial

differences in hyperactive and anxious behavior at 17 months.

Profiling the upper and lower unexpected groups

Using the standardized residuals of the preceding model, two unexpected

clusters were constituted from cases that were 1.5 standard deviation above (upper

unexpected cluster, $n = 108$) and below (lower unexpected cluster, $n = 72$) the expected

pathway model. A random sample of cases near the regression line was then selected to

create the expected comparison cluster ($n = 143$). A preliminary series of t-tests were

then conducted to begin to identify the most significant variables in each of the

unexpected clusters.

Ten variables achieved significance on bivariate tests that differentiated the

upper from the lower cluster, confirming two distinct clusters (Table 3). We

characterize the upper cluster as an overly aggressive-coerced cluster because they show

significantly higher levels of physical aggression behavior at 17 and 29 months ($t =$

3.33, $p < .01$; $t = 4.89$, $p < .001$, respectively), higher levels of indirect aggression at 56-68 months ($t = 5.13$, $p < .001$) and are affected by coercive parental practices at 41 months ($t = 3.86$, $p < .001$).

We characterize the lower cluster as an ADH cluster because they demonstrated higher levels of inattention at 17, 29 and 56-68 months ($t = -2.66$, $p < .01$; $t = -2.83$, $p < .01$; $t = -.4.27$, $p < .001$, respectively), higher levels of hyperactive behavior at 17, 29 and 56-68 months ($t = -2.66$, $p < .01$; $t = -3.64$, $p < .001$; $t = -4.00$, $p < .001$, respectively), had a difficult temperament ($t = -2.06$, $p < .05$), greater prosocial skills at 29 months ($t = -2.01$, $p < .05$), higher levels of anxiety at 29 and 56-68 months ($t = -2.83$, $p < .01$; $t = -2.22$, $p < .05$), higher levels of separation anxiety at 17 months ($t = -2.06$, $p < .05$), and finally, were overprotected by their mothers ($t = -4.49$, $p < .001$).

A standard logistic regression was conducted to confirm the profile of the preceding unexpected clusters. Sex, indirect aggression at 56-68 months, coercive parental practices at 41 months, and physical aggression behavior at 29 months significantly predicted the upper unexpected cluster, compared to the lower unexpected cluster. More specifically, a one unit increase in physical aggressive behaviors at 56-68 months predicts a four-fold increase in odds of being a boy (Wald Test (1) = 5.67, $p < .05$). Also, a one unit increase in indirect aggression at 56-68 months (Wald Test (1) = 13.40, $p < .001$), coercive parental practices at 41 months (Wald Test (1) = 10.06, $p < .01$) and physical aggression at 29 months (Wald Test (1) = 18.00, $p < .001$) respectively predicts an increase of 0.4, 0.4 and 0.3 in odds of belonging to the upper unexpected cluster, compared to the lower unexpected cluster. This confirms that the upper group could be accurately represented with an overly-aggressive-coerced profile.

Maternal overprotection at 17 months, hyperactive behavior at 29 months, inattention at 56-68 months, and anxiety at 29 and 56-68 months emerged as significant predictors for the lower unexpected cluster. For children of that group, a one unit increase in overprotection by the mother at 17 months predicts a three-fold increase in odds of belonging to this unexpected cluster (Wald Test (1) = 12.86, $p < .001$), compared to the upper unexpected cluster. Also, a one unit increase in hyperactive behavior at 29 months predicts a two-fold increase in odds of belonging to lower cluster, compared to the upper cluster (Wald Test (1) = 6.95, $p < .01$). Finally, a one unit increase in inattention at 56-68 months (Wald Test (1) = 8.00, $p < .01$) and anxiety at 29 and 56-68 months [Wald Test (1) = 7.32, $p < .01$; Wald Test (1) = 4.65, $p < .05$, respectively] predicts respectively an increases of 2.4, 2.2 and 1.8 in odds of being significantly associated with the lower cluster. This confirms that the lower unexpected cluster could be represented, with some confidence, as having an inattentive-hyperactive-maternally-overprotected profile.

Predicting membership to the unexpected clusters

We next conducted stepwise sequential logistic regressions to predict membership to the upper unexpected cluster compared to the expected cluster (omitted). Sex and birth weight for gestational age were entered as control variables in the first block. Results in figure 2 show that a one unit increase in physical aggression between 17 and 56-68 months predicts a 2.5 increase in odds of belonging to the overly-aggressive-coerced cluster compared to the expected cluster while controlling for initial differences in physical aggression at 17 months (Wald Test (1) = 13.42, $p < .001$). Also, one unit increase in coercive parental practices at 41 months (Wald Test (1) = 8.04, $p <$

.05), and in indirect aggression at 56-68 months (Wald Test (1) = 22.71, $p < .001$) predicts a two-fold increase in odds of belonging to the overly-aggressive-coerced cluster compared to expected cluster, respectively. Finally, an interaction effect is found between aggressive behavior change score (56-68 – 17 months) and sex, as one unit increase in odds predicts .47 greater chances of being a girl and belonging to the expected cluster compared to the overly-aggressive-coerced cluster (Wald Test (1) = 5.00, $p < .05$).

Finally, we conducted another stepwise sequential logistic regression between the lower unexpected cluster compared to the expected cluster (omitted). As a primary step, we first entered sex and birth weight for gestational age as control variables. Results in figure 3 show that a one unit increase in hyperactive behavior between 17 and 56-68 months predicts a four-fold increase in odds of belonging to the lower unexpected cluster compared to the expected cluster while controlling for initial differences in hyperactive behavior at 17 months (Wald Test (1) = 24.13, $p < .001$). The lower unexpected cluster could then be represented, with some confidence, as having only an overly-hyperactive profile, with inattention and maternal overprotection not being found significant in the final model.

Discussion

The purpose of this study was to examine early childhood variables that tend to deflect from an estimated developmental pathway of physical aggression at school entry. More specifically, we first sought to examine the characteristics of unexpected pathways away from the hypothesized developmental course by testing the role of difficult temperament, hyperactivity, anxiety, and prosocial behavior as would be predicted by

existing theory. Our method generated an empirical model, driven by a developmental operationalization of Cloninger's work.

Our second goal was to examine the source of deflection. We then determined membership to the upper and lower clusters of deflection away from the expected pathway; our data indicated two unexpected pathways.

Overly-aggressive-coerced cluster. Our findings indicate a first possible pathway of increasing physically aggressive behavior between 17 and 56-68 months of age while discounting the influence of initial level of aggressiveness at 17 months. Specifically, this heterogeneous group of preschoolers has twice the risk of being aggressive, both physically and indirectly, and being affected by harsh parental practices. This result is consistent with studies showing a small proportion of children exhibiting high levels of aggression throughout preschool years (Jester et al., 2005; Nagin & Tremblay, 2001; Nagin & Tremblay, 1999). This unexpected pathway group was also predicted by parental coercive practices measured when the child was 41 months of age. As found in previous studies (Côté, Vaillancourt, Barker, Nagin & Tremblay, 2007; Gershoff, 2002; Jester et al., 2005; Loukas, Zucker, Fitzgerald, & Krull, 2003), hostile parenting is associated with higher levels of physically aggressive behavior during childhood. It has also been previously proposed that indirect aggressive behaviors were specifically related to maternal coercion (Hart, Nelson, Robinson, Olsen, & McNeilly-Choque, 1998). Our data indicate such a cluster of highly aggressive children also demonstrating higher levels of indirect aggression at 56-68 months of age, which is consistent with other findings (Côté, Vaillancourt, Barker, Nagin & Tremblay, 2007; Vaillancourt, Brendgen, Boivin & Tremblay, 2003). In their study, Côté and

colleagues created developmental trajectories using a sample of children from the National Longitudinal Survey of Children and Youth (NLSCY; Statistics Canada, 1995). A proportion of 13.5% of children exhibited both physically and indirectly aggressive behavior. In addition, boys were more likely to show physically aggressive behavior than girls, which is consistent with our finding indicating that boys had more chances belonging to our first unexpected group demonstrating increasing levels of physical aggressive behavior between 17 and 56-68 months of age.

Within this context, our results could be interpreted as supporting a link between highly aggressive children and a coercive style of parenting (Patterson, 1982). On the one hand, these children would elicit more physical punishment from their parents because they are difficult to control. As such, harsh parental control would result in more coercive interactions establishing a cycle maintaining physically aggressive behavior during childhood. Physically aggressive behaviors have been shown to be modulated by the joint contribution of adverse home environment including coercive practices and shared genes (Ge et al., 1996). On the other hand, the link between child aggression and hostile parenting can be initially driven by the hostile parenting. Our data set allows us to examine some aspects of parenting but does not rule out this competing explanation.

It remains unclear whether the link between the development of physically aggressive behavior and coercive practices is due to genetic or environmental influences, a correlation between them, or even a reciprocal influence of child-parent characteristics. Taken together, the previous results support Loeber & Stouthamer-Loeber's (1998) explanation for the development of physical aggressive behavior as

being part of a complex pattern of continuity and discontinuity of individual developmental processes throughout childhood years.

Overly-hyperactive cluster. Our data indicate a second possible pathway of increasing hyperactive behavior between 17 and 56-68 months of age while controlling for initial levels of hyperactivity at 17 months. Specifically, this heterogeneous group of children has a four-fold increase risk of being hyperactive during preschool years. This finding is consistent with previous work suggesting a partial independence of hyperactive, inattentive, and aggressive behaviors from one another (Hinshaw, 1987). Consistent with our second possible pathway, research using latent growth modeling by Jester et al. (2005) found a pathway group of children constituted of inattentive / hyperactive behavior remaining constant throughout childhood with decreasing levels of aggressive behaviors while controlling for any possible overlap between these behavioral domains. This trajectory is similar to those of Nagin and Tremblay (2001, 1999). According to Frick (1994), one of the major difficulties in studying specific factors associated with a developmental pathway of hyperactive or aggressive behavior is that they often co-occur together. Some authors suggest that family context variables specific to the development of such behaviors might explain the mechanisms maintaining and moderating these different pathways (Johnston & Mash, 2001).

Consistent with our findings, Jester and colleagues (2005) have provided evidence for differential influence of family characteristics in the development of two types of behavior. More specifically, lower parental emotional support in early childhood predicted an inattention / hyperactivity trajectory. Conversely, conflict in the family environment predicted membership to an aggressive behavior trajectory. While

it was not confirmed in our final stepwise sequential logistic regressions, maternal overprotection was initially associated with our *hyperactive* cluster. More specifically, being overprotected tripled the odds of belonging to a hyperactive developmental pathway. This is consistent with recent research by Pfiffner and McBurnett (2006) suggesting a combination of three family factors as correlates of anxiety comorbid with ADHD. As such, the combining role of inadequate care and excessive protectiveness in parenting practices might explain why some individuals evolve through a pathway of hyperactive behavior rather than taking an aggressive trajectory through childhood years (Parker, 1983; Moore, 2004). To address the possible link between overprotection and hyperactive behavior, a longitudinal analysis of children with a stable childhood pathway of hyperactivity of both overprotective and nonoverprotective mothers would be required.

The overall findings of this research using the analysis of residuals highlight the importance of specific factors in the child's home environment combining to modulate different possible developmental pathways. It could be interpreted that some parenting characteristics may be specifically associated with the development of a hyperactive behavioral pathway (overprotection), while others are specific to the development of a physically aggressive behavior pathway (coercive practices). This paper offers a limited demonstration of how similar risk factors combine to create different developmental trajectories (multifinality). It represents only a first step in identifying possible behavioral pathways that need to be further confirmed with stronger analytical techniques such as latent growth modeling. Nonetheless, the person-centered approach used in this paper represents an attempt to consider the true ramifications of an open

system perspective and is thus consistent with the study of unexpected pathways within a developmental psychopathology framework.

Our findings have implications for clinical practice. Priority should be given to the early identification of preschoolers' demonstrating high levels of physical aggression in order to design interventions that include parents, given that coercive practices are a powerful marker of more serious developmental trajectory of aggressive behavior. Also, as for children with hyperactive behavior, and those whose parents are overprotective, appear to be at risk for the development of more serious hyperactive pathway through preschool years: As such, parental involvement in the intervention process becomes imperative for this group as well.

There are limitations to this study. First, the fact that mothers reported their child's behaviors might be a source of bias. Children's physical aggression scores changed between 17 and 56-68 months of age. This might reflect changes in mothers' perceptions rather then substantive developmental changes in their child's aggressive behavior or even reporting biases. It has been shown that mothers tend to overreport externalizing problems (Clarke-Stewart, Allhusen, McDowell, Thelen, & Call, 2003). For this matter, future studies are encouraged to use additional sources of information, such as fathers' perceptions, and observational data to validate mothers' perceptions of child behavior.

Another limitation concerns the group constitution. Cases were selected based on whether they were above or below 1.5 standard deviation from the mean on the dependant variable. This criterion is arbitrary. This procedure doesn't allow studying pathways for cases situated between the upper and lower thresholds. Our results do not

take into account children showing less severe pathways of behavioral development. This limits our understanding of other possible vulnerability factors that might modulate the course of development. Also, other vulnerability factors not accounted for in the initial model of predicted pathway of physical aggression may be responsible for constitution of unexpected pathway clusters.

Our non-at-risk sample was primarily constituted of middle-class French Canadian Caucasian children, limiting the generalizability of our results. It is not clear whether the current results will extend to other cultures, single-parent families, and more disadvantaged populations. We see this as a potential strength as it reduces variations that could be due to acclimatization or adjustment to family transition and hardship.

Finally, it is plausible that the other variables which did not achieved entry into the explanatory model for the unexpected clusters simply did not do so because of unreliable measurement (small alphas). Nevertheless, the two specific configurations generated appear consistent with previous empirical findings in the literature. These potential methodological characteristics notwithstanding, this study represents an innovative approach in revealing possible distinctive pathways and tests initial hypothesis to the development of subtype of aggressively behavioral manifestations during childhood. We generated results despite having a sample of less at-risk children, making our approach quite conservative. We encourage others with rich data sets to replicate and extend the methods and ideas entertained in this paper.

References

Anderson, P., Doyle, L.W., & the Victorian Infant Collaborative Study Group (2003).

    Neurobehavioral outcomes of school age children born extremely low birth weight

    or very preterm in the 1990s. *Journal of the American Medical Association, 289*,

    3264–3272.

Bergman, L. R., Magnusson, D., & El-Khouri, B. M. (2003). *Studying the individual*

    development in an interindividual context: A person-oriented approach. Mahwah,

    NJ: Lawrence Erlbaum Associated Publishers.

Berkowitz, L. (1993). *Aggression: Its Causes, consequences, and control*. NY:

    McGraw-Hill.

Broidy, L. M., Nagin, D. S., Tremblay, R. E., Bates, J. E., Brame, B., Dodge, K. A., et

    al. (2003). Developmental trajectories of childhood disruptive behaviors and

    adolescent delinquency: A six-site, cross-national study. *Developmental*

    Psychology, 39, 222-245.

Caspi, A. (2000). The child is father of the man: Personality continuities from childhood

    to adulthood. *Journal of Personality and Social Psychology, 78*, 158-172.

Caspi, A., Henry, B., McGee, R. O., Moffitt, T. E., & Silva, P. A. (1995).

    Temperamental origins of child and adolescent behavior problems: From age three

    to fifteen. *Child Development, 66*, 55-68.

Chess, S., & Thomas, A. (1977). Temperamental individuality from childhood to

    adolescence. *Journal of the American Academy of Child Psychiatry, 16*, 218-226.

Cicchetti, D. (2006). Development and psychopathology. In D. Cicchetti, & C. J.

   Donald (Eds.), *Developmental psychopathology: Vol. 1. Theory and method* (2nd

   ed., pp. 1-23). Hoboken, NJ: John Wiley & Sons Inc.

Clarke-Stewart, K. A., Allhusen, V. D., McDowell, D. J., Thelen, L., & Call, J. D.

   (2003). Identifying psychological problems in young children: How do mothers

   compare with child psychiatrists? *Journal of Applied Developmental Psychology,

   23*, 589-624.

Cloninger, C. R. (1987). A systematic method for clinical description and classification

   of personality variants. A proposal. *Archives of General Psychiatry, 44*, 573-588.

Cloninger, C. R., Svrakic, N. M., & Svrakic, D. M. (1997). Role of personality self-

   organization in development of mental order and disorder. *Development and

   Psychopathology, 9*, 881-906.

Côté, S., Tremblay, R. E., Nagin, D., Zoccolillo, M., & Vitaro, F. (2002). The

   development of impulsivity, fearfulness, and helpfulness during childhood:

   Patterns of consistency and change in the trajectories of boys and girls. *Journal of

   Child Psychology and Psychiatry, 43*, 609-618.

Côté, S. M., Vaillancourt, T., Barker, E. D., Nagin, D., & Tremblay, R. E. (2007). The

   joint development of physical and indirect aggression: Predictors of continuity and

   change during childhood. *Development and Psychopathology, 19*, 37-55.

Crick, N. R., & Dodge, K. A. (1994). A review and reformulation of social information-

   processing mechanisms in children's social adjustment. *Psychological Bulletin, 75*,

   74-101.

Crick, N. R., & Grotpeter, J. K. (1995). Relational aggression, gender, and social-

psychological adjustment. *Child Development, 66*, 710-722.

Crick, N. R., Grotpeter, J. K., & Bigbee, M. A. (2002). Relationally and physically

aggressive children's intent attributions and feelings of distress for relational and

instrumental peer provocations. *Child Development, 73*, 1134-1142.

Dobkin, P. L., Tremblay, R. E., Mâsse, L. C., & Vitaro, F. (1995). Individual and peer

characteristics in predicting boys' early onset of substance abuse: A seven-year

longitudinal study. *Child Development, 66*, 1198-1214.

Frick, P. J. (1994). Family dysfunction and the disruptive behavior disorders: A review

of recent empirical findings. *Advances in Clinical Child Psychology, 16*, 203–226.

Frick, P. J., Christian, R. E., & Wooton, J. M. (1999). Age trends in the association

between parenting practices and conduct problems. *Behavior Modification, 23*,

106-128.

Frick, P. J., & Morris, A. S. (2004). Temperament and developmental pathways to

conduct problems. *Journal of Clinical Child and Adolescent Psychology, 33*, 54-

68.

Ge, X., Conger, R. D., Cadoret, R. J., Neiderhiser, J. M., Yates, W., Troughton, E., et al.

(1996). The developmental interface between nature and nurture: A mutual

influence model of child antisocial behavior and parent behaviors. *Developmental

Psychology, 32*, 574–589.

Gershoff, E. T. (2002). Corporal punishment by parents and associated child behaviors

and experiences: A meta-analytic and theoretical review. *Psychological Bulletin,

128*, 539-579.

Haapasalo, J., & Tremblay, R. E. (1994). Physically aggressive boys from ages 6 to 12: Family background, parenting behavior, and prediction of delinquency. *Journal of Consulting and Clinical Psychology, 62*, 1044-1052.

Hart, C. H., Nelson, D. A., Robinson, C. C., Olsen, S. F., & McNeilly-Choque, M. K. (1998). Overt and relational aggression in Russian nursery-school-age children: Parenting style and marital linkages. *Developmental Psychology, 34*, 687-697.

Hinshaw, S. P. (1987). On the distinction between attentional deficits/hyperactivity and conduct problems/aggression in child psychopathology. *Psychological Bulletin, 101*, 443– 463.

Jester, J. J., Nigg, J. T., Adams, K., Fitzgerald, H. E., Puttler, L. I., Wong, M. M., et al. (2005). Inattention/hyperactivity and aggression from early childhood to adolescence: Heterogeneity of trajectories and differential influence of family environment characteristics. *Development and Psychopathology, 17*, 99-125

Johnston, C., & Mash, E. J. (2001). Families of children with attention–deficit/hyperactivity disorder: Review and recommendations for future research. *Clinical Child and Family Psychology Review, 4*, 183–207.

Kochanska, G. (1993). Toward a synthesis of parental socialization and child temperament in early development of conscience. *Child Development, 64*, 325–347.

Kochanska, G., Murray, K. T., & Harlan, E. T. (2000). Effortful control in early childhood: Continuity and change, antecedents, and implications for social development. *Developmental Psychology, 36*, 220-232.

Lacourse, E., Nagin, D. S., Vitaro, F., Côté, S., Arseneault, L., & Tremblay, R. E. (2006). Prediction of early-onset deviant peer group affiliation: A 12-year longitudinal study. *Archives of General Psychiatry, 63*, 562-568.

Loeber, R., & Stouthamer-Loeber, M. (1998). Development of juvenile aggression and violence: Some common misconceptions and controversies. *American Psychologist, 53*, 242-259

Loukas, A., Zucker, R. A., Fitzgerald, H. E., & Krull, J. L. (2003). Developmental trajectories of disruptive behavior problems among sons of alcoholics: Effects of parent psychopathology, family conflict, and child undercontrol. *Journal of Abnormal Psychology, 112*, 119–131.

Magnusson, D. (2003). The person approach: Concepts, measurements models, and research strategy. *New Directions for Child and Adolescent Development, 101*, 3-23.

Moore, P. S. (2004). The use of social stories in a psychology service for children with learning disabilities: A case study of a sleep problem. *British Journal of Learning Disabilities, 32*, 133-138.

Nagin, D., & Tremblay, R. E. (1999). Trajectories of boys' physical aggression, opposition, and hyperactivity on the path to physically violent and nonviolent juvenile delinquency. *Child Development, 70*, 1181–1196.

Nagin, D. S., & Tremblay, R. E. (2001). Parental and early childhood predictors of persistent physical aggression in boys from kindergarten to high school. *Archives of General Psychiatry, 58*, 389-394.

Ostrov, J. M., & Keating, C. F. (2002). Gender differences in preschool aggression

during freeplay and structured interactions: An observational study. *Social

Development, 13*, 255-277.

Parker, G. (1983). *Parental overprotection: A risk factor in psychosocial development.*

New York: Grune & Stratton.

Patterson, G. R. (1982). *Coercive family process.* Eugene, OR: Castalia.

Pettit, G. S., Harrist, A. W., Bates, J. E., & Dodge, K. A. (1991). Family interaction,

social cognition and children's subsequent relations with peers at kindergarten.

Journal of Social and Personal Relationships, 8, 383-402.

Pfiffner, L. J., & McBurnett, K. (2006). Family correlates of comorbid anxiety disorders

in children with attention deficit/hyperactivity disorder. *Journal of Abnormal

Child Psychology, 34*, 725-735.

Richters, J. E. (1997). The hubble hypothesis and the developmentalist's dilemma.

Development and Psychopathology, 9, 193-229.

Roberts, B. W., & DelVecchio, W. F. (2000). The rank-order consistency of personality

traits from childhood to old age: A quantitative review of longitudinal studies.

Psychological Bulletin, 126, 3–25.

Rothbart, M. K. (2004). Commentary: Differentiated measures of temperament and

multiple pathways to childhood disorders. *Journal of Clinical Child and

Adolescent Psychology, 33*, 82-87.

Shiner, R. L. (1998). How shall we speak of children's personalities in middle

childhood? A preliminary taxonomy. *Psychological Bulletin, 124*, 308-332.

Shiner, R. L., & Caspi, A. (2003). Personality differences in childhood and adolescence: Measurement, development, and consequences. *Journal of Child Psychology and Psychiatry, 44*, 2-32.

Statistics Canada. (1995). National longitudinal survey of children: Overview of survey instruments for 1994–95 data collection cycle 1. Retrieved September 9, 2006 from http://dsp-psd.pwgsc.gc.ca/Collection/Statcan/89F0078X/89F0078XIE1996001.pdf

Thomas, A., & Chess, S. (1977). *Temperament and development*. New York: Brunner/Mazel.

Tremblay, R. E., Loeber, R., Gagnon, C., Charlebois, P., Larivée, S., & LeBlanc, M. (1991). Disruptive boys with stable and unstable high fighting behavior patterns during junior elementary school. *Journal of Abnormal Child Psychology, 19*, 285-300.

Tremblay, R. E., & Nagin, D. S. (2005). The developmental origins of physical aggression in humans. In R. E. Tremblay, W. W. Hartup, & J. Archer (Eds.), *Developmental origins of aggression* (pp. 83-106). New York: Guilford Press.

Tremblay, R. E., Pagani-Kurtz, L., Mâsse, L. C., Vitaro, F., & Pihl, R. O. (1995). A bimodal preventive intervention for disruptive kindergarten boys: Its impact through mid-adolescence. *Journal of Consulting and Clinical Psychology, 63*, 560-568.

Tremblay, R. E., Pihl, R. O., Vitaro, F., & Dobkin, P. L. (1994). Predicting early onset of male antisocial behavior from preschool behavior. *Archives of General Psychiatry, 51*, 732-738.

Tremblay, R. E., Vitaro, F., Nagin, D. S., Pagani, L., & Séguin, J. R. (2003). The Montreal longitudinal and experimental study: Rediscovering the power of descriptions. In T. P. Thornberry, & M. D. Krohn (Eds.), *Taking stock of delinquency: An overview of findings from contemporary longitudinal studies* (pp. 205-254). New York: Kluwer Academic/Plenum.

Vaillancourt, T., Brendgen, M., Boivin, M., & Tremblay, R. (2003). Longitudinal confirmatory factor analysis of indirect and physical aggression: Evidence of two factors over time? *Child Development, 74*, 1628–1638.

Von Bertalanffy, L. (1968). *General systems theory.* New York: Braziller.

Von Eye, A., & Bergman, L. R. (2003). Research strategies in developmental psychopathology: Dimensional identity and the person-oriented approach. *Development and Psychopathology, 15*, 553-580.

Weiss, B., Dodge, K. A., Bates, J. E., & Pettit, G. S. (1992). Some consequences of early harsh discipline: child aggression and a maladaptive social information processing style. *Child Development, 63*, 1321–35.

Table 1

Sociodemographic characteristics of the children household at the second wave (1999) of the QLSCD (n=1820)

Variables	Percentage	Mother percentage	Father percentage
Sex of the child			
Girls	49.6		
Boys	50.4		
No. of brothers and sisters			
0	39.3		
1	42.6		
2	12.4		
3	4.3		
4+	1.3		
Parental education			
No high school diploma		13.4	16.9
High school diploma		10.3	11.7
Postsecondary studies		17.3	17.1
Technical school diploma		10.3	11.0
College diploma		14.5	13.7
Partial university studies		5.3	4.0
University degree		28.8	25.6

47

Table 2

Stepwise multiple regression predicting physical aggression at 56-68 months

Variable	B	SE B	95% CI
Controlled baseline:			
Anxious behavior at 17 months	.13***	.12	(.07 - .20)
Hyperactive behavior at 17 months	.29***	.40	(.25 - .34)
Anxious behavior change score (56-68 months – 17 months)	.11***	.16	(.07 - .15)
Hyperactive behavior change score (56-68 months – 17 months)	.32***	.47	(.27 - .36)
Temperament at 17 months	.11***	.11	(.06 - .16)
Prosocial behavior at 17 months	.00	.00	(-.03 - .03)
Prosocial behavior at 29 months	.02	.04	(-.00 - .05)
Prosocial behavior at 56-68 months	.01	.02	(-.02 - .05)

Note. Adjusted R^2 = .24***; *** indicates $p < 0.001$

Table 3

T-test significance and mean score between upper and lower unexpected groups generated from the prediction of physical aggression at 56-68 months

Variable	T-test Significance	Mean score	
	Unexpected groups	Upper unexpected cluster	Lower unexpected cluster
Maternal overprotection at 17 months	t = -4.49***	4.16	5.60
Difficult temperament at 17 months	t = -2.06*	2.75	3.43
Coercion at 41 months	t = 3.86***	4.06	3.23
Hyperactive behavior at 17 months	t = -2.66**	3.56	4.48
Hyperactive behavior at 29 months	t = -3.64***	4.12	5.43
Hyperactive behavior 56-68 months	t = -4.00***	4.76	5.88
Inattention at 17 months	t = -2.66**	2.15	3.04
Inattention at 29 months	t = -2.83**	2.38	3.51
Inattention at 56-68 months	t = -4.27***	3.35	4.86
Physical aggression at 17 months	t = 3.33**	1.82	1.16
Physical aggression at 29 months	t = 4.89***	2.77	1.61
Indirect aggression at 56-68 months	t = 5.13***	1.59	0.41
Anxiety at 29 months	t = -2.83**	0.85	1.64
Anxiety at 56-68 months	t = -2.22*	2.82	3.52
Separation anxiety at 17 months	t = -2.06*	2.55	3.17
Prosocial skills at 29 months	t = -2.01*	2.89	3.80

Note. * indicates $p < 0.05$, ** indicates $p < 0.01$, *** indicates $p < 0.001$

Figure 1a. The three steps of data analysis strategy.

First step: Generating an expected pathway model guided by a theoretical framework

Second step: Profiling the upper and lower unexpected clusters

Figure 1b. The three steps of data analysis strategy.

Third step: Predicting membership in the unexpected clusters

Upper unexpected group

Expected Group

Lower unexpected group

Stepwise sequential logistic regression

The first regression compares the upper unexpected group with the expected one.

The second regression compares the lower unexpected group with the expected one.
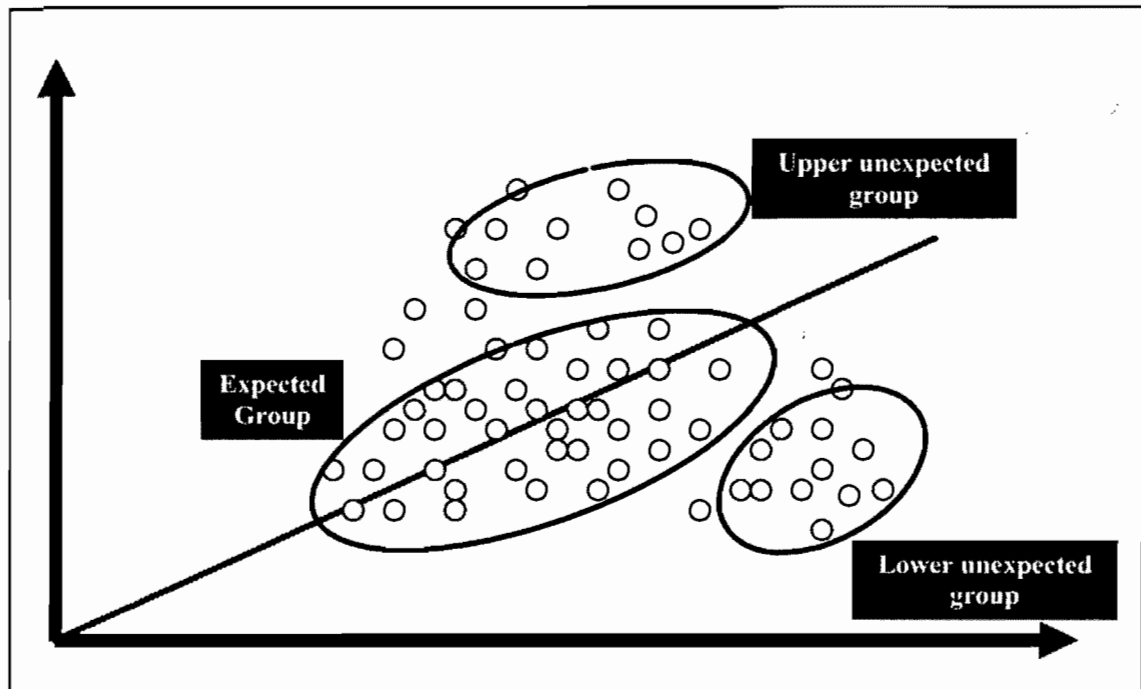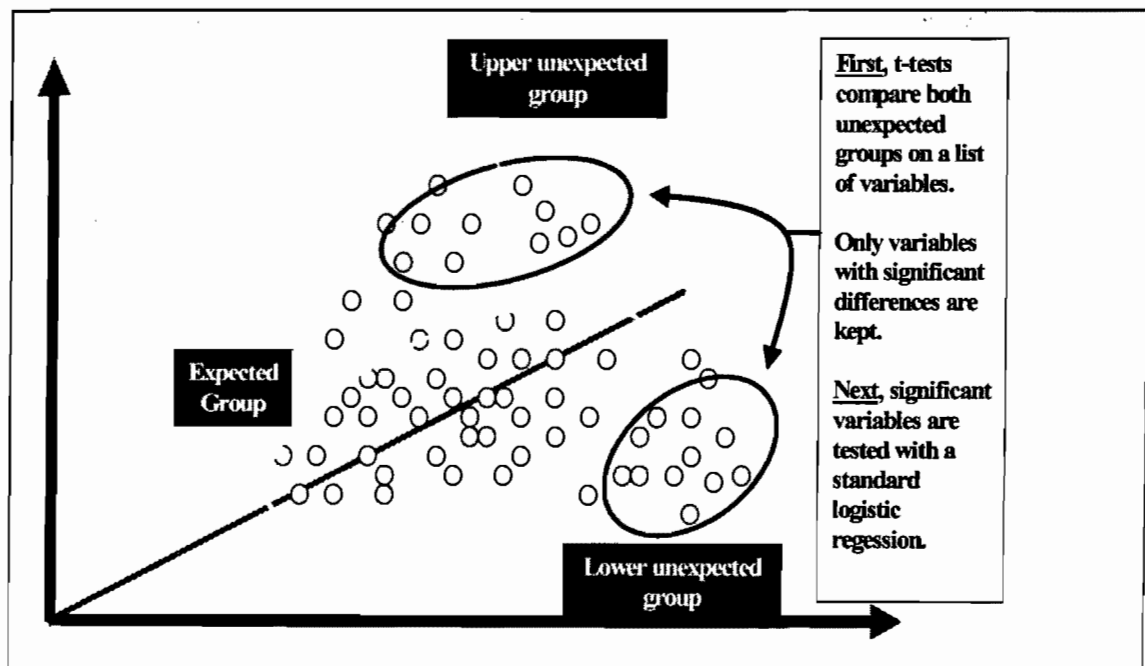
This represents the final step to the profiling and characterization of the unexpected groups
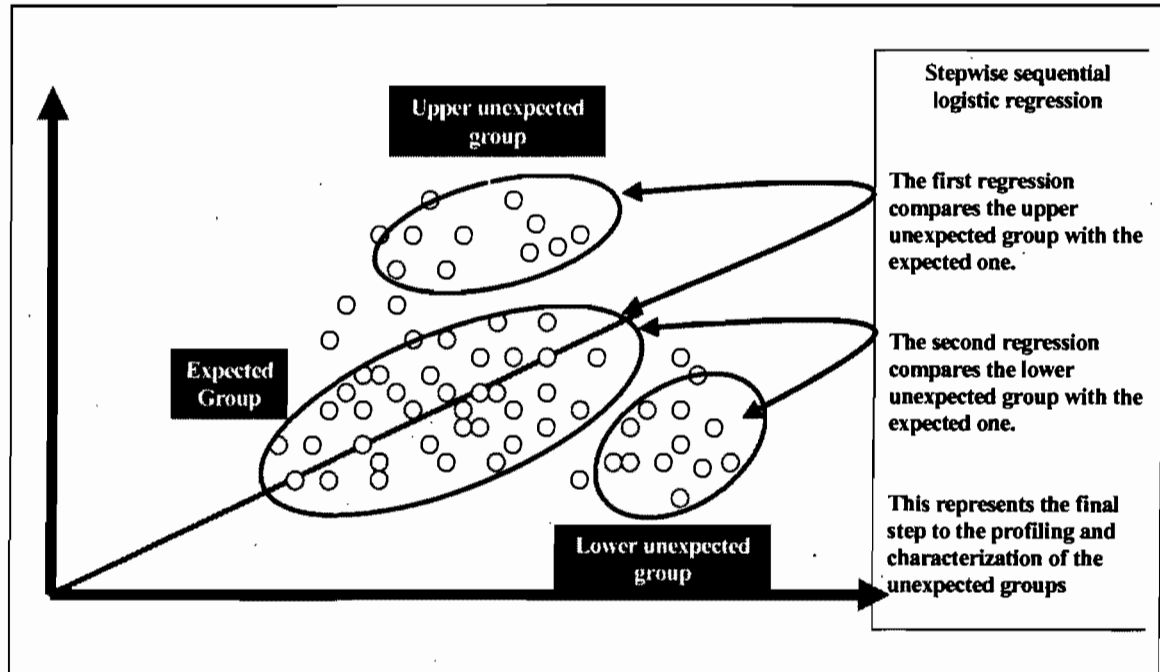
Figure 2. Physical aggression mean score for unexpected and expected clusters.
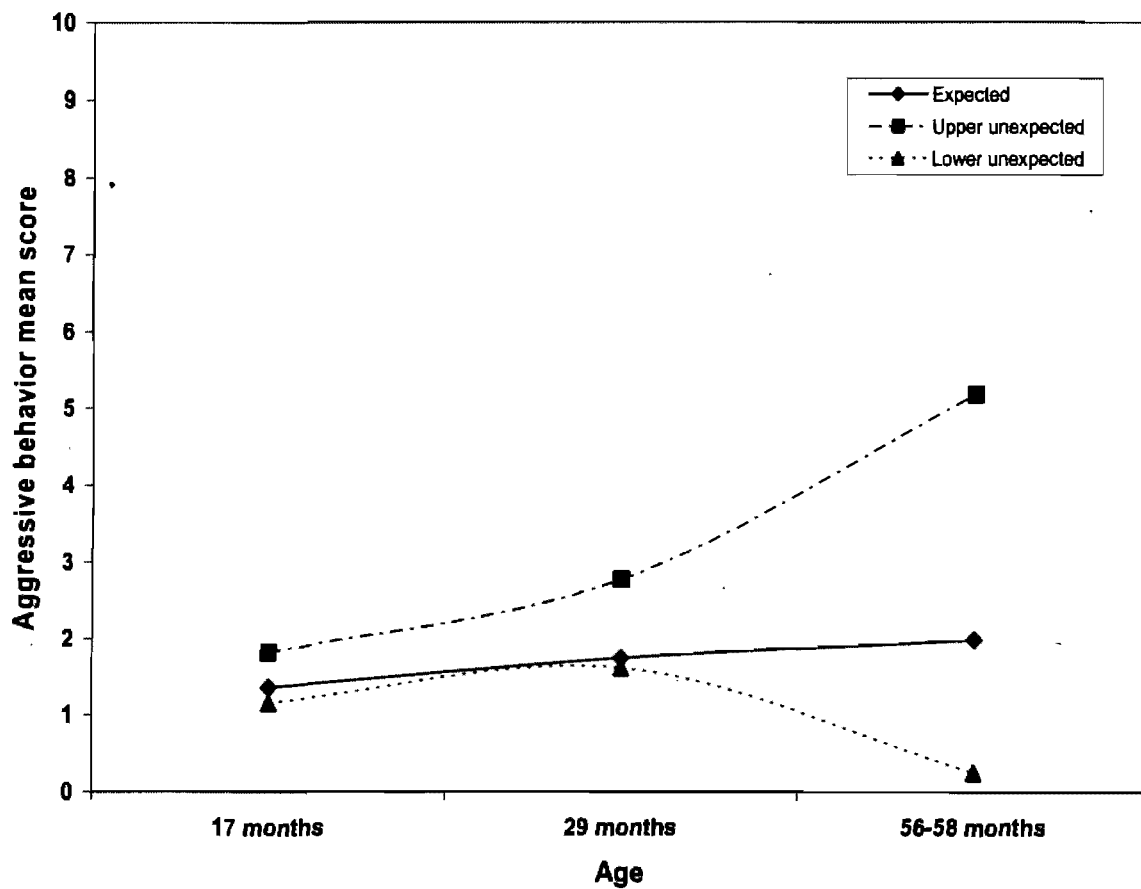
Figure 3. Hyperactive behavior mean score for unexpected and expected clusters.
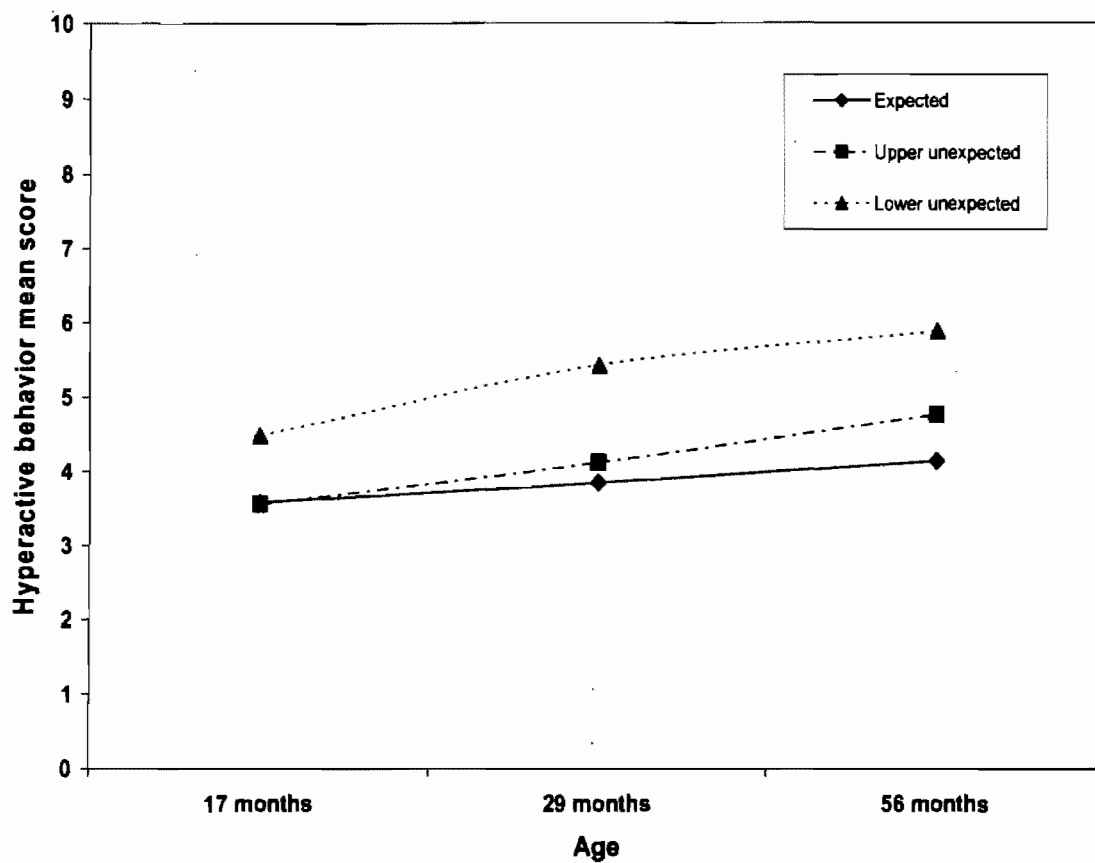
Article 2

When the expected are not the observed: Failed predictions of

child anxiety at school entry

Abstract

Using the Quebec Longitudinal Study of Child Development data set, this study examines early childhood variables that tend to deflect life-course trajectories away from a hypothesized anxiety pathway using a developmental psychopathology framework. We analyzed residual cases from a prediction equation driven by previous empirical work emphasizing the role of individual and parental characteristics in the development of anxiety by school entry. Our findings indicate the presence of two clusters of individuals following different pathways from the majority of the studied sample. The first is made up of individuals with increasing hyperactive and emotionally distressed behaviors from early infancy to school entry. The second unexpected cluster is characterized specifically by separation anxiety around kindergarten and school entry years. Our overall findings highlight the importance of specific factors in child's home environment combining to modulate many pathways to different behavioral outcomes.

Introduction

The present investigation prospectively examines what accounts for failed predictions of anxious behavior in kindergarten. We examine early childhood variables that tend to deflect life course outcomes estimated by a cumulative risk paradigm.

Unexpected outcomes represent a deflection from a hypothesized pathway. In the context of this study, these are characterized by residual cases, or more concretely, differences between the observed and expected values predicted by substantive and statistical methods in the social science literature. This task will be accomplished by using the Quebec Longitudinal Study of Child Development. Given that individual development does not exactly follow the same patterns of mental, biological, and behavioral components throughout the life course, we expect to find many cases of such developmental inconsistencies.

Anxiety disorders are among the most prevalent forms of psychological distress experienced by children in our society (Costello & Angold, 1995). These can lead to chronic maladaptation in adulthood if left untreated (Ollendick & King, 1994). In fact, their chronic and invalidating nature is often seriously underestimated (Kessler, Berglund, Demler, Jin & Walters, 2005) as is their stability across time (Pagani, Japel, Vaillancourt, Côté, & Tremblay, 2007). An insufficient understanding of its nature and susceptibility to personal and individual variations generate a state of invalidity for many individuals and the overuse of health care and medical services (Stein et al., 2004; Wang et al., 2005). Despite a substantial body of research on anxious behaviors, the mechanisms by which anxious pathways develop and are associated through parent-child interactions are not clear.

According to Wood, McCleod, Sigman, Hwang, and Chu (2003), four plausible pathways could explain transmission of anxiety among parent-child dyads: (1) some parenting behaviors may elicit anxiety in their children; (2) child's own anxious behaviors and manifestations may elicit parental anxiety; (3) genetic vulnerabilities shared by both parent and child may explain their common anxious behaviors; and (4) parenting, genetic similarities, and other risk and protective factors may mutually reinforce or moderate through an iterative process. Consistent with the first pathway is Chorpita and Barlow's (1998) theoretical model of anxiety which focuses primarily on the concept of control. Drawn from Parker's work, the model emphasizes parental practices characterized by low warmth and high control (Parker, 1983). If parents fail to provide their children with occasions to engage in situations or activities that foster the development of self-help skills and the construction of parent-child relationship boundaries, children may not able to develop a sense of positive autonomy and self-control over challenging situations of the everyday life (e.g., putting on clothes, tying shoes).

Relatedly, Chorpita and Barlow (1998) stress the salience of the environment and events occurring during childhood as important as genetics in the development of anxious behaviors. As such, parental attitudes and behaviors play an important role in the development of the child's notion of control over events. Parental skills are generally considered the cornerstones of socio-emotional development in young children (Bornstein, 1995). During childhood, a parent's capacity to detect a child's needs and respond adequately contributes to the establishment of secure parent-child relation, creating a context favorable for the child's socio-emotional development

(Bretherton and Waters, 1985; De Wolff and Van Ijzendoom, 1997; Isabella, 1995). For example, results from research done with older children suggest that inconsistent parental behaviors characterized by intrusion and overprotection contribute to the development of perceptions of lack of control and aggravate (reinforce) child anxiety (Chorpita and Barlow, 1998).

Parental control is associated with increased child psychopathology (Caron, Weiss, Harris, & Catron, 2006). Autocratic parental decision-making fosters children's over-dependence upon parents, overprotection, and excessive interference of child activities (Wood et al., 2003). In response, children may develop a dysfunctional dependence upon parents. The contingencies associated with parenting behaviors might also reinforce the child's perception of lack of control over perceived or actual threats, thereby accentuating separation anxiety (Wood et al., 2003). Chorpita and Barlow (1998) suggest that children experiencing little or no control over day-to-day challenges early in life will develop a sense of helplessness. This represents a significant risk factor for development of anxious behaviors because it amplifies the impact of contextual stressors. Rubin and Mills (1991) claim that parental overprotection prevents children from engaging in behaviors that are important for the development of social growth and perceived mastery over their environment. Additionally, it would be the combination between biologic vulnerabilities and environmental factors that may lead to the emergence of a developmental pathway of anxious behaviors including anxiety separation and difficulties (Chorpita & Barlow, 1998).

Perceptions that parents have about their parenting competence are at the heart of the quality of the parental involvement and the parent-child interaction dynamics during

childhood (Parke and Buriel, 1998; Teti and Gelfand, 1991; Thompson, 1998). Unfortunately, parental responsiveness is not always optimal and, its correlate, maternal depressive symptoms represent more risks to child development. Children reared by a depressed caregiver are at increased risk of later socioemotional, cognitive, and behavioral deficits (Campbell et al., 2004; Goodman & Gotlib, 2002). Maternal depression is believed to play an important role through its undeniable transmission of biological risk and its impact on the family process. This inherent parental characteristic displayed via maternal unresponsiveness and negativity influences later child behavioral outcomes (Pagani, Japel, Girard, Farhat, Côté, & Tremblay, 2004). Findings from research show that direct as much as indirect interactions between children and depressed caregivers are most often characterized by insensitive and less positive exchanges, which in turn result in emotional insecurity for the child (Cummings and Davies, 1995; Davies and Cummings, 1994). Data from observational research shows that children of depressed mothers have greater chances of being fussy, having a difficult temperament, and demonstrating insecure attachments to their mothers compared to children of nondepressed mothers (Goodman & Gotlib, 1999; Luoma et al., 2001). In sum, early maternal depressive symptoms risk undermining children's emotional security by threatening their sense of protection within the parent-child relationship.

Parental depression has frequently been associated with greater use of coercive behavior to rear and discipline children (Smith & Brooks-Gunn, 1997; Wissow, 2001). Additionally, data from Rapee (2002) indicate that maternal control uniquely predicts child anxiety compared to paternal control behaviors. Use of coercive discipline by

mothers mediates the predictive link between maternal depression and children's disruptive behaviors (Spieker, Larson, Lewis, Keller, & Gilchrist, 1999). Lack of consistency in parental responses to child's needs, as well as the tendency to adopt coercive and punitive strategies would be associated with the development of an insecure attachment and subsequent behavior problems (Crittenden, 1988; Lyons-Ruth, Connell, Grunebaum, & Botein, 1990). Hirschi (1969) claims that parental use of coercive practices might prevent the development of attachment bonds between children and their parents. As a consequence, children risk failing to internalize parental and social values, risk experiencing a low sense of self-control. Additionally, individuals low in self-control might engage in aggressive and under-controlled behaviors such as hyperactivity in order to get immediate and easy gratification of their needs (Gershoff, 2002).

The presence of inadequate care and excessive protectiveness (Parker, 1983) might explain why some individuals develop anxious and hyperactive behavior from early to middle childhood years. This is consistent with recent research by Pfiffner and McBurnett (2006) suggesting a combination of three family factors as correlates of comorbid anxiety applicable to ADHD including overprotection, coercive parental behaviors, and low caregiving and warmth. Findings also suggest that overprotected children have a tendency to be less sensitive to the behaviors and feelings of others (Taylor & Alden, 2006) and to misread others intentions in addition to social cues (Taylor & Alden, 2005). Finally, other biological factors, such as low birth weight, have also been associated with cognitive deficits leading to misreading other's intentions. Not only children born preterm have greater difficulty completing tasks

involving reading and math, but they also tend to be more inattentive, aggressive, and hyperactive than their full-term peers (Anderson, Doyle, & the Victorian Infant Collaborative Study Group, 2003). Altogether, the above findings indicate that many risk factors may mediate or precipitate the development of anxious behaviors and other related behavioral problems in preschool years.

Given that developmental psychopathology focuses on the nature and the course of individual patterns of adjustment and maladjustment, it represents an ideal framework to study the mechanisms by which anxiety evolve during childhood. It considers a multitude of potential risk and protective factors that interact do determine numerous developmental pathways to child adaptation to the environment. Additionally, it offers a useful heuristic paradigm to understand the transactional and cumulative influences of predictors causing anxious behaviors. From this view, behavioral disorders are not due to singular linear causes, but rather to an interplay of risk and protective factors influencing pathways to certain developmental outcomes (Cicchetti, 2006). Thus, children exposed to similar family environments may not share the same outcome. They might evolve through different developmental paths, corresponding to vonBertalanffy's principle of multifinality (vonBertalanffy, 1968). Magnusson (2003) suggests that inter-individual differences in development are influenced by constitutional factors, maturation, and experiences. Individuals will take partly different directions because they do not develop exactly the same patterns of mental, biological, and behavioral components over the life course.

In their review on the relation between parenting and childhood anxiety, Wood and colleagues suggest moving from traditional correlational research to paradigms that

would clarify the direction of effects linking parenting and development of preschoolers' anxiety (Wood, McLeod, Sigman, Hwang & Chu, 2003). Repeated measures of parenting and anxiety at developmentally important time points offer the possibility to examine directional pathways. Longitudinal research designs might help reveal the temporal sequence of events in the child life-course linking transactions between parenting and anxious child manifestations. Wood and colleagues stress two steps to follow in order to better understand the development of anxiety. The first step is to clarify possible pathways and test initial hypothesis in assessing predictors of anxiety at developmentally meaningful childhood intervals. Those should be associated with specific challenges of the preschool periods such as entry in daycare, kindergarten and primary school. An innovative next step would be to conduct statistical modeling to examine change in parenting practices and also changes in anxiety trajectories.

In this paper, we generally seek to apply Wood and colleagues' first step in exploring unexpected pathways deflecting from a hypothesized anxiety route using a developmental psychopathology framework. To date, past efforts to examine development of anxious behaviors have largely focused on variable-centered aspects rather than on profile of individual functioning that better respect an open-system perspective. As suggested by Bergman and Trost (2006), all livings things have functional interactions with their environment. Individual developmental processes in the life course are nonlinear more often than linear and the transformations of the mental, biological, and behavioral components of the integrated person-environment system do not always occur linearly along a timescale, but are more a dynamic process with nonlinear shifts occurring during the life course.

Most social science theories rest upon heuristically rich open systems (Richters, 1997). From an open system perspective, multiple maladaptive outcomes can result from similar origins varying among individuals, tracing multiple developmental pathways to any particular behavior disorder (Cicchetti & Tucker, 1994). However, mainstream research methods and paradigms tend to rely upon generally stagnant and non transactional methods approaches which assume closed rather than open systems to test their hypothesis. This leaves room for multiple errors in prediction.

A broad array of models has been proposed to better understand the way by which anxiety is transmitted from parents to children. Among them, intergenerational transmission mechanisms, genetic predisposition, family systems theory, parental sensitivity and warmth, and emotional modeling of parenting behavior have been used to clarify the numerous associations found in the literature between parenting variables and developmental psychopathology including anxiety. Also, many predictor variables have been considered to help explain the nature and course of anxiety across childhood, many studies emphasizing parenting as one of the most important contributor (Wood, McLeod, Sigman, Hwang & Chu, 2003). Traditionally, most longitudinal studies have employed variable-oriented designs restricting children to a single mean pathway, which yields contradictory results about internalizing trends throughout childhood. For example, Hollenstein, Granic, Stoolmiller, and Snyder (2004) found that most children display a low and stable internalizing trajectory, while Colder, Mott, and Berman (2002) found an upward trend between 4-and-8-year-old children. Adding to this complex picture, Gazelle and Ladd (2003) observed a decreasing trend in internalizing symptoms between 6 and 10 years of age. Taken together, the discrepancies demonstrated in the

preceding findings seem to indicate the presence of subgroups (clusters) of individuals following different pathways from the majority of the studied sample. To better examine and characterized such clusters of individuals within a developmental psychopathology perspective, a person-oriented approach would provide a more qualitative depiction of the many pathways followed by preschoolers and allow better interpretability of behavioral development (von Eye & Bergman, 2003). The person approach measurement model emphasizes individual differences by studying clusters of people with similar characteristics who do not necessarily behave as estimated with respect to an expected outcome (Bergman, Magnusson, & El-Khouri, 2003). Moreover, the prediction and identification of such heterogeneity could provide a better depiction of the complex change processes occurring during childhood. Therefore, to better understand why some individuals will have different outcomes while sharing the same starting points (same predictors), we apply vonBertalanffy's principle of multifinality to our analyses.

Chorpita and Balrow (1998) provide an appealing framework for examining the mechanisms by which different predictors aggravate developmental risk of an anxious pathway during early childhood. It also inspires us to examine other possible developmental pathways and outcomes within a developmental psychopathology framework. Our approach is counterintuitive to prevailing research practices and seeks to illustrate inconsistencies in the developmental course of anxiety based on the analysis of residual cases from a prediction equation emphasizing the role of separation anxiety, maternal depression, and coercive parental practices in the development of anxious behavior at kindergarten entry. Specifically, our goal is to determine the factors that

predict membership to unexpected clusters of residuals cases, the expected cluster serving as a comparison group.

Method

Participants and procedure

Data from the present paper were drawn from a larger ongoing prospective longitudinal investigation launched in 1998 with a cohort of infants from the Canadian province of Quebec. Data collection was conducted by the Institut de la Statistique du Québec on an annual basis. Infants were followed from 5 months to approximately 6 years of age. They were selected from the Master Birth Registry which, under the auspices of the Ministry of Health and Social Services, comprises records of all births by calendar year. This data was granted by the Access to Information Commission. Infants were excluded if they were living in northern Quebec and First Nations territories. They were also excluded if their gender could not be determined from the Master Birth Registry or if the duration of their mother's pregnancy was impossible to calculate.

The sample consisted of 2694 infants (and their families), representative of 94.5% of the target population. Among those, 1997 infants made up the second wave of the longitudinal study (because 8 became ineligible and 689 were untraceable). From this sampling procedure, 1820 cases were retained. Biological parents were present in the household. Table 1 shows that the sub-sample is evenly represented of girls and boys and that 39.3 % of these children were firstborn. The average maternal age at birth of the target child was 26.93 years ($SD = 8.90$), and 13.4% of mothers and 16.9% of fathers did not have a high school diploma.

A computerized interview was conducted at the child's residence with the person most knowledgeable. The mother was the interviewee in 99% of the cases, mainly because mothers stayed home most often with the 5-month-old infant at the first wave. The duration of the interviews was 100 minutes, on average. Interviewees were also asked to complete questionnaires.

Measures: Outcome variable

The anxiety variable emanates from the Social Behavior Questionnaire (SBQ, mother report, Tremblay et al., 1991). The SBQ assesses children's behavioral adjustment and originate from the Ontario Child Health Study and the Montreal Longitudinal-Experimental Study. It comprises a number of reliable subscales with responses rated on a 3-point Likert scale: 1 = never or not true, 2 = sometimes or somewhat true, and 3 = often or very true. As our dependant variable, anxiety represents a 4-item scale assessed when the child was between 56 and 68 months of age (looks sad; too apprehensive or anxious; worried; cries a lot, Cronbach alpha = .56). All scale scores were converted to standardized scales ranging from 0 to 10 for each variable. As an early childhood behavioral assessment, the SBQ represents a good predictor of later psycho-social adjustment (Dobkin, Tremblay, Mâsse, & Vitaro, 1995; Haapasalo & Tremblay, 1994; Tremblay, Pagani-Kurtz, Mâsse, Vitaro, & Pihl, 1995; Tremblay, Pihl, Vitaro, & Dobkin, 1994).

Measures: Prediction variables for the expected pathway model

Separation anxiety at 56-68 months of age. A 5-item scale assessed separation anxiety when the child was between 56 and 68 months of age (preoccupied by the loss or the fact that something might happen to one of his/her parents; feels physical

uneasiness when separated from the parents; clings to the adults or too dependent; do not want to sleep alone; gets very upset when separate from the parents, Cronbach alpha = .52).

Maternal depression. A 12-item scale assessed maternal depression when child was 17-months-old (do not want to eat, have little appetite; not able to feel better, even with the help of family or friends; difficulty to concentrate on tasks; feel depressed; everything requires an effort; full of hope facing the future; agitated sleep; happy; feel alone; enjoy life; cry a lot; feel that nobody loves him/her, Cronbach alpha = .46).

Coercive parental practices. A 5-item scale assessed coercive parental practices when the child was 41-months-old (angry at the child following a speech or a gesture that he/she is not supposed to make; hit the child when he/she is difficult; get angry when punishing the child; raise voice or shout at the child; give bodily punishments, Cronbach alpha = .41).

Measures: Behavioral explanatory variables emanating from the SBQ

Emotional distress. A 7-item scale assessed emotional distress when the child was 17 and 56-68 months of age (seems to be unhappy or sad; not as happy as other children; to fearful or anxious; worried; cries a lot; nervous; trouble enjoying him/herself, Cronbach alpha = .42).

Hyperactive behavior. A 7-item scale assessed hyperactive behavior at 17 and 56-68 months of age (can not stay in place; consistently moves; impulsive and acts without thinking; can not wait for his/her turn; can not remain calm when has to do something; easily distracted; can not concentrate and maintain attention, Cronbach alpha = .75).

Inattention. A 4-item scale assessed inattention when the child was 17 months of age (can not concentrate; gives up easily; inattentive; easily distracted, average Cronbach alpha = .52), and a 3-item between 56 and 68 months of age (difficulty to pursue any activity; can not maintain his/her attention for a long period of time; inattentive, average Cronbach alpha = .66).

Anxiety at 17 and 29 months of age. A 4-item scale assessed anxiety when the child was 17 and 29 months of age (looks sad; too apprehensive or anxious; worried; cries a lot, Cronbach alpha = .56).

Separation anxiety at 17 months of age. A 4-item scale assessed separation anxiety when the child was 17 months of age (constantly seeks help; clings to adults or too dependent; do not want to sleep alone; gets very upset when separate from the parents, Cronbach alpha = .52).

Physical aggression. A 12-item scale assessed physical aggression when the child was between 56 and 68 months of age (kicks others; gets into fights; takes things away from others; pushes others to get what he/she wants; threatens to hit others; gets angry when accidentally hurt; physically attacks others; cruel to others; punches others; bullies others; bites others; hits others, Cronbach alpha = .80).

Measures: Parental explanatory variable

Maternal overprotection. A 4-item scale assessed maternal overprotection when the child was 17-months-old (need to have my child near me all of the time; would consider myself a real mother hen; miss my child when i'm out; have trouble deciding on whether or not to use child care, Cronbach alpha = .63).

Measures: Control variables

    Sex. Sex was controlled throughout the analyses.

    Socioeconomic status. Socioeconomic status of the family was measured when the child was 17 months of age and is computed as a composite score with five variables including mother's and father's education, their employment prestige, and household revenue.

    Birth weight for gestational age. This variable was computed by dividing birth weight with gestational birth age in weeks.

Data analysis strategy

    There are three steps to our technique (Figure 1a and 1b). First, an expected pathway model, guided by an empirical framework, was generated to identify those individuals showing anxious behavior at 56-68 months in the presence of putative risk factors during early childhood. In substantive terms, early childhood risk factors for later anxiety include separation anxiety, maternal depression, and coercive parental practices. We generated such a model using stepwise multiple linear regression. In order to better estimate the impact of behavioral development, our model includes a change score of separation anxiety since it was the only predictor measured at 2 time-points intervals in the database. This represents the simple difference between two data points on anxious separation (56-68 months minus 17 months), with its behavioral baseline (17 months) serving as its control in the model.

    In principle, those fitting the expected pathway model are cases appearing closest to the regression line. Unexpected pathways in the context of this study occur when predictors are not associated with anxious behavior at 56-68 months. We

determined that residual scores at 1.5 standard deviation above or below the regression line would represent cases of unexpected pathways. We categorized these as upper and lower clusters, respectively. The expected cluster represents a random selection of cases situated close to the regression line.

Next, a series of t-tests using theoretical and explanatory variables were computed in order to describe the groups. More specifically, these include anxious separation behaviors at 17 and 56-68 months of age; maternal depression measured when child is 17 months of age; coercive practices at 41 months of age; hyperactive behavior, inattentive behavior, and emotional distress at 17 and 56-68 months of age respectively; anxious behavior at 17 and 29 months of age; physical aggressive behavior at 56-68 months of age; and finally, maternal overprotection at 17 months of age. We then used a standard logistic regression to evaluate the unique contribution of each variable found significant in the above t-tests to generate a characteristic profile for the two unexpected clusters.

Finally, we conducted a stepwise sequential logistic regression to predict membership in the unexpected clusters. Given that our goal is to determine the factors that predict membership to either the upper or lower clusters, the expected cluster would serve as the comparison group in the analyses (omitted). For every analysis, the content of the blocks was theoretically and longitudinally determined, with birth weight for gestational age and sex entered as controls in the first block, SES in the second block, followed by explanatory parental variable (overprotection) in the third block. Theoretical and explanatory behavioral variables (anxious separation, maternal depression, coercive practices, hyperactive behavior, inattentive behavior, emotional

distress behavior, anxious behavior, physical aggression) were entered in the fourth block.

Results

Generating an expected pathway model guided by a theoretical framework

First, the results from stepwise multiple regression to generate an expected pathway model are presented. As reported in table 2, three risk factors were selected using a stepwise procedure, each of which contributed significantly to the prediction of anxious behavior at 56-68 months. Specifically, the anxious separation change score (56-68 months – 17 months), maternal depression measured at 17 months, and maternal coercion practices assessed at 41 months made a significant contribution to the model, $F(4, 1490) = 114,868, p < .000$. This model accounted for 23% of the variance in predicting anxious behavior at 56-68 months while controlling for initial differences in separation anxiety at 17 months.

Profiling the upper and lower unexpected clusters

Using the standardized residuals of the preceding model, two unexpected groups were constituted from cases that were 1.5 standard deviation above (upper unexpected group, $n = 121$) and below (lower unexpected group, $n = 57$) the expected pathway model. A random sample of cases near the regression line was then selected to create the expected group ($n = 139$). A series of t-tests were then conducted to begin identify the most significant variables in each of the unexpected clusters.

Five variables achieved significance on bivariate tests that differentiated the upper from the lower cluster, confirming two distinct clusters (Table 3). A first cluster, representing an overly hyperactive-anxious and emotionally distressed cluster of individuals, showed significantly higher levels of hyperactive behavior at 17 and 56-68

months ($t = 2.12, p < .05$; $t = 3.96, p < .001$, respectively), emotional distress at 17 and 56-68 months ($t = 2.23, p < .05$; $t = 7.54, p < .001$, respectively), inattention at 17 and 56-68 months ($t = 2.62, p < .05$; $t = 4.46, p < .001$, respectively), and finally, physical aggression at 56-68 months ($t = 4.25, p < .001$).

A second cluster representing an anxious-overprotected cluster of individuals, demonstrated greater levels of separation anxiety at 17 and 56-68 months ($t = -2.43, p < .05$; $t = -7.24, p < .001$, respectively).

A standard logistic regression was conducted to determine the profile of the preceding upper and lower unexpected clusters in comparison to the expected pathway cluster. Hyperactive behavior at 56-68 months and emotional distress at 56-68 months were significantly associated with the upper unexpected cluster. More specifically, a one unit increase in hyperactive behavior at 56-68 months predicts 50% greater chances of belonging to this unexpected cluster (Wald Test (1) = $6.74, p < .01$). Also, one unit increase in emotional distress at 56-68 months (Wald Test (1) = $23.63, p < .001$) predicts a 30% greater chance of belonging to the upper unexpected cluster compared to the lower unexpected cluster. This confirms that the upper cluster could be accurately represented as an overly-hyperactive-emotionally distress profile.

Anxious separation at 56-68 months was the only descriptor variable associated with the lower unexpected cluster. For children of that group, a one unit increase in anxious separation at 56-68 months predicts a six-fold increase in odds of belonging to the lower cluster compared to the upper cluster (Wald Test (1) = $24.20, p < .001$). This confirms that the lower unexpected cluster could be represented, with some confidence, as having a separation-anxiety profile.

Predicting membership to the unexpected clusters

We next conducted stepwise sequential logistic regressions to predict membership to the upper unexpected cluster compared to the expected cluster (omitted). Sex and birth weight for gestational age were entered as control variables in the first block. Results in figure 2 show that a one unit increase in emotional distress between 17 and 56-68 months predicts a two-fold increase in odds of belonging to the upper unexpected cluster compared to the expected cluster while controlling for initial differences in emotional distress at 17 months (Wald Test (1) = 23.17, $p < .001$). Also, one unit increase in hyperactive behavior between 17 and 56-68 months predicts an increase of 1.5 in odds of belonging to the upper cluster compared to the expected cluster (Wald Test (1) = 5.60, $p < .05$) (see figure 3).

Finally, we conducted another stepwise sequential logistic regression between the lower unexpected cluster compared to the expected cluster (omitted). As a primary step, we first entered sex and birth weight for gestational age as control variables. Results show that a one unit increase in separation anxiety at 56-68 months predicts an increase of 3.2 in odds of belonging to the lower unexpected cluster compared to the expected cluster (Wald Test (1) = 27.33, $p < .001$). More specifically, separation anxiety mean scores at 56-68 months for the expected and upper cluster are respectively 2.24 and 2.28 while the lower unexpected cluster mean score is 4.07.

Discussion

The purpose of this study was to examine early childhood variables that tend to deflect from an estimated developmental pathway of anxious behavior at school entry. More specifically, we first sought to examine the characteristics of unexpected pathways away from the hypothesized developmental course by testing the role of separation anxiety, maternal depression, and coercive parental practices. Using these predictors, an expected pathway model accounting for 23% of the variance was initially generated in order to derive standardized residuals.

Our second goal was to examine the source of deflection. We then determined membership to the upper and lower clusters of deflection away from the expected pathway. These represent heterogeneous individuals following different pathways from the majority of the studied sample. Data from the present paper identified two such unexpected clusters.

Hyperactive-emotional-distressed cluster. Our findings indicate a first pathway made up of both increasing hyperactive and emotionally distressed behaviors from early infancy to kindergarten entry while controlling for baseline levels of hyperactive and emotionally distressed behaviors. This result highlights the comorbid relation between hyperactive and anxious behaviors previously described in the literature. For example, Tannock (2000) found that 15 to 30% of anxious children from clinical samples were also diagnosed with ADHD. Other research also indicates that children exhibiting co-occurrence of hyperactivity and anxiety are generally less impulsive (Newcorn et al., 2001), have lower self-esteem (Tannock, 2000), and experience more difficulties with parental separations (Biederman, Newcorn, & Sprich, 1991). Therefore, it appears that

psychosocial factors and specific correlates in the environment modulate co-occurrence of hyperactive and anxious behaviors to create a distinct subgroup of ADHD-anxiety children. However, the mechanisms linking these behaviors remain unclear and little is known about the specific and combined influences of genetic and environment. It seems likely that such comorbid configuration might not respond to typical interventions that treat individuals as homogeneous.

Additionally, individuals from the first unexpected cluster show twice the risk of belonging to an emotional distress profile. This is consistent with the attachment theory perspective which emphasizes the importance of parental warmth and responsiveness (Bowlby, 1969). Among risk factors, maternal depression seems to contribute to the development of an insecure attachment, perhaps by increasing the child vulnerability to distressing events (Radke-Yarrow, Cummings, Kuczynski, & Chapman, 1985). The emotional security hypothesis (Cummings and Davies, 1994) posits that the child's capacity to manage environmental stresses is directly related to the stability and quality of their attachment bonds. In the same manner, work by Spitz (1976) on emotional deficiency and separation anxiety showed that the establishment of an internalized (object) relation is essential to adaptive development.

From a developmental psychopathology perspective, disruption of the internal representations of the relations to others and self-esteem could be implied in the association between depression and insecure attachment (Cicchetti and Toth 1998; Cummings and Davies, 1994). As such, emotional distress can increase the vulnerability, expression, and maintenance of depressive symptoms. Knowing that depression diagnosed after school entry forecasts a potential chronic and relapsing

developmental course (Zeanah, 2000), our findings suggest the importance of preventive interventions for either maternal depression or early childhood signs of emotional distress (such fearful or anxious manifestations, being worried, crying a lot, having trouble enjoying him/herself) that can potentially improve the use of more sensitive and warm parenting practices and foster mother-child interactions during preschool period. This is even more important considering that school entry represents a period of greater risk for development of internalizing problems given the academic and social demands on children (Pianta & Castaldi, 1989).

Separation-anxiety cluster. Our data indicate a second unexpected cluster characterized specifically by separation anxiety at 56-68 months of age. Inversely to the first unexpected cluster, these children did not exhibit high levels of emotional distress or anxious behaviors from infancy to kindergarten entry. Rather, the expression of anxious predispositions in this cluster of children seems to be primarily associated with the challenge of parental separation around kindergarten and school entry years. This finding is consistent with previous work suggesting that onset of anxious separation is widespread across childhood and may be exacerbated by important moments of parent-child separation such as kindergarten and primary school modifying child's attachment profile (Bell-Nolan & Brazeal, 1993). In addition, Wood and colleagues (2003) proposed that child dependence on parents during the preschool years may reinforce the perception of lack of control over threatening situations. Based on Chorpita and Barlow's model (1998), it could be interpreted that children from this cluster may have been provided with few early occasions to separate (perhaps being overprotected by parents) and develop a sense of autonomy and self-control over challenging situations.

As such, sense of perceived control may be a possible mediator between stressful experiences of separation and anxiety, and over time it may evolve as a moderator of the expression of anxiety (Chorpita & Barlow, 1998).

Cassidy (1994) suggests that insecure attachment and anxious pathology, including separation, may cause development difficulties with the regulation of emotion. The emotional regulation notion makes primarily reference to the use of strategies of control of the emotions and consists in processes used for modulation of the intensity and length of internal emotional states and the physiological processes bound to emotions (Thompson, 1994). According to Sroufe (1984), emotional regulation can be considered as an adaptive strategy whose function is to maintain emotional comfort in face of separation in order to better internalize a mental representation of the parent-child attachment. Moreover, regulation develops within a relational network in which the parents play a major, but non exclusive, role during early childhood. Parents appear as the first regulators of the child's negative and positive emotions. Consequently, it could be argued that children unusually high levels of anxiety in response to separation from the parent might be the result of an underexposure to stressful early separations from parents, limiting the development of self-regulation mechanisms. As such, children may develop lack of control over threatening situations that accentuate separation anxiety (Wood, McLeod, Sigman, Hwang & Chu, 2003).

Our overall findings highlight the importance of specific factors in the child's home environment combining to modulate many pathways to different behavioral outcomes. Specifically, some parenting characteristics such as maternal depression and coercive practices appear to be associated with child's development of an overly

hyperactive-anxious behavioral pathway throughout childhood (between the ages of 17 and 56-68 months). Moreover, some other children may not exhibit a clear pathway, but rather manifest anxiousness only later in childhood at important developmental separations from their parents. As such, it could be interpreted that a sub-group of parents failed to provide their children with earlier occasions to practice separations that allow the development of self-control skills, confidence, and consolidation of parent-child boundaries. Unfortunately, our investigation does not offer a qualitative understanding of the underlying mechanisms of these pathways.

Although the findings of the current study highlight the importance of parenting practices in the course of the preschool period and difficulties in separation later during the same period, some limitations must be kept in mind. We offer a limited demonstration of how some risk factors combine to create different developmental trajectories (multifinality). As proposed by Wood and colleagues (2003), our investigation represents only the first analytical step in identifying possible behavioral pathways. The non-mainstream approach used in this paper is an attempt to respect an open system perspective and is thus consistent with the study of unexpected pathways. Stronger analytical techniques such as latent growth modeling are needed to confirm the preceding pathways. In fact, if we looked more accurately for heterogeneity in developmental psychopathology research, we might be able to obtain better interventions results.

Other limitations pertain to the assessment of anxious separation. First, children's anxious separation change scores between 17 and 56-68 months of age may reflect changes in mothers' perceptions rather than substantive developmental changes

or even reporting biases. Moreover, it has been shown that mothers tend to underreport internalizing problems, particularly separation anxiety (Clarke-Stewart, Allhusen, McDowell, Thelen, & Call, 2003). Future studies are encouraged to use additional sources of information, such as fathers' perceptions, and observational data to validate mothers' perceptions of child behavior. Second, the scale used at 17 months of age in our investigation consisted of items that can be considered as "normal" developmental reactions for children of this age. Thus, qualifiers like "constantly seeks help"; "clings to the adults or is too dependent"; "doesn't want to sleep alone"; and "gets very upset when separates from parents" are probably considered typical child reactions by mothers, and therefore not highly scored. Our assessment of anxious separation at school-entry should be more reliable since children of this age are not typically expected to over-react to parental separations.

Another limitation concerns the group constitution. Cases were selected based on whether they were above or below 1.5 standard deviation from the mean on the dependant variable. This criterion is arbitrary. This procedure does not allow studying pathways for cases situated between the upper and lower thresholds. The results do not take into account children showing less severe unexpected pathways of behavioral development which limit our understanding of other possible vulnerability factors that might modulate the course of development. Other vulnerability factors not accounted for in the initial model of predicted pathway of anxious behavior may be responsible for constitution of unexpected pathway clusters. For example, maternal sensitivity could be considered as a possible protective factor in the developmental modulation of anxious behaviors (Campbell, Brownell, Hungerford, Spieker, Mohan, & Blessing, 2004).

Moreover, future research designs should employ synchronized measures of maternal depression in the preschool period to better assess the link between maternal depression and the severity of anxious manifestations in children. As proposed by Maughan, Cicchetti, Toth, & Rogosch (2007), developmental timing of maternal depression over the course of development may have a differential effect on child's level of anxiousness.

Our non-at-risk sample was primarily constituted of middle-class French Canadian Caucasian children, limiting the generalizability of our results. It is not clear whether the current results will extend to other cultures, single-parent families, and more disadvantaged populations. We see this as a potential strength as it reduces variations that could be due to acclimatization or adjustment to family transition and hardship.

Finally, it is plausible that the other variables which did not achieved entry into the explanatory model for the unexpected clusters simply did not do so because of unreliable measurement (small alphas). Nevertheless, considering that internalizing problems are usually more difficult to assess than externalizing ones, the two specific configurations generated appear consistent with previous empirical findings in the literature. These potential methodological characteristics notwithstanding, this study represents an innovative approach in revealing possible distinctive pathways and tests hypotheses about anxious behavioral manifestations during childhood. We encourage others with similar datasets to further develop techniques that address the open systems principles of equifinality and multifinality.

References

Anderson, P., Doyle, L.W., & the Victorian Infant Collaborative Study Group (2003). Neurobehavioral outcomes of school age children born extremely low birth weight or very preterm in the 1990s. *Journal of the American Medical Association, 289*, 3264–3272.

Bell-Dolan, D., & Brazeal, T. J. (1993). Separation anxiety disorder, overanxious disorder, and school refusal. *Child and Adolescent Psychiatric Clinics of North America, 2*, 563–580.

Bergman, L. R., Magnusson, D., & El-Khouri, B. M. (2003). *Studying the individual development in an interindividual context: A person-oriented approach*. Mahwah, NJ: Lawrence Erlbaum Associated Publishers.

Bergman, L. R., & Trost, K. (2006). The person-oriented versus the variable-oriented approach: Are they complementary, opposites, or exploring different worlds? *Merrill-Palmer Quarterly, 52*, 601-632.

Biederman, J., Newcorn, J., & Sprich, S. (1991). Comorbidity of attention deficit hyperactivity disorder with conduct, depression, anxiety and other disorders. *American Journal of Psychiatry, 148*, 564-577.

Bornstein, M. (1995). Parenting infants. In M. H. Bornstein (Ed.), *Handbook of parenting* (pp. 3–39). Mahwah, NJ: Lawrence Erlbaum Associates.

Bowlby, J. (1969). *Attachment and loss: Vol. 1. Attachment*. New York: Basic Books.

Bretherton, I., & Waters, E. (1985). Growing points of attachment theory and research. *Monographs of the Society for Research in Child Development, 50*(Serial No. 209).

Campbell, S. B., Brownell, C. A., Hungerford, A., Spieker, S. J., Mohan, R., & Blessing, J. S. (2004). The course of maternal depressive symptoms and maternal sensitivity as predictors of attachment security at 36 months. *Development and Psychopathology, 16,* 231-252.

Caron, A., Weiss, B., Harris, V., & Catron, T. (2006). Parenting behavior dimensions and child psychopathology: Specificity, task dependency, and interactive relations. *Journal of Clinical Child and Adolescent Psychology, 35,* 34-45.

Cassidy, J. (1994). Emotion regulation: Influences of attachment relationships. In N. Fox (Ed.), The development of emotion regulation: Biological and behavioral considerations. *Monographs of the Society for Research in Child Development, 59*(2-3, Serial No. 240), 228-249.

Chorpita, B. F., & Barlow, D. H. (1998). The development of anxiety: The role of control in the early environment. *Psychological Bulletin, 124,* 3-21.

Cicchetti, D. (2006). Development and psychopathology. In D. Cicchetti, & C. J. Donald (Eds.), *Developmental psychopathology: Vol. 1. Theory and method* (2nd ed., pp. 1-23). Hoboken, NJ: John Wiley & Sons Inc.

Cicchetti D., & Toth, S. L. (1998). The development of depression in children and adolescents. *American Psychologist, 53,* 221–241.

Cicchetti, D., & Tucker, D. (1994). Development and self-regulatory structures of the mind. *Development and Psychopathology, 6,* 533-549.

Clarke-Stewart, K. A., Allhusen, V. D., McDowell, D. J., Thelen, L., & Call, J. D. (2003). Identifying psychological problems in young children: How do mothers compare with child psychiatrists? *Journal of Applied Developmental Psychology, 23,* 589-624.

Colder, C. R., Mott, J. A., & Berman, A. S. (2002). The interactive effects of infant activity level and fear on growth trajectories of early childhood behavior problems. *Development and Psychopathology, 14,* 1-23.

Costello, E. J., & Angold, A. (1995). Epidemiology. In J. S. March (Ed.), *Anxiety disorders in children and adolescence* (pp.109-122). New York: Guilford.

Crittenden, P. (1988). Family and dyadic patterns of functioning in maltreating families. In K. Browne, C. Davies, & P. Stratton (Eds.), *Early prediction and prevention of child abuse* (pp. 161-189). Oxford, England: John Wiley & Sons.

Cummings, E. M., & Davies, P. T. (1994). Maternal depression and child development. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 35,* 73-112.

Cummings, E. M., & Davies, P. T. (1995). The impact of parents on their children: An emotional security hypothesis. *Annals of Child Development, 10,* 167-208.

Davies, P. T., & Cummings, E. M. (1994). Marital conflict and child adjustment: An emotional security hypothesis. *Psychological Bulletin, 116,* 387-411.

De Wolff, M., & Van IJzendoorn, M. H. (1997). Sensitivity and attachment: A meta-analysis on parental antecedents of infant attachment. *Child Development, 68,* 571-591.

Dobkin, P. L., Tremblay, R. E., Mâsse, L. C., & Vitaro, F. (1995). Individual and peer characteristics in predicting boys' early onset of substance abuse: A seven-year longitudinal study. *Child Development, 66*, 1198-1214.

Gazelle, H., & Ladd, G. W. (2003). Anxious solitude and peer exclusion: A diathesis-stress model of internalizing trajectories in childhood. *Child Development, 74*, 257-278.

Gershoff, E. T. (2002). Corporal punishment by parents and associated child behaviors and experiences: A meta-analytic and theoretical review. *Psychological Bulletin, 128*, 539-579.

Goodman, S. H., & Gotlib, I. H. (1999). Risk for psychopathology in the children of depressed mothers: A developmental model for understanding mechanisms of transmission. *Psychological Review, 106*, 458-490.

Goodman, S. H., & Gotlib, I. H. (2002). *Children of depressed parents: Mechanisms of risk and implications for treatment.* Washington, DC: American Psychological Association.

Haapasalo, J., & Tremblay, R. E. (1994). Physically aggressive boys from ages 6 to 12: Family background, parenting behavior, and prediction of delinquency. *Journal of Consulting and Clinical Psychology, 62*, 1044-1052.

Hirschi, T. (1969). *Causes of delinquency.* Berkeley, CA: University of California Press.

Hollenstein, T., Granic, I., Stoolmiller, M., & Snyder, J. (2004). Rigidity in parent—child interactions and the development of externalizing and internalizing behavior in early childhood. *Journal of Abnormal Child Psychology, 32*, 1573-2835.

Isabella, R. A. (1995). The origins of infant-mother attachment: Maternal behavior and infant development. *Annals of child development, 10*, 57-81.

Kessler, R. C., Berglund, P., Demler, O., Jin, R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the national comorbidity survey replication. *Archives of General Psychiatry, 62*, 593-602.

Luoma, I., Tamminen, T., Kaukonen, P., Laippala, P., Puura, K., Salmelin, R., et al. (2001). Longitudinal study of maternal depressive symptoms and child well-being. *Journal of the American Academy of Child and Adolescent Psychiatry, 40*, 1367-1374.

Lyons-Ruth, K., Connell, D. B., Grunebaum, H. U., & Botein, S. (1990). Infants at social risk: Maternal depression and family support services as mediators of infant development and security of attachment. *Child Development, 61*, 85-98.

Magnusson, D. (2003). The person approach: Concepts, measurements models, and research strategy. *New Directions for Child and Adolescent Development, 101*, 3-23.

Maughan, A., Cicchetti, D., Toth, S. H., & Rogosch, F. A. (2007). Early-occurring maternal depression and maternal negativity in predicting young children's emotion regulation and socioemotional difficulties. *Journal of Abnormal Child Psychology, 35*, 685-703.

Newcorn, J. H., Halperin, J. M., Jensen, P. S., Abikoff, H. B., Arnold, E., Cantwell, D. P., et al. (2001). Symptom profiles in children with ADHD: Effects of comorbidity and gender. *Journal of the American Academy of Child & Adolescent Psychiatry, 40*, 137-146.

Ollendick, T. H., & King, N. J. (1994). Diagnosis, assessment, and treatment of internalizing problems in children: The role of longitudinal data. *Journal of Consulting and Clinical Psychology, 62*, 918-927.

Pagani, L. S., Japel, C., Girard, A., Farhat, A., Côte, S., & Tremblay, R. E. (2006). Middle childhood life-course trajectories: Links between family dysfunction and children's behavioral development. In A. C. Huston & M. N. Ripke (Eds.), *Developmental contexts in middle childhood: Bridges to adolescence and adulthood* (pp. 130-149). New York: Cambridge University Press.

Pagani, L. S., Japel, C., Vaillancourt, T., Côté, S., & Tremblay, R. E. (2007). Links between life course trajectories of family dysfunction and anxiety during middle childhood. *Journal of Abnormal Child Psychology,*

Parke, R. D., & Buriel, R. (1998). Socialization in the family: Ethnic and ecological perspectives. In W. Damon (Series Ed.) & N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Vol. 3. Social, emotional, and personality development* (5th ed., pp. 463-552). New York: Wiley.

Parker, G. (1983). *Parental overprotection: A risk factor in psychosocial development.* New York: Grune & Stratton.

Pfiffner, L. J., & McBurnett, K. (2006). Family correlates of comorbid anxiety disorders in children with attention deficit/hyperactivity disorder. *Journal of Abnormal Child Psychology, 34*, 725-735.

Pianta, R. C., & Castaldi, J. (1989). Stability of internalizing symptoms from kindergarten to first grade and factors related to instability. *Development and Psychopathology, 1*, 305-316.

Radke-Yarrow, M., Cummings, E. M., Kuczynski, L., & Chapman, M. (1985). Patterns of attachment in two-and three-year-olds in normal families and families with parental depression. *Child Development, 36*, 884-893.

Rapee, R. M. (2002). The development and modification of temperamental risk for anxiety disorders: Prevention of a lifetime of anxiety? *Biological Psychiatry, 52*, 947-957.

Richters, J. E. (1997). The hubble hypothesis and the developmentalist's dilemma. *Development and Psychopathology, 9*, 193-229.

Rubin, K. H., & Mills, R. S. (1991). Conceptualizing developmental pathways to internalizing disorders in childhood. *Canadian Journal of Behavioural Science, 23*, 300-317.

Smith, J. R., & Brooks-Gunn, J. (1997). Correlates and consequences of harsh discipline for young children. *Archives of Pediatric and Adolescent Medicine, 151*, 777-786.

Spieker, S. J., Larson, N. C., Lewis, S. M., Keller, T. E., & Gilchrist, L. (1999). Developmental trajectories of disruptive behavior problems in preschool children of adolescent mothers. *Child Development, 70*, 443-458.

Spitz, L. (1976). The evolution of a psychiatric emergency crisis intervention service in a medical emergency sitting room. *Comprehensive Psychiatry, 17*, 99-113.

Stein, M. B., Sherbourne, C. D., Craske, M. G., Means-Christensen, A., Bystritsky, A., Katon, W., et al. (2004). Quality of care for primary care patients with anxiety disorders. *American Journal of Psychiatry, 161*, 2230-2237.

Sroufe, L. A. (1984). The organization of emotional development. In K. Scherer & P. Ekman (Eds.), *Approaches to emotion* (pp. 109-128). Hillsdale, NJ: Lawrence Erlbaum.

Tannock, R. (2000). Attention deficit hyperactivity disorder with anxiety disorders. In T. E. Brown (Ed.), *Attention deficit disorders and comorbidities in children, adolescents, and adults* (pp. 125–170). Washington, DC: American Psychiatric Press.

Taylor, C. T., & Alden, L. E. (2005). Social interpretation bias and generalized social phobia: The influence of developmental experiences. *Behaviour Research and Therapy, 43*, 759-777.

Taylor, C. T., & Alden, L. E. (2006). Parental overprotection and interpersonal behavior in generalized social phobia. *Behavior Therapy, 37*, 14-24.

Teti, D. M., & Gelfand, D. M. (1991). Behavioral competence among mothers of infants in the first year: The mediational role of maternal self-efficacy. *Child Development, 62*, 918-929.

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development, 59*(2–3, Serial No. 240).

Thompson, R. A. (1998). Emotional competence and the development of self. *Psychological Inquiry, 9*, 308-309.

Tremblay, R. E., Loeber, R., Gagnon, C., Charlebois, P., Larivée, S., & LeBlanc, M. (1991). Disruptive boys with stable and unstable high fighting behavior patterns during junior elementary school. *Journal of Abnormal Child Psychology, 19*, 285-300.

Tremblay, R. E., Pagani-Kurtz, L., Mâsse, L. C., Vitaro, F., & Pihl, R. O. (1995). A bimodal preventive intervention for disruptive kindergarten boys: Its impact through mid-adolescence. *Journal of Consulting and Clinical Psychology, 63*, 560-568.

Tremblay, R. E., Pihl, R. O., Vitaro, F., & Dobkin, P. L. (1994). Predicting early onset of male antisocial behavior from preschool behavior. *Archives of General Psychiatry, 51*, 732-738.

Von Bertalanffy, L. (1968). *General systems theory.* New York: Braziller.

Von Eye, A., & Bergman, L. R. (2003). Research strategies in developmental psychopathology: Dimensional identity and the person-oriented approach. *Development and Psychopathology, 15*, 553-580.

Wang, P. S., Berglund, P., Olfson, M., Pincus, H. A., Wells, K. B., & Kessler, R. C. (2005). Failure and delay in initial treatment contact after first onset of mental disorders in the national comorbidity survey replication. *Archives of General Psychiatry, 62*, 603-613.

Wissow, L. S. (2001). Ethnicity, income, and parenting contexts of physical punishment in a national sample of families with young children. *Child Maltreatment, 6*, 118-129.

Wood, J. J., McCleod, B. D., Sigman, M., Hwang, W.-C., & Chu, B. C. (2003). Parenting and childhood anxiety: Theory, empirical findings, and future directions. *Journal of Child Psychology and Psychiatry, 44*, 134-151.

Zeanah, C. H., Jr. (2000). *Handbook of infant mental health* (2nd ed.). New York: Guilford Press.

Table 1

Sociodemographic characteristics of the children household at the second wave (1999) of the QLSCD (n=1820)

Variables	Percentage	Mother percentage	Father percentage
Sex of the child			
Girls	49.6		
Boys	50.4		
No. of brothers and sisters			
0	39.3		
1	42.6		
2	12.4		
3	4.3		
4+	1.3		
Parental education			
No high school diploma		13.4	16.9
High school diploma		10.3	11.7
Postsecondary studies		17.3	17.1
Technical school diploma		10.3	11.0
College diploma		14.5	13.7
Partial university studies		5.3	4.0
University degree		28.8	25.6

Table 2

Stepwise multiple regression predicting anxiety at 56-68 months

Variable	B	SE B	95% CI
Controlled baseline:			
Anxious separation at 17 months	.53***	.58	(.47 - .59)
Anxious separation change score (56-68 months – 17 months)	.51**	.62	(.45 - .56)
Maternal depression at 17 months	.10**	.06	(.03 - .17)
Coercion at 41 months	.15***	.11	(.09 - .22)

Note. Adjusted R^2 = .24***;   *** indicates $p < 0.001$, ** indicates $p < 0.01$

Table 3

T-test significance and mean score between upper and lower unexpected groups generated from the prediction of anxiety at 56-68 months

Variable	T-test Significance	Mean score	
	Unexpected groups	Upper unexpected cluster	Lower unexpected cluster
Hyperactive behavior at 17 months	$t = 2.12$*	3.98	3.23
Hyperactive behavior 56-68 months	$t = 3.96$***	5.26	3.95
Inattention at 17 months	$t = 2.62$*	2.67	1.87
Inattention at 56-68 months	$t = 4.46$***	4.52	2.92
Emotional distress at 17 months	$t = 2.23$*	1.15	0.78
Emotional distress at 56-58 months	$t = 7.54$***	3.15	1.51
Separation anxiety at 17 months	$t = -2.43$*	2.54	3.47
Separation anxiety at 56-68 months	$t = -7.24$***	2.28	4.07
Physical aggression at 56-68 months	$t = 4.25$***	2.75	1.61

Note. * indicates $p < 0.05$, *** indicates $p < 0.001$

Figure 1a. The three steps of data analysis strategy

First step: Generating an expected pathway model guided by a theoretical framework
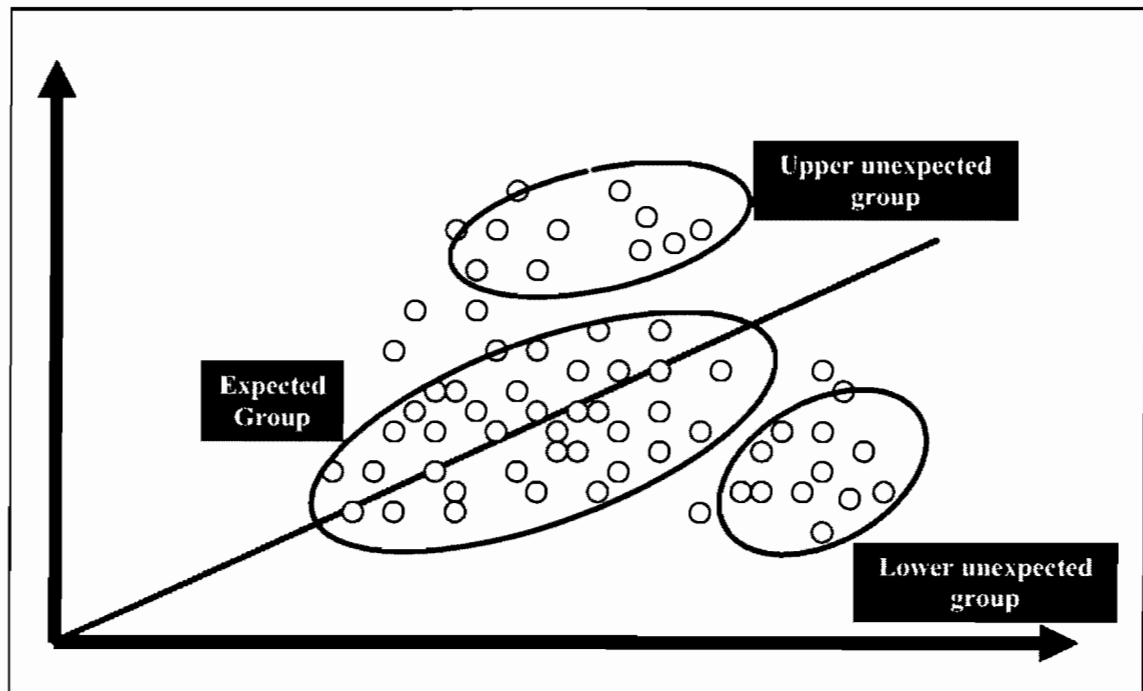
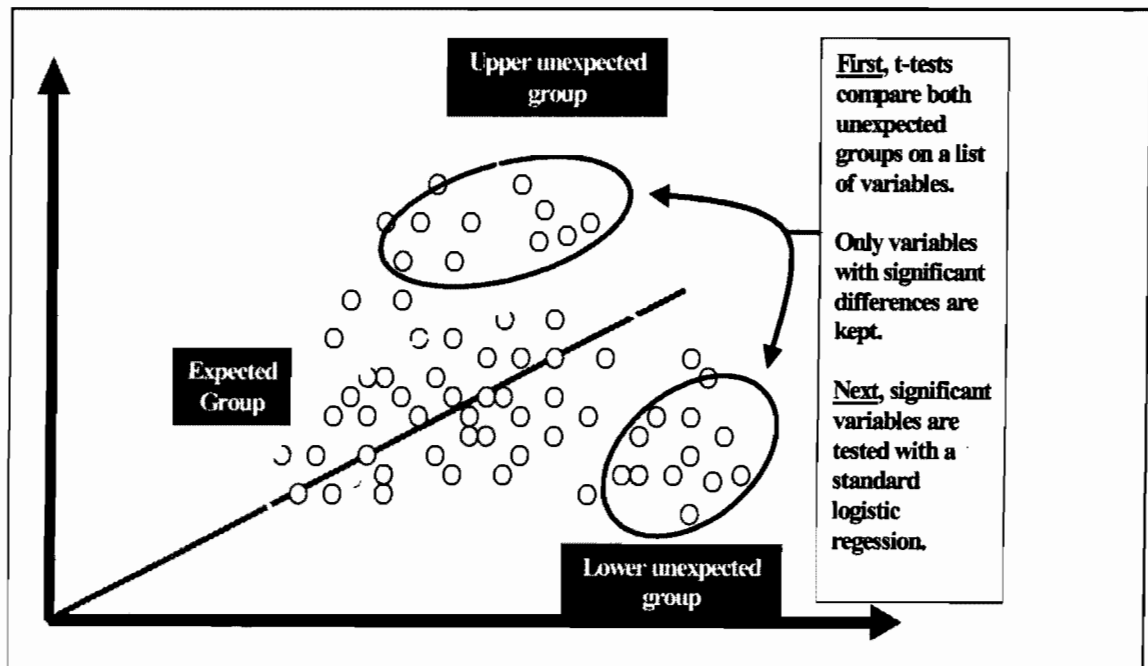**Second step:** Profiling the upper and lower unexpected clusters

Figure 1b. The three steps of data analysis strategy

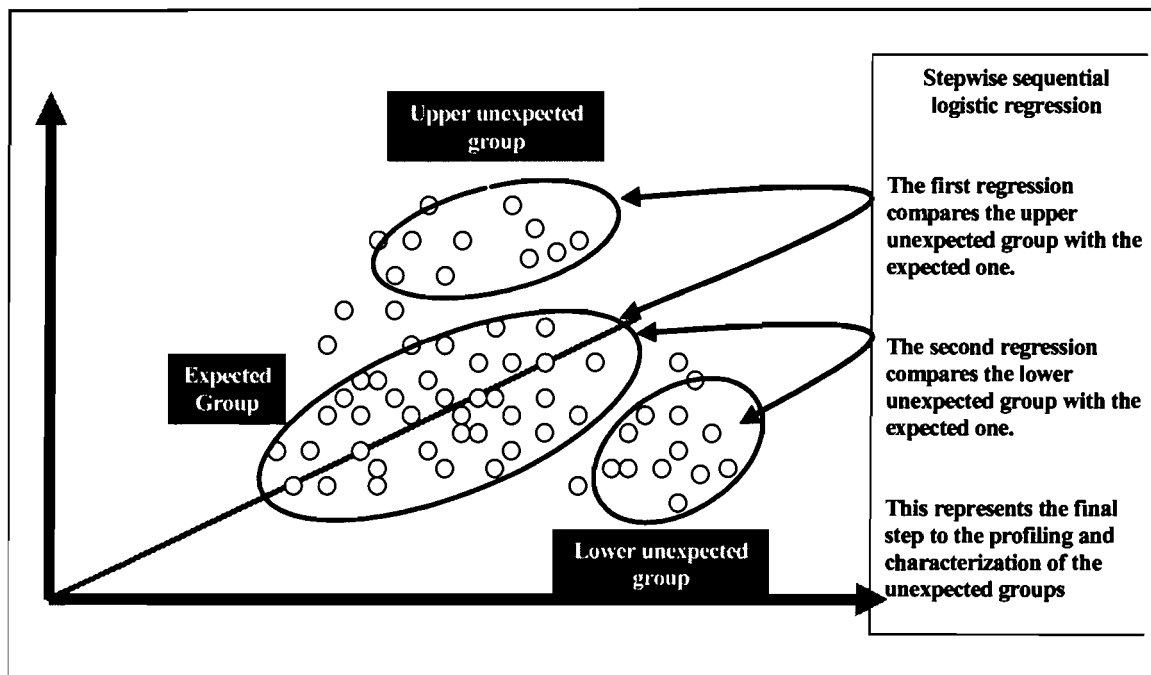**Third step:** Predicting membership in the unexpected clusters

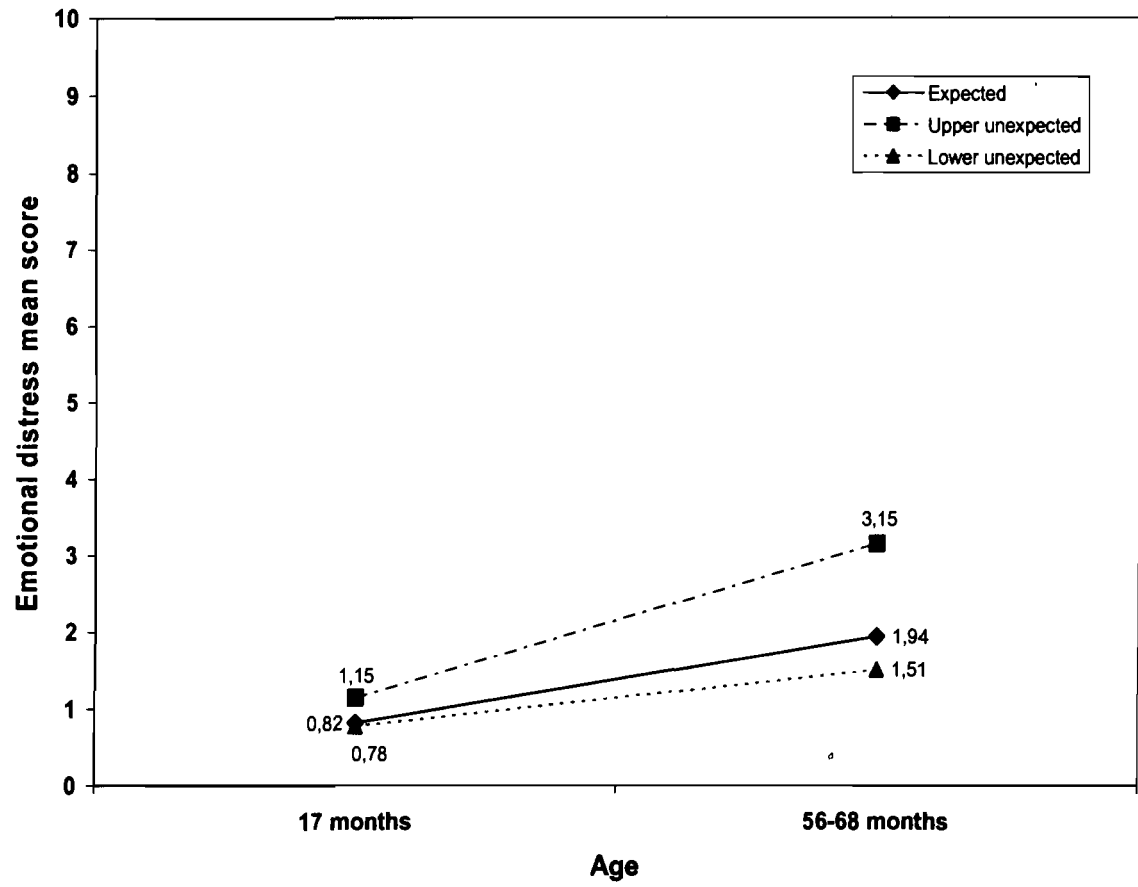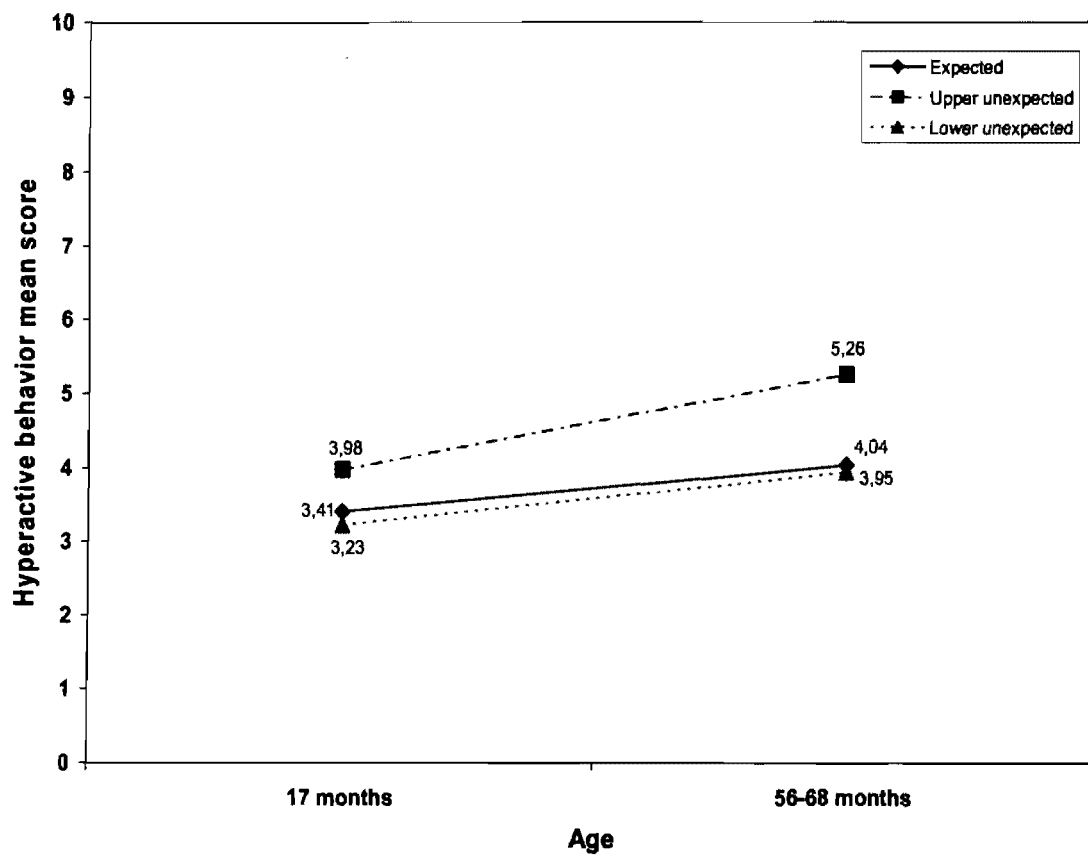*Figure 2*. Emotional distress mean score for unexpected and expected clusters.

Figure 3. Hyperactive behavior mean score for unexpected and expected clusters.

Conclusion

Synthèse des deux articles

Article 1

Le modèle conceptuel de Cloninger (1987) a été utilisé afin de générer une régression utilisant le tempérament difficile, l'hyperactivité, et l'anxiété en vue d'obtenir des résidus standardisés permettant l'identification de sous-groupes hétérogènes ne réagissant pas comme la moyenne de l'échantillon dans la prédiction de l'agression physique à la fin de la période préscolaire. Il faut noter que, contrairement au modèle original de Cloninger (1987), les habiletés prosociales n'ont pu être utilisées dans les analyses du premier article, cette variable n'étant pas corrélée avec les autres mentionnées précédemment. La combinaison de celles-ci a tout de même permis de générer un modèle montrant une variance expliquée atteignant 24%, et surtout, des résidus standardisés permettant l'identification de deux sous-groupes.

Le premier groupe montre un niveau d'agressivité physique significativement plus élevé que la moyenne de l'échantillon entre 17 et 56-68 mois, tout en contrôlant le niveau initial d'agressivité. De plus, les individus de ce groupe semblent avoir été élevés par des parents ayant plus souvent recours à des méthodes d'éducation coercitives telles que mesurées à l'âge de 43 mois. Ces résultats concordent avec les données obtenues par plusieurs études montrant qu'il existe une petite proportion d'enfants faisant preuve d'un niveau d'agressivité physique pendant toute la période préscolaire (Jester et al., 2005; Nagin & Tremblay, 2001; Nagin & Tremblay, 1999). De plus, l'hostilité dont certains parents fait preuve dans leurs pratiques éducatives pendant la période préscolaire est associée à des niveaux supérieurs d'agressivité physique, plus spécifiquement celle provenant de la mère (Côté, Vaillancourt, Barker, Nagin & Tremblay, 2007; Hart, Nelson, Robinson, Olsen, & McNeilly-Choque, 1998; Jester et al., 2005; Loukas, Zucker, Fitzgerald, & Krull, 2003). Enfin, les individus de ce sous-groupe montrent également un niveau significativement plus élevé d'agressivité indirecte que la moyenne de l'échantillon à l'âge de 56-68 mois. L'ensemble de ces résultats va dans le sens du modèle développé par Patterson (1982) selon lequel

l'utilisation de pratiques parentales sévères telles que frapper l'enfant lorsqu'il est difficile ou d'élever la voix ou crier après l'enfant lorsque l'on doit le gronder est associé à des niveaux plus élevés d'agressivité physique de la part de ces enfants.

Quant à lui, le second sous-groupe obtenu par l'analyse des résidus standardisés se caractérise principalement par un niveau élevé de comportements hyperactifs pendant la période préscolaire entre 17 et 56-68 mois, et ce, même lorsque le niveau initial de ceux-ci est contrôlé. Il est intéressant de noter que Jester et ses collègues (2005) ont obtenu des résultats similaire en utilisant une approche de modélisation de trajectoires latentes (latent growth modeling) afin d'identifier de potentiels trajets développementaux de l'inattention, l'hyperactivité et l'agressivité. Leurs résultats suggèrent, entre autre, une trajectoire se caractérisant à la fois par un niveau d'hyperactivité demeurant élevé et une réduction de l'agressivité à la période de l'enfance. Ce type de trajectoire a également été obtenu par Nagin et Tremblay (1999, 2001). D'autre part, plusieurs études suggèrent que les caractéristiques familiales des enfants présentant une combinaison d'hyperactivité et d'agressivité seraient déterminantes dans l'expression ultérieure de l'un ou l'autre de ces comportements (Moore, 2004; Parker, 1983; Pfiffner and McBurnett, 2006).

Les résultats précédents sont intéressants car ils témoignent de la présence de sous-groupes hétérogènes d'individus qui ne réagissent pas tel que le modèle de Cloninger (1987) le prévoit. À cet effet, il ne faut pas perdre de vue que ce dernier a été conceptualisé principalement pour expliquer les comportements criminels d'individus adultes. Il ne tient donc pas compte du caractère développemental des variables qui sous-tendent l'apparition et l'évolution des comportements agressifs ainsi que du rôle des variables contextuelles telles que les pratiques parentales pendant la période préscolaire. Aussi, la méthode utilisée dans cet article ne permet pas d'expliquer les mécanismes par lesquels les variables spécifiquement associées aux enfants et aux parents viennent à produire ces différentes trajectoires développementales. De plus, la sélection de l'écart-type nécessaire à la constitution des groupes provenant des résidus standardisés demeure arbitraire et il pourrait y avoir certainement d'autres sous-groupes

d'individus qui n'ont pas été détectés par le devis utilisé. Malgré tout, la méthodologie utilisée dans cet article respecte une approche centrée sur la personne et tient compte des aspects transactionnels d'un système ouvert entre l'enfant et le contexte dans lequel il se développe.

Article 2

Contrairement au premier article, la prédiction de l'anxiété à la fin de la période préscolaire n'a pas été dictée par un modèle conceptuel identifiant de façon précise la combinaison de facteurs de risque. Pour cet article, le model théorique de Chorpita et Barlow (1998) a été privilégié en regard de l'attention qu'il porte à la notion de control originalement élaboré par Parker (1983). Ces auteurs stipulent que les parents jouent un rôle déterminant dans la perception que leur enfant développera quant au contrôle qu'il exerce sur son environnement. Plus spécifiquement, si les parents ne sont pas en mesure d'offrir à l'enfant des occasions lui permettant de développer des habiletés d'auto-régulation face aux défis quotidiens (comme s'habiller seul, attacher ses souliers) ce dernier ne pourra développer un sentiment d'autonomie et d'auto-contrôle, et en conséquence, ressentira plus d'anxiété.

Une combinaison de variables incluant l'anxiété de séparation, la dépression maternelle, et les pratiques parentales a donc été utilisé afin de générer une régression en vue d'obtenir des résidus standardisés permettant l'identification de sous-groupes hétérogènes ne réagissant pas comme la moyenne de l'échantillon dans la prédiction de l'anxiété à la fin du primaire. Cette méthodologie a généré un modèle de régression permettant l'obtention d'une variance expliquée de 23%. L'utilisation des résidus standardisés situés à un écart-type et demi permet l'observation de deux sous-groupes hétérogènes.

Le premier se caractérise par un regroupement d'enfants montrant une combinaison de comportements hyperactifs et de détresse émotionnelle entre 17 et 56-58 mois comparativement à la moyenne de l'échantillon. Ce résultat illustre la

comorbidité entre ces deux composantes comportementales fréquemment rencontrée dans la littérature. Plus spécifiquement, les enfants montrant à la fois des comportements hyperactifs et anxiogènes auraient un faible estime d'eux-mêmes (Tannock, 2000), seraient moins impulsifs que les enfants montrant une symptomatologie spécifiquement associée à des comportements hyperactifs (Newcorn et al., 2001), et enfin, éprouveraient des difficultés lors de séparation avec les parents (Biederman, Newcorn, & Sprich, 1991). À cet égard, les enfants de ce sous-groupe montrent deux fois plus de chance d'éprouver de la détresse émotionnelle. Ce résultat concorde avec la théorie de l'attachement qui souligne l'importance de la disponibilité et de la chaleur des parents dans le développement d'un attachement sécurisant (Bowlby, 1969). Dans le même ordre d'idée, l'hypothèse de la sécurité émotionelle de Cummings et Davies (1994) indique que la capacité de l'enfant de gérer les situations stressantes provenant de son environnement est intimement associée à la qualité de la relation d'attachement entre l'enfant et les parents.

Quoiqu'elle n'ait pas été significative dans le modèle final de prédiction, la dépression maternelle représente l'un des facteurs de risque important au développement de l'anxiété à la période préscolaire. Selon Cicchetti et Toth (1998), l'analyse d'un tel résultat dans une perspective de psychopathologie développementale pourrait s'expliquer par les effets subtils que peut avoir la dépression maternelle sur les représentations mentales de l'enfant. Avec le temps, et l'accumulation des mauvaises séparations dues au manque de disponibilité psychique de la mère, l'enfant développerait un modèle de la relation parent-enfant insécurisant ayant comme conséquence l'augmentation de sa détresse émotionnelle. Ainsi, certaines variables spécifiquement associées aux parents peuvent contribuer au développement de trajectoires diverses et l'expression de divers comportements anxiogènes au début de la période scolaire. Ce résultat est d'autant plus important que les premières exigences académiques représentent une importante source de stress pour les enfants. À cet effet, il a été démontré que les enfants éprouvant des troubles internalisés à l'entrée scolaire risquent de développer des difficultés émotives à plus long terme (Zeanah, 2000).

Le second sous-groupe obtenu par les analyses des résidus standardisés est constitué d'individus montrant de l'anxiété de séparation à 56-68 mois. Contrairement aux enfants du premier sous-groupe, ces derniers ne montrent pas de niveaux élevés de détresse émotionnelle ou toute autre forme d'anxiété entre 17 et 56-68 mois. En fait, l'expression de prédispositions anxiogènes pour ce sous-groupe semble être spécifiquement associée aux séparations qu'exigent la maternelle et l'école primaire. À cet effet, les travaux de Bell-Nolan et Brazeal (1993) montrent que l'apparition des premières formes de l'anxiété de l'enfant est exacerbée par tels moments. Afin d'interpréter ce résultat, et en se basant sur le modèle de Chorpita et Barlow (1998), il est possible d'avancer que ces enfants n'aient pas été en mesure de développer leurs habiletés d'auto-contrôle et leur autonomie car ils auraient été exposé à peu de situations leur permettant de le faire plus tôt dans leur enfance. Ainsi, la perception d'auto-contrôle serait possiblement un médiateur entre les expériences stressantes issues de la séparation avec les parents et l'anxiété ressentie, et à long terme, un modérateur dans l'expression de l'anxiété (Chorpita & Barlow, 1998).

Aussi intéressant soit-il, le choix du modèle de Chorpita et Barlow (1998) représente une limite inhérente à l'étude de l'anxiété à la période préscolaire. Ce dernier est principalement basé sur le rôle prédominant des parents au développement du sentiment de contrôle de l'enfant et ne tient pas compte du rôle de ce dernier sur les pratiques parentales. Ce modèle ne permet donc pas d'analyser les effets bidirectionnels possibles au développement de l'anxiété et de ses modes de transmission entre les parents et l'enfant. Enfin, comme pour le premier article, la méthodologie employée dans cet article ne permet pas d'identifier tous les sous-groupes hétérogènes possibles et leurs trajectoires associées.

Forces et limites des articles et avenues futures

L'objectif principal de cette thèse était d'identifier des sous-groupes hétérogènes d'individus ne réagissant pas aux attentes des modèles théoriques et statistiques et présentant des caractéristiques inattendues (Cicchetti, 2006). Afin d'examiner de plus près ces individus, il importe d'éviter certaines erreurs commises par le passé, dont

l'utilisation de devis de recherche centré principalement sur les variables. À cet égard, l'une des forces de ce projet de thèse repose sur l'utilisation d'une approche centrée sur la personne permettant d'examiner plus qualitativement ces sous-groupes d'individus montrant des caractéristiques développementales différentes de la moyenne de l'échantillon (ou de la norme). Conformément au troisième postulat de cette approche, il existerait autant de patrons complexes d'organisation de la personnalité que d'individus, et une multitude de trajectoires développementales se définissant par une diversité de caractéristiques individuelles. Le recours aux méthodes traditionnelles d'analyse centrée sur les variables ne permettrait pas de faire ressortir ces différences individuelles, mais surtout, la nature des interactions entre l'individu et son environnement se traduisant plus souvent qu'autrement par des trajectoires discontinues (Bergman & Trost, 2006). L'analyse des résidus standardisés présentée dans les deux articles précédents représente ainsi une façon novatrice d'explorer les caractéristiques de ces sous-groupes d'individus, et par le fait même, d'identifier de potentielles trajectoires développementales de l'agression physique et de l'anxiété durant la période préscolaire.

La recherche scientifique étant plus souvent qu'autrement paradoxale, cet avantage de l'approche centrée sur la personne comporte également ses limites. Ainsi, afin de faire ressortir ces différences individuelles et les trajectoires associées, il est nécessaire de créer une équation de départ produisant des résidus standardisés. Or, le choix initial des variables qui seront utilisées comporte en soi certaines faiblesses. Dans un premier temps, il n'existe aucun critère permettant d'établir clairement le nombre de variables à utiliser dans les modèles initiaux, si ce n'est que le principe de parcimonie suggéré par Tabachnick et Fidell (2001) ainsi que le pourcentage de variance expliquée souhaité aux environs de 25%. Dans un second temps, les règles permettant de dicter la sélection et la combinaison des variables du modèle initial reposent principalement sur les résultats d'études empiriques ayant démontré la cohérence des variables choisies en regard de la variable dépendante à l'étude. Le choix des variables demeure donc une action quelque peu arbitraire et tributaire des connaissances empiriques et préférences théoriques du chercheur. Cependant, il importe de noter que la plupart des modèles statistiques traditionnels et même les plus récents procèdent de manière semblable.

Ainsi, malgré leurs limites inhérentes, les règles adoptées dans cette thèse ne sont donc pas très différentes de celles généralement utilisées et globalement acceptées par la communauté scientifique.

La méthode utilisée étant exploratoire, la présente thèse ne représente qu'une étape préliminaire à l'utilisation de méthodes plus complexes telles que la modélisation de trajectoires latentes permettant l'identification plus rigoureuse de sous-groupes hétérogènes d'individus. Comme le propose Wood et ses collègues (2003), il importe d'explorer certaines hypothèses initiales quant aux caractéristiques individuelles qui sont associées aux trajectoires afin de mieux comprendre leur développement. Quoique l'identification de sous-groupes d'individus soit rendue possible par la technique utilisée ici, les mécanismes par lesquels les caractéristiques individuelles tracent les routes développementales obtenues dans les articles ne sont pas totalement expliqués. Les résultats font certainement ressortir l'importance des variables parentales dans la modulation des trajectoires de l'agression physique et de l'anxiété, mais ils n'expliquent pas clairement la direction et la force de ces liens.

Une explication de cet état de fait concerne principalement les temps de mesure des variables sélectionnées. Par exemple, les pratiques parentales coercitives sont uniquement évaluées lorsque l'enfant est âgé de 41 mois. Il en va de même pour la constitution familiale mesurée uniquement à 17 mois. Or, il aurait été préférable d'avoir recours à d'autres temps de mesure pendant la période préscolaire afin de mieux examiner la nature des associations entre les variables explicatives, et celles relatives aux comportements des enfants. Sans ces autres points de mesure, il devient difficile d'expliquer clairement comment ces associations se développent et varient à travers le temps. Cette thèse présente certaines variations des comportements des enfants pendant la période préscolaire, mais néglige celles concernant les variables parentales et celles associées aux divers contextes de la vie de l'enfant, telles que les changements dans la constitution familiale et les impacts du milieu de garde. À cet égard, les prochaines études sur ce thème sont encouragées à sélectionner des variables représentant les divers contextes de vie de l'enfant et à mesurer ces dernières à plusieurs reprises pendant la

période préscolaire afin de mieux comprendre les mécanismes sous-jacents au développement des trajectoires de l'agression physique et de l'anxiété.

Une autre limite concerne la mesure des comportements des enfants reposant principalement sur la perception maternelle. Quoique cette méthode de collecte des données comporte des avantages, la mère étant la personne connaissant le mieux l'enfant car passant le plus de temps avec ce dernier dans les premières années de la vie (99% pour l'ÉLDEQ), elle implique également certaines limites. Ainsi, les résultats d'une étude de Clarke-Stewart et collègues (2003) suggèrent que les mères auraient tendance à sous-estimer les comportements internalisés et surestimer ceux de type externalisé. Malgré le fait que les mères formulaient des évaluations comportementales semblables à celles de psychiatres, les auteurs de l'étude suggèrent d'avoir recours à des mesures additionnelles afin d'augmenter la validité des variables à l'étude. Dans le cas de la présente thèse, il aurait ainsi été préférable d'avoir recours à un ensemble de méthode de collectes de données telles que les observations de l'enfant par des évaluateurs externes et les perceptions du père afin de s'assurer de la validité des perceptions maternelles. Cette recommandation est évidemment valable à toute étude voulant analyser les trajectoires développementales avec des sujets d'âge préscolaire.

Malgré les limites présentées précédemment, cette thèse a tout de même donné lieu à des avancements scientifiques. D'une part, il convient de souligner que la méthode novatrice présentée dans cette thèse a permis d'obtenir des résultats semblables à d'autres études empiriques ayant eu recours à des techniques diversifiées et parfois plus complexes concernant les trajectoires développementales de l'agression physique et de l'anxiété. D'autre part, elle a permis de faire ressortir l'importance de la comorbidité entre certains comportements externalisés et internalisés et d'en comprendre les facteurs de risque identiques à la période préscolaire. Enfin, la méthode d'analyse utilisée dans les articles pourrait avoir une utilité non négligeable dans le contexte d'évaluation des programmes d'intervention. En effet, l'identification de sous-groupes hétérogènes d'enfants ne réagissant pas selon les attentes pourrait mettre en lumière les variables médiatrices ou modératrices impliquées dans l'obtention de résultats parfois décevant

des programmes d'intervention (Baron & Kenny, 1986). Il deviendrait ainsi possible de prévoir des ajustements à ces programmes comptes tenus des caractéristiques spécifiques des participants et ainsi favoriser l'obtention de changements.

Bibliographie

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51,* 1173-1182.

Bell-Dolan, D., & Brazeal, T. J. (1993). Separation anxiety disorder, overanxious disorder, and school refusal. *Child and Adolescent Psychiatric Clinics of North America, 2,* 563–580.

Bergman, L. R., & Trost, K. (2006). The person-oriented versus the variable-oriented approach: Are they complementary, opposites, or exploring different worlds? *Merrill-Palmer Quarterly, 52,* 601-632.

Biederman, J., Newcorn, J., & Sprich, S. (1991). Comorbidity of attention deficit hyperactivity disorder with conduct, depression, anxiety and other disorders. *American Journal of Psychiatry, 148,* 564-577.

Bowlby, J. (1969). *Attachment and loss: Vol. 1. Attachment.* New York: Basic Books.

Chorpita, B. F., & Barlow, D. H. (1998). The development of anxiety: The role of control in the early environment. *Psychological Bulletin, 124,* 3-21.

Cicchetti, D. (2006). Development and psychopathology. In D. Cicchetti, & C. J. Donald (Eds.), *Developmental psychopathology: Vol. 1. Theory and method* (2nd ed., pp. 1-23). Hoboken, NJ: John Wiley & Sons Inc.

Cicchetti D., & Toth, S. L. (1998). The development of depression in children and adolescents. *American Psychologist, 53,* 221–241.

Clarke-Stewart, K. A., Allhusen, V. D., McDowell, D. J., Thelen, L., & Call, J. D. (2003). Identifying psychological problems in young children: How do mothers compare with child psychiatrists? *Journal of Applied Developmental Psychology, 23*, 589-624.

Cloninger, C. R. (1987). A systematic method for clinical description and classification of personality variants. A proposal. *Archives of General Psychiatry, 44*, 573-588.

Côté, S. M., Vaillancourt, T., Barker, E. D., Nagin, D., & Tremblay, R. E. (2007). The joint development of physical and indirect aggression: Predictors of continuity and change during childhood. *Development and Psychopathology, 19*, 37-55.

Cummings, E. M., & Davies, P. T. (1994). Maternal depression and child development. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 35*, 73-112.

Hart, C. H., Nelson, D. A., Robinson, C. C., Olsen, S. F., & McNeilly-Choque, M. K. (1998). Overt and relational aggression in Russian nursery-school-age children: Parenting style and marital linkages. *Developmental Psychology, 34*, 687-697.

Jester, J. J., Nigg, J. T., Adams, K., Fitzgerald, H. E., Puttler, L. I., Wong, M. M., et al. (2005). Inattention/hyperactivity and aggression from early childhood to adolescence: Heterogeneity of trajectories and differential influence of family environment characteristics. *Development and Psychopathology, 17*, 99-125

Loukas, A., Zucker, R. A., Fitzgerald, H. E., & Krull, J. L. (2003). Developmental trajectories of disruptive behavior problems among sons of alcoholics: Effects of parent psychopathology, family conflict, and child undercontrol. *Journal of Abnormal Psychology, 112*, 119–131.

Moore, P. S. (2004). The use of social stories in a psychology service for children with learning disabilities: A case study of a sleep problem. *British Journal of Learning Disabilities, 32*, 133-138.

Nagin, D., & Tremblay, R. E. (1999). Trajectories of boys' physical aggression, opposition, and hyperactivity on the path to physically violent and nonviolent juvenile delinquency. *Child Development, 70*, 1181–1196.

Nagin, D. S., & Tremblay, R. E. (2001). Parental and early childhood predictors of persistent physical aggression in boys from kindergarten to high school. *Archives of General Psychiatry, 58*, 389-394.

Newcorn, J. H., Halperin, J. M., Jensen, P. S., Abikoff, H. B., Arnold, E., Cantwell, D. P., et al. (2001). Symptom profiles in children with ADHD: Effects of comorbidity and gender. *Journal of the American Academy of Child & Adolescent Psychiatry, 40*, 137-146.

Parker, G. (1983). *Parental overprotection: A risk factor in psychosocial development.* New York: Grune & Stratton.

Patterson, G. R. (1982). *Coercive family process.* Eugene, OR: Castalia.

Pfiffner, L. J., & McBurnett, K. (2006). Family correlates of comorbid anxiety disorders in children with attention deficit/hyperactivity disorder. *Journal of Abnormal Child Psychology, 34*, 725-735.

Tabachnick, B.G., & Fidell, L. S. (2001). *Using multivariate statistics.* MA: Allyn & Bacon.

Tannock, R. (2000). Attention deficit hyperactivity disorder with anxiety disorders. In T. E. Brown (Ed.), *Attention deficit disorders and comorbidities in children, adolescents, and adults* (pp. 125–170). Washington, DC: American Psychiatric Press.

Wood, J. J., McCleod, B. D., Sigman, M., Hwang, W.-C., & Chu, B. C. (2003). Parenting and childhood anxiety: Theory, empirical findings, and future directions. *Journal of Child Psychology and Psychiatry, 44*, 134-151.

Zeanah, C. H., Jr. (2000). *Handbook of infant mental health* (2nd ed.). New York: Guilford Press.

Annexe