THE RECIPROCAL NATURE OF THE RELATIONSHIP BETWEEN PARENTING AND ADOLESCENT PROBLEM BEHAVIORS

by

Rubab Gozde Arim

B.A., Bogazici University, 2001
M.A., University of British Columbia, 2003

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Abstract

This research is comprised of three separate studies which utilized adolescent self-report data from the Canadian National Longitudinal Survey of Children and Youth (NLSCY). The first study evaluated the factor structure and the equality of measurement properties of three parenting behavior scales (i.e., Parental Nurturance, Parental Rejection, and Parental Monitoring) over a four-year period and found that the factor structure of the NLSCY parenting behavior scales did not show a good fit across three age groups. Revised models for Parental Nurturance and Monitoring were tested and confirmed, however, these models exhibited only configural invariance over time. The second study examined the factor structure and the equality of measurement properties of three problem behavior scales (i.e., Indirect Aggression, Direct Aggression, and Property Offence) across gender and three adolescent age groups (10-11, 12-13, and 14-15 years). This study found support for the structure of the three problem behavior scales, but failed to provide evidence for measurement invariance across groups. All three scales achieved configural invariance across gender and age groups. In addition, the Indirect Aggression scale achieved loading invariance across gender and for the 12 versus 14 year-olds; whereas the Direct Aggression scale exhibited loading invariance for only the 10 versus 12 year-olds. The third study investigated the reciprocal relationship between parental nurturance and adolescent aggression (both indirect and direct aggression) over a four-year period and found that, for girls, parental nurturance at age 10 was associated with both indirect and direct aggression at age 12. For boys, parental nurturance at age 12 was associated with both aggressive behaviors at age 14. The implications of these results for the measurement of parenting and problem behaviors and for the examination of the

reciprocal influences in transactional models are discussed, with suggestions for future research.

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Co-Authorship Statement

The order of authorship in each manuscript was determined according to the American Psychological Association "Ethical Principles of Psychologists and Code of Conduct", Principle 6.23 (APA, 1992)[1]. The co-authors contributed to the identification and design of the studies. The data analyses were performed by the first author. The manuscripts were prepared by the first author, feedback from the co-authors were incorporated in the final version for publication.

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1. INTRODUCTION

There is substantial evidence that adolescents, particularly early adolescents, are more likely than children or young adults to engage in problem behaviors (Farrington, 1986; Loeber & Hay, 1997) and that quality of parenting is related to the development of adolescent problem behaviors (Simons, Chao, Conger, & Elder, 2001). Research in the area of parenting and adolescent problem behaviors has been dominated by studies that have examined the association between specific parenting behaviors and adolescent problem behaviors (Steinberg & Morris, 2001). These studies varied in their approach to investigating the direction of influence between parenting behaviors and adolescent problem behaviors.

Until recently, work in the area of parenting behaviors and adolescent problem behaviors has tended to provide a unidirectional conceptualization of influence, that is, from parent to adolescent or from adolescent to parent to describe the relationship between parenting and adolescent problem behaviors. For example, research has indicated that negative parenting behaviors (e.g., low parental monitoring, harsh discipline) are associated with higher levels of externalizing problem behaviors, such as delinquency (Bender, Allen, & McElhaney, 2007; Pettit, Laird, Dodge, Bates, & Criss, 2001), whereas positive parenting behaviors (e.g., support) are associated with lower levels of externalizing problem behaviors (Barnes & Farrell, 1992; de Kemp, Scholte, Overbeek, & Engels, 2006). There is also evidence that adolescent problem behavior influences parenting behavior. For example, Kerr and Stattin (2003) found that high levels of adolescent delinquency were related to low parental control and support over time.

The evidence supporting the influence of parenting behaviors on adolescent behaviors and vice versa suggests that both adolescents and their parents are influenced by each other's behavior. Thus, it seems reasonable to argue that parenting behavior and adolescent behavior are reciprocally related (Kuczynski, 2003). From this standpoint, a unidirectional conceptualization of influence between parenting behavior and adolescent problem behavior fails to capture the dynamic features of this relationship. In fact, current perspectives on parent-adolescent relations emphasize the importance of examining reciprocal effects between parenting behaviors and adolescent outcomes (Kuczynski; Lollis & Kuczynski, 1997), which is the underlying reason for conducting this research.

Adolescence is characterized by tremendous developmental changes that are occurring within the individual, including physical development, cognitive maturation, and behavioral changes. Despite the great interest in examining the relationship between parenting and adolescent problem behaviors, relatively less research has focused on the measurement aspects of specific parenting behavior and adolescent problem behavior scales. Specifically, little is known about the utility and equality of measurement properties of most existing parenting behavior and problem behavior scales across different adolescent age groups. Therefore, prior to the investigation of reciprocal influences, an important aim of this research was to address the general concerns about the quality of measurement of parenting behaviors and problem behaviors.

1.1. Research Objectives

The main objectives of this research were to: (a) contribute to a growing literature in reciprocal models that investigate the relationship between parenting behaviors and

problem behaviors, and (b) contribute to the area of measurement of parenting and problem behaviors during adolescence.

To address these research objectives, three separate studies were conducted using adolescent self-report data from the Canadian National Longitudinal Survey of Children and Youth (NLSCY). The first study evaluated the factor structure and the equality of measurement properties of the NLSCY parenting behavior scales over a four-year period. The second study examined the factor structure and the equality of measurement properties of three problem behavior scales across gender and three age groups (10-11-, 12-13-, and 14-15-year-olds). The third study investigated the reciprocal relationships between parenting and adolescent problem behaviors over a four-year period.

The statistical analyses in Study 1 and Study 2, not only provided support as to the measurement properties of the parenting and behavioral scales in the NLSCY, but they provided the foundation for the examination of the reciprocal influences between parenting and adolescent problem behaviors in Study 3. Study 3 used adolescent self-report data to examine the extent to which a particular parenting behavior evoked or influenced a particular adolescent problem behavior, as well as the extent to which that adolescent problem behavior evoked or influenced the behavior of the parent.

1.2. A Brief Overview of the National Longitudinal Survey of Children and Youth

The NLSCY is a longitudinal survey jointly conducted by Statistics Canada and Human Resources and Social Development Canada (HRSDC). The first cycle of the survey began in 1994 and follow-up surveys were administered biennially. The target population of the survey in the first cycle was children who were newborn to 11 years old.

The sample design was based on national household demographics, and initially there were to be three sources of data: (a) the *Main Component*, approximately 12,900 households were selected from 10 provinces for the NLSCY sample as the Main Component, (b) the *Integrated Component*, approximately 2,700 households were integrated from the National Population Health Survey (NPHS) data collected on the health of Canadian children, and finally (c) the *Territories Component*, approximately 2,300 children living in Yukon, Nunavut, and Northwest Territories (NWT) were included. Unfortunately, data from the Territories Component were never processed, which means that the final NLSCY data excluded households located in the Yukon, Nunavut, and NWT, First Nations (Aboriginal) reserves, and children living in institutional settings. In total 13,439 households were maintained in the first cycle resulting in 22,831 children who participated in the survey (Statistics Canada, HRDC, 1995). The response rate of this longitudinal sample in the second cycle was 76% (Statistics Canada, HRDC, 1997).

The main objectives of the NLSCY were threefold (a) to collect a wide range of information about factors influencing a child's social, emotional, and behavioral development over time, (b) to determine the prevalence of risk and protective factors for children and youth and understand how these factors influence their development, and (c) to make this information available to government officials for developing policies and programs.

Data were collected in two different contexts - the household and the school. The household-collected data included information about the person most knowledgeable (PMK) about the child, the spouse/partner of the PMK, and the child. The PMK was the

biological mother for 90% of responding children. The school collection included a teacher's questionnaire, a principal's questionnaire as well as a Math Computation and Reading Comprehension test (added in the second cycle) administered to the child.

The current research used data from two scales of the child self-report questionnaire that was administered in the household: (a) nineteen questions from the Parenting Questionnaire (Lempers, Clark-Lempers, & Simons, 1989), which assess three parenting behaviors (i.e., Parental Nurturance, Parental Rejection, and Parental Monitoring), and (b) seventeen items from the child behavior scale, which were originally derived from the Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1981). These seventeen items formed three externalizing problem behavior scales, namely, Indirect Aggression, Direct Aggression, and Property Offence.

The selection of the NLSCY dataset to conduct this research was purposeful. First, the survey is administered longitudinally to a representative sample of children and youth in Canada. This important feature of the NLSCY enabled me to examine the structure and equivalence of the parenting and problem behavior scales across time and representative groups of adolescents. Moreover, the NLSCY has been widely used in the investigation of parenting and child behaviors because the research findings based on this dataset have the highest potential for impacting children's health and development, primarily through the implications it has for social policy (see Willms, 2002). I expect that the findings of this study will be especially useful to researchers who use the NLSCY data by providing empirical support for the measurement properties of parenting and problem behavior scales that are commonly used when investigating children's health and development.

1.3. Overview of Research Themes

The shift from unidirectional to bidirectional conceptualization of influence between parenting behavior and adolescent problem behavior necessitates the use of a developmental perspective whereby dynamic changes in both adolescent and parent behaviors can be simultaneously examined for reciprocal influence. Transactional models are one of the most commonly used conceptual frameworks to examine adolescent development as a continuous transaction between the adolescent and the experiences provided by the adolescent's social environment, such as family (Sameroff 1975a, 1975b; Sameroff & MacKenzie, 2003). The use of longitudinal data is indispensable in the empirical study of transactional models. In general, adolescents' age is used to categorize the developmental levels that occur sequentially within each of the interacting domains (i.e., the adolescent and the context) over time (Eyberg, Schuhmann, & Rey, 1998).

An important feature of the transactional model is that adolescent outcomes occur within a sequence of continuous modifications of relations within and between the adolescent and the context (Sameroff, 1975b). Thus, it can be argued that transactional models assume qualitative changes within the individual, within the environment, and in the interaction between the two over time (Ollendick & Vasey, 1999). In terms of measuring the relationship between parenting and adolescent problem behaviors, we can expect both constructs (i.e., parenting behavior and adolescent problem behavior) to potentially differ on their underlying characteristics over time (whether perceived by the adolescent or by the parent) as a result of the restructurings of interactions (i.e., transactions) between the adolescent and the parent. For example, the expression of a particular parenting behavior (e.g., control) may change dramatically between the ages of

10 and 15. Similarly, an adolescent's engagement in a problem behavior (e.g., delinquency) will likely be very different over time, in that a specific behavior, such as hitting, may no longer be representative of a problem behavior, and other behaviors, such as vandalizing, may become more representative of that problem behavior.

The assumption of qualitative changes within and between the constructs in transactional models is related to two foundational issues in measurement, namely, *construct validity* and *construct comparability*. Construct validity is considered as the whole of validity (Hubley & Zumbo, 1996; Loevinger, 1957) that refers to the appropriateness, meaningfulness, and usefulness of the specific inferences based on individuals' scores on an assessment in a particular sample within a particular context (Zumbo, 2007). Construct comparability refers to, but is not limited to, the fairness and equivalence of measurement across groups (Meredith, 1993). Providing support for construct comparability involves an investigation of measurement equivalence or invariance, requiring individuals from different groups be assessed on the same construct using the same metric (Steenkamp & Baumgartner, 1998; Wu, Li, & Zumbo, 2007). Given the qualitative changes within and between the constructs in transactional models, it is crucial to provide support for construct validity at each time point in the model. In addition, construct comparability or incomparability can not be assumed, therefore should be empirically tested.

In this study, the first two manuscripts addressed construct validity and comparability issues by evaluating the factor structure and the equality of measurement properties of parenting and adolescent problem behavior scales. The factor structure of the scales was evaluated based on Loevinger's (1957) model for construct validation.

Loevinger (1957) suggested that there are three mutually exclusive mandatory aspects of construct validity: the *substantive component*, *structural component*, and *external component*. The substantive component of validity refers to the creation of a representative item pool and is related to the degree to which selected items on a scale account for a particular behavior that is being assessed given theoretical conceptions of the behavior. The structural component is related to psychometric evaluation of the items. In the context of a parental nurturance scale development; this aspect of validity suggests that the nature and magnitude of the relations between behavioral manifestations of nurturance (e.g., items such as smiling, praising) should be equivalent to the structural relations between comparable items assessing the same aspects of nurturance. Both substantive and structural components of validity focus on the internal structure of a scale (i.e., items). In contrast, external component is concerned with the correlation of the item responses to the total score, relation with other test scores and relevant external variables, and distortions and biases.

Messick (1975) extended Loevinger's (1957) definition of construct validity and included an ethical component that questions whether the measure has been used for the intended purpose. This aspect of construct validity requires providing support regarding the actual and potential consequences of the use of a particular test, especially with respect to social issues, such as bias, fairness, and distributive justice (Messick, 1995). As an example, what would be a potential consequence of using an aggression scale as a diagnostic tool? What are the value implications of score interpretations as a basis for decision-making? The ethical component of validity is highly relevant to this study given the main objectives of the NLSCY, which include developing policies and programs for

child, family, and youth health. An evaluation of the ethical component of validity can ensure that the implications of the findings from the NLSCY are based on specific inferences relatively free of bias. However, in the absence of support for other components of construct validity, (e.g., structural), an evaluation of the ethical component of construct validity is precluded.

An important remark should be made here regarding the investigation of components of construct validity. Construct validation is not a procedure, but an ongoing process (Zumbo, 2007), which means that one source of evidence can never be entirely adequate to establish construct validity (Cronbach & Meehl, 1955; Hubley & Zumbo, 1996). Therefore, the process of construct validation of the parenting and problem behavior scales in the NLSCY dataset cannot be limited to the present study.

This study addressed two aspects of construct validity: structural and external components. The structural component of validity was evaluated by examining the measurement models of the parenting behavior and adolescent problem behavior scales using confirmatory factor analysis (CFA). The CFA allows verification of the underlying dimensions of a latent variable by testing the pattern of the relationship between the factors (i.e., latent variables) and the items (i.e., observed indicators). The factorial structure should be consistent with the underlying theory about the construct. As an example, a three-factor structure representing three distinct parental behaviors (i.e., nurturing, rejecting, and monitoring) was hypothesized for the parenting questionnaire.

In this study, I used a CFA approach to test the structural validity of both parenting and adolescent problem behavior measures for two main reasons: (a) CFA has been commonly used to evaluate latent variables and provide support for construct

validation in the psychological measurement literature (DiStefano & Hess, 2005), and (b) CFA provides a stronger analytical framework for structural validity than other methods (e.g., correlation) by accounting for measurement error (Brown, 2006).

After providing support for the structural component of validity, the next step was an evaluation of the external component of validity by assessing the extent to which parental nurturance predicts adolescent aggressive behaviors and vice versa in a transactional model. It should be noted that if the findings from the CFA analyses did not provide support for the structural component, then the external component of validity was not evaluated.

The equality of measurement properties of parenting and adolescent problem behavior scales was evaluated by examining measurement invariance. If the assumption of qualitative changes within and between the constructs in transactional models is true, then, one would expect construct incomparability (i.e., lack of measurement invariance) across groups. However, *presence* of construct incomparability does not necessarily imply *absence* of construct validity. In other words, in the absence of construct comparability (i.e., lack of measurement invariance), the specific inferences made from the scores from a particular sample in a particular context and time can still be meaningful; however, this possibility can not be assumed and therefore should be empirically tested.

Construct comparability has received attention mostly in cross-cultural research (Little, 2000), however, establishment of measurement equivalence or invariance of constructs has important implications for developmental research. More specifically, given the common practice of comparing scores between boys and girls or across

different age groups, such as children versus adolescents, ensuring measurement equivalence or invariance of constructs becomes an essential. The statistical methods to examine construct comparability or equivalence can be broadly classified under two categories: (a) scale-level analyses, and (b) item-level analyses (Zumbo & Koh, 2005). As the name implies, in scale-level analyses, a set of items that comprise a scale is evaluated for different levels of measurement invariance (e.g., weak to strict measurement invariance, see Vandenberg & Lance, 2000) using a single or multi-group CFA; whereas in item-level analyses, one item at a time is evaluated for invariance using a differential item functioning (DIF) method, with methods based on item response theory (IRT) or logistic regression (see Zumbo & Hubley, 2003 for a review). In this study, I utilized a scale-level analysis because I was interested in evaluating the overall pattern or configuration of factors (parenting behaviors and problem behaviors) across gender and different age groups, rather than focusing on the characteristics of each item in each scale.

I acknowledge that there may be changes in the expression or manifestation of the constructs in developmental psychology from early childhood through adulthood. For example, there is no doubt that cognitive abilities increase from childhood to adulthood within the normal range of human development. Thus, for any test of cognitive abilities, an important piece of evidence for construct validation would be that older children score higher than younger children, after controlling for the effects of other factors, such as health and education. However, developmental maturation can not be expected to predict *all* constructs in developmental psychology. For example, it is not clear whether a self-esteem scale would show a similar pattern of increase or decrease with age. Thus,

developmental growth may be relevant to the construct validity or comparability of some (but not all) psychological constructs, such that the presence of these constructs at a particular age may differ as a result of developmental changes.

Regarding parenting and adolescent problem behaviors, research findings suggest that problem behaviors may manifest differently in girls versus boys and in children versus adolescents (Dodge, Coie, & Lynam, 2006). However, little is known about whether adolescents' perceptions of parenting behaviors change over time. Thus, an examination of equivalence or invariance of parenting and problem behavior scales will be an important contribution to the developmental psychology literature with respect to understanding differences in perceptions of parenting behaviors and expressions of problem behaviors over time.

In this study, given the tremendous developmental changes that are occurring during adolescence, which may also vary as a function of gender, I do not expect to observe complete measurement invariance of parenting and problem behavior scales across gender and different age groups. It is possible that both parenting behaviors and adolescent problem behaviors manifest themselves differently across these groups. However, the different manifestations at the item level may not necessarily imply construct bias. Stated differently, if the configuration of the factor models is the same across groups, analyses across gender and age can be conducted within a developmental framework, as in the case of transactional models.

A unique feature of this work is its contribution to the area of measurement of parenting (Study 1) and adolescent problem behaviors (Study 2), as well as use of transactional model to investigate the direction of influence between parenting and

adolescent problem behaviors over a four-year period of time (Study 3). Moreover, Study 1 examined a range of parenting behaviors reported by adolescents (i.e., parental nurturance, rejection, and monitoring) and Study 2 examined a range of externalizing problem behaviors, such as indirect aggression, direct aggression, and property offence. Furthermore, the use of three-time point encompassing the ages of 10 through 15 in Study 3 allowed a more complete picture of the dynamic relationship between parenting and problem behavior during the period of adolescence.

1.4. Outline of the Thesis

This manuscript-based thesis is comprised of five chapters. Chapter 1 (this chapter) provides an introduction to the research topic, describes the research objectives, and provides a brief overview of the data source and the research themes. Chapters 2, 3, and 4 contain the three separate manuscripts intended for publication and present the results from the set of three studies. Chapter 5 then provides a general discussion which unifies the three manuscripts and relates the significance of the study to the field, with suggestions for future research.

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2. STUDY 1 - Evaluation of the Factor Structure of the Child-Report Parenting Questionnaire[2]

2.1. Introduction

There is overwhelming evidence to suggest that parenting plays a central role in child development (Cummings, Davies, & Campbell, 2000; Masten & Shaffer, 2006). Examining the effects of parenting has been a dominant research theme in developmental psychology over the past five decades. In particular, the impact of parenting on adolescent health and development has received much attention because adolescence has been identified as a period of rapid developmental (e.g., physical and cognitive maturation) and psychosocial changes (e.g., establishment of autonomy and identity; Steinberg & Silk, 2002). This research has shown that parenting behaviors are key determinants of adolescent academic, social, and behavioral outcomes. Although this knowledge is well documented, one of the hallmarks of the parenting literature is that it is replete with mixed findings, and is inconsistent with respect to how researchers are measuring various aspects of parenting (Dix & Gershoff, 2001; O'Connor, 2002). The establishment of an accurate measure of parenting behaviors should precede the investigation of the relationship between parenting behaviors and adolescent outcomes.

2.2. Definition and Measurement of Parenting

Parenting is a multifaceted, complex process comprised of tasks, roles, skills, and resources (Horowitz, Hughes, & Perdue, 1982). Historically, however, the prevailing view on parenting has been that parental attitudes determine parental behaviors, which

[2] A version of this manuscript will be submitted for publication. Arim, R. G., Shapka, J. D., Dahinten, V. S., Olson, B. F. (2009). *Evaluation of the factor structure of the child-report Parenting Questionnaire in the National Longitudinal Survey of Children and Youth.*

then influence children's developmental outcomes (Stogdill, 1936). It was not until the 1930s that researchers began to focus on parental practices, such as nurturance and control, as an alternative to parental attitudes in assessing parenting. Between 1936 and 1974, a total of 59 instruments on parenting behaviors were developed and reported in the published literature. The majority of these instruments (64%) were parent-report questionnaires, whereas the remaining was responded to by children (Holden, 2001). Although only a few of these instruments became popular, some are still being used today despite how dated they are (e.g., Child Rearing Practices Report, developed by Block, 1965).

Between 1975 and 2000, a further 28 parenting instruments were developed (Dix & Gershoff, 2001), and a majority of them have been used in research in the last two decades. These parenting instruments assess a variety of parenting behaviors, including, punishment, discipline, involvement, intrusiveness, supervision, nurturance, and neglect. While diversity among assessments of parenting behaviors have added richness to the field of research, the existence of different conceptualizations and measures of the same parenting construct have contributed to inconsistencies in the literature. Moreover, the diversity in the measures raises serious concerns about the quality of all the assessments. In fact, very few of these instruments have been empirically examined and even when the psychometric properties have been looked at, it appears that many of these instruments do not attain a high level of internal consistency, such as Cronbach's (1951) coefficient alpha greater or equal to .80.

As noted by Dix and Gershoff (2001), a lack of validity and reliability information gives rise to "inconsistent findings, wasted effort, and slow progress" in

research (p. 138). It is clear that there is a need for systematic conceptualization, definition, and measurement of parenting behaviors. Developing consistency and a theoretical understanding of parenting behaviors will not only help us unravel the mixed findings in the literature, but is necessary for evaluating the impact of parenting practices on adolescent development.

Recently, several researchers highlighted this need and focused on construct validation to clarify the factor structure of different parenting measures. For example, Dishion, Burraston, and Li (2003) provided evidence for the construct validity of five parenting constructs labeled as monitoring, limit-setting, positive reinforcement, relationship quality, and problem solving using multitrait-multimethod (MTMM) data from a sample of families with high-risk adolescent children between the ages of 11 and 14 years. More recently, a new parental monitoring instrument has been developed by Cottrell and his colleagues (2007). To determine the structure of the scale and provide evidence for construct validity, the authors administered the instrument to an ethnically homogeneous sample of 518 parents and their adolescent children between the ages of 12 and 17 years. Using structural equation modeling techniques, the authors confirmed the presence of seven correlated factors, representing different types of monitoring (e.g., direct vs. indirect) and monitoring in distinct domains (e.g., school and health). Regarding reliability information, the authors indicated that the coefficient alpha score was greater than .69 for all seven factors. Construct validity was determined by examining the relationships between each factor of the instrument and two other related measures (i.e., parental knowledge and open/problem communication scales). Based on

the results, the authors suggested that there was evidence to conclude that the new instrument had good psychometric properties.

A major limitation of the two above-mentioned studies is that the samples were not representative of the broad range of adolescents and parents. However, Karazia, van Dulmen, and Wildman (2008) used a more ethnically diverse sample of parents of children between the ages of 2 and 16 years in order to confirm the structure of a parenting scale that assesses dysfunctional discipline strategies, by comparing alternative factor solutions found in the literature. These authors indicated that a shortened two-factor model assessing two styles of discipline strategies (i.e., overreactivity and laxness) that were associated with children's problem behaviors showed the best fit to the data. An important contribution of this study is that the findings provide evidence for the utility of this parenting scale in measuring two dysfunctional parenting discipline strategies for both children and adolescents.

The present study aimed to contribute to this emerging literature by examining the utility of a parenting questionnaire currently used in the National Longitudinal Survey of Children and Youth (NLSCY). More specifically, the focus of this study was to (a) confirm the factor structure of the NLSCY child-report parenting questionnaire, which has been pre-established by Statistics Canada (Statistics Canada, HRSDC, 1998), and (b) examine the longitudinal measurement invariance of the questionnaire across age. It is crucial to provide empirical evidence for the utility of this measure because most researchers who examine the key determinants of children's health and development using the NLSCY data include this parenting scale in their analyses.

There are three main reasons we chose the NLSCY dataset for the purpose of this study. First, the dataset is a representative sample of children and youth in Canada, which greatly enhances the generalizability of our findings. Second, the dataset is comprised of longitudinal data, which means we will be able to examine the structure and equivalence of the parenting scales across time and groups. Third, this dataset has a high profile in Canada, and therefore, has the highest potential for impacting on children's health and development, primarily through the implications it has for social policy (see Willms, 2002).

2.3. Parenting Questionnaire in the NLSCY

The NLSCY is an ongoing longitudinal survey that is jointly conducted by Statistics Canada and Human Resources and Social Development Canada (HRSDC). The main objective of the NLSCY was to create a national database on the developmental characteristics of Canadian children and youth and to monitor their development from infancy to adulthood. The first cycle of the survey began in December, 1994. Follow-up surveys have been administered biennially.

The child-report parenting questionnaire used in the NLSCY was originally developed by Lempers, Clark-Lempers, and Simons (1989), and was based on Schaefer's (1965) Children's Report of Parental Behavior Inventory (CRPBI) and Roberts, Block, and Block's (1984) Child Rearing Practices Report (CRPR). The original questionnaire, consisting of 29 items, was designed to measure three parenting behaviors: nurturance, inconsistent rejection-oriented discipline, and monitoring. Nurturance denotes positive evaluation, expression of affection, and equalitarian treatment. Inconsistent rejection-oriented discipline behaviors include negative affect, control and hostility. Monitoring

involves parental direction and supervision (see Roberts et al., 1984; Schaefer, 1965). These three dimensions of parenting behavior were supported through an exploratory factor analysis (EFA) using varimax rotation (Lempers et al., 1989). The coefficient alpha statistic was .80 for the original 29-item scale. The authors did not provide the internal consistency scores for the three subscales, nor did they provide any information on validity.

The developers of the NLSCY incorporated this scale to assess children's perception of their relationship with their parents and parental supervision. In the NLSCY version, the wording of one item was modified and 10 items were excluded (6 nurturance, 3 rejection, and 1 monitoring), resulting in a 19-item scale. Documentation for the NLSCY indicates that the factor structure of the parenting scale was determined by Statistics Canada via EFA, with the first cycle of available data on children between the ages of 10 and 11 years. Statistics Canada's procedure involved the following steps. First, the sample from each age group was randomly divided into two half-samples to compare whether the analyses yielded the same results. Second, a principal component analysis was conducted separately on each half-sample to determine how many factors should be extracted for the subsequent factor analysis (Statistics Canada, HRDC, 1995). It is important to note that optimal scaling (Young, 1981) was used to transform the ordinal data, in nature, to interval data to perform the statistical analyses appropriately, and that normalized weights were used for all analyses. The findings from these factor analyses indicated three factors in the scale. Similar to the original scale, these factors were labeled as Nurturance (7 items; alpha = .77), Rejection (7 items; alpha = .59), and Monitoring (5 items; alpha = .54).

Although an EFA may reveal the underlying structure of a scale, a stronger empirical and conceptual evaluation of the scale is necessary to provide evidence of construct validity (Brown, 2006). Confirmatory factor analysis (CFA) has recently taken on a "major role" in the process of scale development (Noar, 2003, p.633). CFA is a more feasible method for evaluating construct validity due to its ability to explicitly test hypotheses concerning the factor structure of the data by specifying the number and composition of the factors (Schumacker & Lomax, 2004). Brown summarized the advantages of conducting a CFA as follows: (a) conceptually viable measurement models can be specified, (b) the amount of error in each observed variable can be determined, and (c) better estimates of the relationships of the observed variables to latent variables, and the relationships among latent variables can be obtained.

Another key advantage of CFA is its ability to test whether measurement models can be generalized across groups of individuals or across time (Brown, 2006). Measurement invariance (MI), or the equivalence of measurement across groups is a central issue to the measurement of parenting. In particular, MI is critically important when investigating group differences, such as between girls and boys or children and adolescents. Legitimate comparison across groups or time can only be assured if MI has been established (Vandenberg & Lance, 2000).

Measurement equivalence or invariance is obtained when the probability of selecting a response option is identical across respondents, given their group membership and true score (Meredith, 1993; Millsap & Tein, 2004; Wu, Li, & Zumbo, 2007). Stated differently, MI means that when an individual answers a question, the chance that the person will select a particular response is the same across all individuals, regardless of

their group membership. In the CFA framework, MI is obtained when the same factor structure with equal factor loadings and item uniqueness (error variances) across groups are observed. Obtaining the same factor structure across groups is considered *configural invariance* (i.e., same pattern of fixed and free parameters). Obtaining equal factor loadings is considered *loading invariance*, which indicates that each item has the same metric scale across groups. Finally, achieving equal item uniqueness is considered *error invariance,* indicating measurement error is the same across groups; hence, reliability estimates are equivalent (Meredith, 1993; Vandenberg & Lance, 2000). When all three levels of invariance are achieved, the scale is said to be measurement invariant across groups.

Recent research has emphasized the importance of establishing MI for parenting measures (Locke & Prinz, 2002); unfortunately, there are few studies investigating MI and, for the most part, they are focused on determining the cross-cultural equivalence of parenting measures (Bradford et al., 2003; Krishnakumar, Buehler, & Barber, 2003; Vazsonyi, Hibbert, & Snider, 2003). However, a recent study investigated equivalence of parental acceptance, intrusiveness, and harshness between mothers and fathers (Adamsons & Buehler, 2007). The parental harshness measure was the only scale that demonstrated complete MI. Parental intrusiveness demonstrated loading invariance. Parental acceptance indicated only configural invariance. These findings suggested that the factor structure of the intrusiveness and harshness (but not acceptance) scales was similar for mother and fathers. Regrettably, a major shortcoming of this study is that the authors used a sample of parents with children from only the 6^{th} grade. That is, there was no variation in the age of children of participating parents. Given that parenting behaviors

change as children mature, an important research goal should be to examine MI of parenting measures that are being used with children or parents of children of different ages. We were able to locate only one study that examined MI across child age. Karazsia et al. (2008) found that the shortened two-factor model of the discipline strategies scale (Arnold, O'Leary, Wolff, & Acker, 1993) demonstrated loading invariance across preschool (ages 2 to 4 years), early elementary (ages 5 to 8 years), and late elementary (ages 9 to 12 years) school children. Although error invariance was not obtained, they concluded that this parenting scale was useful in making valid comparisons of parents' use of strategies for discipline across different age groups during childhood and early adolescence.

2.4. The Present Study

Very little theory-driven information exists about the parenting behavior scales that are being studied in this study. Moreover, no research has examined the notion that these scales (i.e., Nurturance, Rejection, and Monitoring) are invariant across time. Despite this, numerous studies which have used NLSCY data and the parenting behavior scales have been published (e.g., Dahinten, Shapka, & Willms, 2007; Elgar, Mills, McGrath, Waschbusch, Brownridge, 2007; Latimer, Kleinknecht, Hung, & Gabor, 2003; MacPhee & Andrews, 2006; Pires & Jenkins, 2007; Yugo & Davidson, 2007). Some of these studies have examined the longitudinal relationship between the parenting behaviors and adolescent health and developmental outcomes (e.g., Dahinten et al., 2007; Pires & Jenkins, 2007). Most of these studies reported statistically significant relationships between parenting behaviors and adolescent outcomes. However, in the absence of empirically validated theory-based measures of parenting behaviors, it is

possible that the findings were simply a reflection of spurious associations. Furthermore, despite the encouraging findings of equivalence for several measures of parenting behaviors (e.g., harshness) in the literature (Karazsia et al., 2008), no evidence exists for the equivalence of the NLSCY parenting measures across time.

Given the developmental processes that occur during the transition from childhood through adolescence, it is important to ensure that researchers measure the same construct across time to make valid comparisons between groups of children at different developmental stages. More specifically, although parenting behaviors can be perceived to be the same at different ages during childhood, with rapid cognitive, social, and emotional changes occurring in adolescence, the relevance or the influence of specific behaviors, such as praise, may change over time. For example, being praised may be a more relevant indicator of parental nurturance for a 14-year old than it is for a 10-year old. A failure to demonstrate measurement equivalence (i.e., MI) of the parenting measures across different age groups raises questions about the validity of making comparisons between the scores of different age groups.

The present study has two primary purposes: (a) to confirm the structure of the NLSCY child-report parenting questionnaire (revealed by EFA conducted by Statistics Canada), and (b) to explore the longitudinal MI of the scale over a four-year period. The hypothesized NLSCY parenting behaviors model is presented in Figure 2.1. Each of the circles represents a latent variable (i.e., three parenting behavior constructs: nurturance, rejection, and monitoring) and the boxes represent the observed variables (i.e., the items for each parenting behavior construct). One-way arrows indicate the hypothesized influence of the latent variable on the specific observed variable (i.e., factor loadings

indicating how much weight an item has on the construct). Curved-double-headed arrows between latent variables indicate that these variables are correlated (i.e., the constructs are related to each other). The observed variables contain not only the effect of the specific latent variable (i.e., factor loadings), but also measurement error for the specific item, and this error (i.e., item uniqueness) is represented by small arrows pointing to each observed variable box. As can be seen in Figure 2.1., each observed variable is constrained to load only on the latent variable which it is hypothesized to represent. There was no theoretical reason or any empirical evidence from previous research to allow for cross-loadings (i.e., an item can load on more than one latent variable).

Based on previous research results from the NLSCY, we expect that Parental Nurturance would be negatively correlated with Parental Rejection and positively correlated with Parental Monitoring. Parental Monitoring would also have a negative relationship with Parental Rejection. Both Parental Nurturance and Rejection behavior constructs would be composed of seven items each, whereas five items were expected to load on Parental Monitoring construct. Confirmation of this model will provide evidence for construct validity of the parenting behavior measures in the NLSCY to the extent that the constructs are measured by the specified indicators, and are related in a theoretically predictable manner. Evaluation of longitudinal MI will allow us to determine if the structure or measurement of these parenting constructs change over time, and thus provide evidence for score validity.

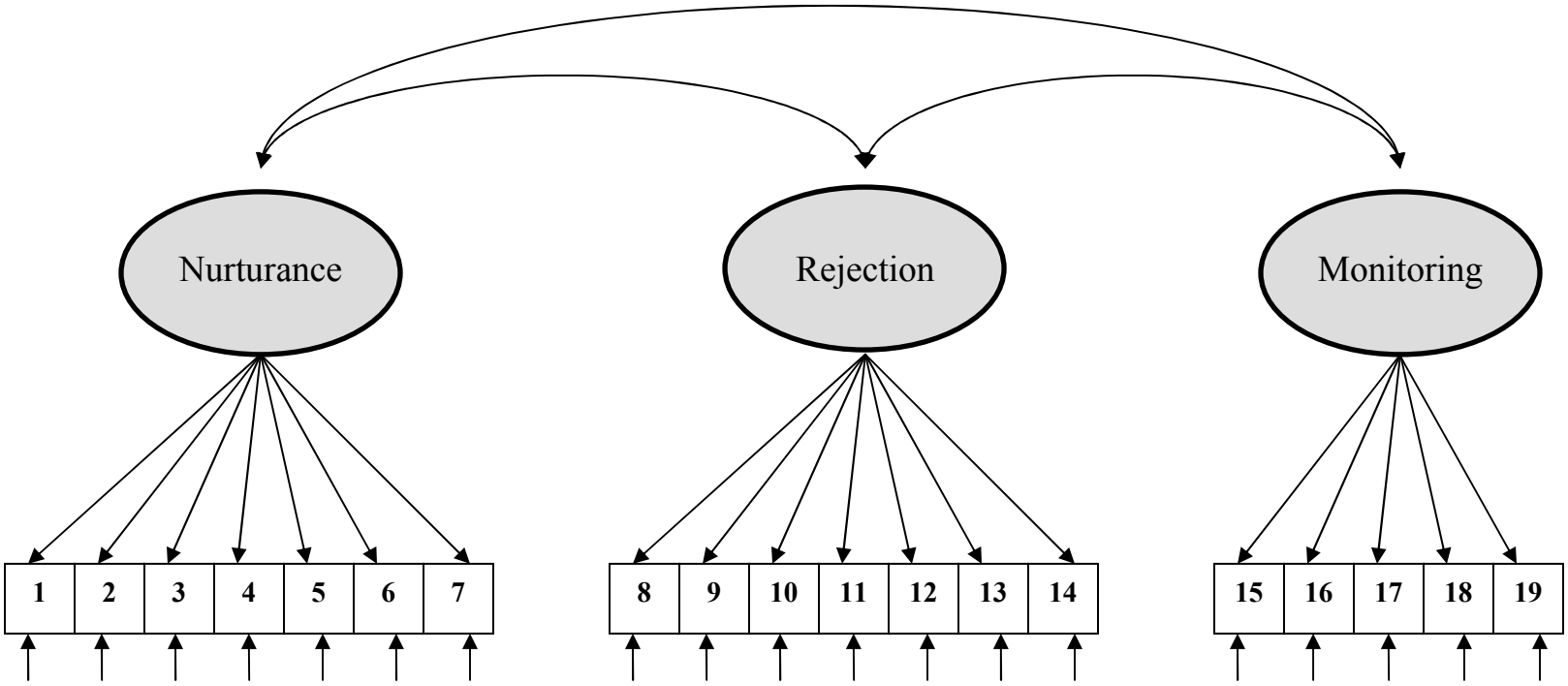

Figure 2.1. The hypothesized measurement model for the child-report parenting questionnaire.

2.5. Method

2.5.1. Source of Data

Data for this study were drawn from the longitudinal sample of the NLSCY. The target population of the NLSCY survey for Cycle 1 was children who were newborn to 11 years old. The survey design was based on selected households from the Statistics Canada's Labour Force Survey (LFS) data. The main component of the NLSCY household sample (approximately 12,900 households) was selected from the LFS data. There was also an integrated component (approximately 2,700 households) selected from the National Population Health Survey (NPHS) data. Households located in the Yukon, Nunavut, and Northwest Territories, and children living in institutional settings were excluded from the sample. The final longitudinal sample of the NLSCY included 13,439 households and 22,831 children who participated in the survey in Cycle 1 (Statistics Canada, HRDC, 1995).

Our study used data from the household context, which included information about the person most knowledgeable (PMK) about the child, the spouse or the partner of the PMK, and the child. Data were collected from the PMK during face-to-face or telephone interviews using computer-assisted interviewing (CAI). For children who were 10 years old and older, a self-complete questionnaire was administered, after obtaining the PMK's permission. The child was asked to complete the questionnaire in a private setting to ensure confidentiality. The interview length for the household collection was approximately two hours (Statistics Canada, HRDC, 1998).

2.5.2. Sample

The sample for the present study included two longitudinal cohorts of children. The first cohort consisted of children who were 10 and 11 years old in Cycle 3 (1998-99) and became 14 and 15 years old by Cycle 5 (2002-03) of the NLSCY. The second cohort consisted of children who were 10 and 11 years old in Cycle 4 (2000-02) and became 14 and 15 years old by Cycle 6 (2004-05; see Table 2.1.).

Table 2.1. Representation of the selected longitudinal cohorts by cycle and age

Age at cycle	Cycle 3	Cycle 4	Cycle 5	Cycle 6
10-11	Cohort 1 n = 2084	Cohort 2 n = 2081		
12-13		Cohort 1 n = 1855	Cohort 2 n = 1950	
14-15			Cohort 1 n = 1697	Cohort 2 n = 1791

There were two reasons for the selection of this age range and particular cycles of data (i.e., Cycles 3 to 6). First, the child-report parenting questionnaire in the NLSCY was responded by only children between the ages of 10 and 15 years. Second, the response format for the child-report parenting questionnaire was changed from a 4-point scale in Cycle 1 to a 5-point scale in subsequent cycles. In addition, some items were removed after Cycle 1 and new items were added after Cycle 2. Therefore, to ensure the consistency of items and the response scale, the sample was drawn from Cycles 3 to 6.

2.5.3. Sample Attrition

The initial sample of 10 and 11 years old from Cycles 3 and 4 was 4,165. The longitudinal attrition rate for this sample from ages 10-11 to ages 12-13 was small (9%),

as was the attrition rate from ages 12-13 to ages 14-15 (8%). To determine the impact of attrition, a series of independent t-tests (or chi-square tests for dichotomous variables) were conducted to examine the differences between children who remained in the study throughout, and those who withdrew at some point in the study (see Table 2.2.). Children were compared on differences in gender, household income[3], and PMK education[4], as well as parental nurturance, rejection, and monitoring. Separate analyses were conducted for each cohort. For the first cohort (10-11 in Cycle 3; 14-15 in Cycle 5), the analyses suggested that children who withdrew from the survey in Cycle 4 were coming from households with lower income compared to children who remained in the study. Children from this cohort who withdrew from the survey in Cycle 5 had a PMK with a lower education and a lower household income compared to children who remained in the survey.

Similar results were obtained for the second cohort (10-11 in Cycle 4; 14-15 in Cycle 6). The children who withdrew from the survey in Cycle 5 had a PMK with lower education and a lower household income compared to children who remained in the survey. Children who withdrew from the survey in Cycle 6 also had a PMK with lower education and a lower household income compared to children who remained in the survey. These analyses indicated that the children who remained in the survey had a higher level of socioeconomic status (SES) than children who withdrew. However, the effect size of this difference was small. No statistically significant differences were found for the parenting variables (see Table 2.2.).

[3] The household income variable was recoded as follows: 0 = less than 10,000; 1 = 10,000 to 14,999; 2 = 15,000 to 19,999; 4 = 20,000 to 29,999; 5 = 30,000 to 39,999; 6 = 40,000 to 49,999; 7 = 50,000 to 59,000; 8 = 60,000 to 79,999; and 9 = 80,000 or more.

[4] The PMK education variable represented the number of years of education with values ranging from 0 to 20.

Table 2.2. Independent Samples T Test Results from the Longitudinal Sample Attrition Analyses

	Comparison of age groups												
	10-11 versus 12-13							10-11 versus 14-15					
	N	*M*	*SD*	*df*	*t*	*p*	*d*[a]	*N*	*M*	*SD*	*df*	*t*	*p*	*d*
Cohort 1														
Household income				1732	2.57	.01	.16				1732	2.70	<.01	.15
not missing	1416	6.89	1.79					1311	6.91	1.78				
missing	318	6.60	1.91					423	6.63	1.89				
PMK education				2073	1.36	.18					830.52	2.69	<.01	.13
not missing	1700	2.92	1.03					1560	2.94	1.02				
missing	375	2.84	1.07					515	2.80	1.09				
Parental nurturance				1459	.33	.74					1459	.18	.85	
not missing	1235	22.37	5.02					1146	22.37	5.01				
missing	226	22.25	5.31					315	22.31	5.29				
Parental rejection				1438	1.07	.29					1438	1.61	.11	
not missing	1218	8.31	4.72					1135	8.36	4.71				
missing	222	7.95	4.33					305	7.88	4.45				
Parental monitoring				1584	.80	.43					1584	-.88	.38	
not missing	1337	15.69	3.06					1244	15.63	3.08				
missing	249	15.52	3.35					342	15.79	3.20				

Chi-square tests	*N*	*df*	χ^2	*p*
Gender 10-11 versus 12-13	2084	1	.24	.63
Gender 12-13 versus 14-15	2084	1	.66	.42

Table 2.2. ***continued***

	Comparison of age groups												
	10-11 versus 12-13							10-11 versus 14-15					
	N	*M*	*SD*	*df*	*t*	*p*	*d*[a]	*N*	*M*	*SD*	*df*	*t*	*p*	*d*
Cohort 2														
Household income				227.76	3.25	.01	.26				1748	4.37	<.01	.27
not missing	1560	7.18	1.70					1456	7.21	1.70				
missing	190	6.71	1.90					294	6.73	1.85				
PMK education				291.24	2.78	.01	.20				489.58	4.30	<.01	.26
not missing	1821	2.90	1.05					1704	2.93	1.04				
missing	235	2.69	1.10					352	2.65	1.10				
Parental nurturance				1424	.12	.91					1424	-.43	.67	
not missing	1296	22.90	4.83					1216	22.87	4.82				
missing	130	22.85	4.41					210	23.02	4.60				
Parental rejection				1381	-.31	.75					1381	.09	.93	
not missing	1254	7.90	4.42					1177	7.92	4.46				
missing	129	8.03	4.75					206	7.89	4.40				
Parental monitoring				1496	-.82	.42					1496	.27	.79	
not missing	1365	15.68	3.10					1287	15.71	3.07				
missing	133	15.91	2.94					211	15.65	3.17				

Chi-square tests	*N*	*df*	χ^2	*p*
Gender 10-11 versus 12-13	2081	1	.52	.47
Gender 12-13 versus 14-15	2081	1	.32	.58

[a]Cohen's *d* (1992) was used as the effect size measure. The interpretation is as follows: trivial effect = .00 to .19; small effect = .20 to .49; medium effect = .50 to .79; and large effect ≥ .80.

In addition to the longitudinal cycle by cycle attrition, there was attrition due to missing data on the items of the child-report parenting questionnaire. To determine the impact of missing data, a series of independent sample t-tests was again performed to examine the differences on the three parental behaviors and sociodemographic variables for children who had complete data and children who had missing values. It should be noted that Statistics Canada imputes missing values for items before calculating the total score for a particular scale, using the PRINQUAL procedure in Statistical Analysis Software (SAS)[5], only if the amount of missing values is less than 10% in a scale. This imputation procedure allowed us to conduct the independent samples t-test analyses on the three parental behavior scales. Analyses were conducted separately for each age group at each cycle. In the sample of adolescents aged 10-11 in Cycle 3 (i.e., Cohort 1), the children who had complete data were coming from a household with a higher income than the children who had missing data (see Table 2.3.). In the sample of adolescents aged 12-13 in Cycle 4 (i.e., Cohort 1), the children who had complete data had a PMK with higher education than the children who had missing data. For the same age group in Cycle 5 (i.e., Cohort 2), the children who had complete data were living in a household with a higher income than the children who had missing data (see Table 2.4.).

[5] This procedure considers (a) the response profile of the case with missing values, (b) the response profile of other cases in the data, and (c) the number of factors in the analyses, before indicating the most plausible item value for a given case (Statistics Canada, HRDC, 1998).

Table 2.3. Independent Samples T Test Results from the Sample Attrition Analyses due to Missing Data: Comparison within 10-11 age group

	Cohort 1							Cohort 2						
	N	*M*	*SD*	*df*	*t*	*p*	*d*[a]	*N*	*M*	*SD*	*df*	*t*	*p*	*d*
Household income				1352.74	4.41	.01	.22				1748	1.12	.26	
not missing	1061	6.99	1.75					1061	7.17	1.69				
missing	673	6.60	1.88					689	7.07	1.79				
PMK education				1662.46	1.80	.07					2054	1.35	.18	
not missing	1266	2.94	1.10					1225	2.91	1.05				
missing	809	2.86	1.07					831	2.84	1.07				
Parental nurturance				1459	.50	.62								
not missing	1267	22.38	5.04					1240	22.87	4.77	1424	-.49	.62	
missing	194	22.19	5.26					186	23.05	4.95				
Parental rejection				1438	.50	.62								
not missing	1267	8.28	4.65					1240	7.98	4.44	1381	1.68	.09	
missing	173	8.09	4.71					143	7.32	4.50				
Parental monitoring				1584	-.52	.60								
not missing	1267	15.64	3.08					1240	15.71	3.12	1496	.22	.82	
missing	319	15.74	3.23					258	15.66	2.92				

Chi-square tests	*N*	*df*	χ^2	*p*
Gender Cohort 1	2084	1	.96	.33
Gender Cohort 2	2081	1	.21	.65

[a]Cohen's *d* (1992) was used as the effect size measure. The interpretation is as follows: trivial effect = .00 to .19; small effect = .20 to .49; medium effect = .50 to .79; and large effect ≥ .80

Table 2.4. Independent Samples T Test Results from the Sample Attrition Analyses due to Missing Data: Comparison within 12-13 age group

	Cohort 1							Cohort 2						
	N	*M*	*SD*	*df*	*t*	*p*	*d*[a]	*N*	*M*	*SD*	*df*	*t*	*p*	*d*
Household income				1077.16	1.82	.07					1092.09	2.82	<.01	.15
not missing	962	7.29	1.68					1053	7.65	1.57				
missing	544	7.12	1.77					567	7.41	1.68				
PMK education				1365.66	1.99	.05	.10				1925	.68	.50	
not missing	1168	2.85	1.05					1251	13.46	2.25				
missing	672	2.74	1.08					676	13.39	2.29				
Parental nurturance				1300	-.78	.43					1380	-1.39	.17	
not missing	1173	21.07	5.34					1260	22.11	5.20				
missing	129	21.46	5.00					122	22.80	4.89				
Parental rejection				1295	-1.93	.06					1379	1.82	.07	
not missing	1173	9.62	4.79					1260	9.73	4.79				
missing	124	10.49	4.91					121	8.90	4.83				
Parental monitoring				1367	-1.68	.09					1441	.63	.53	
not missing	1173	14.81	3.14					1260	14.60	2.77				
missing	196	15.22	3.07					183	14.46	2.98				

Chi-square tests	*N*	*df*	χ^2	*p*
Gender Cohort 1	1855	1	1.55	.21
Gender Cohort 2	1950	1	.70	.40

[a]Cohen's *d* (1992) was used as the effect size measure. The interpretation is as follows: trivial effect = .00 to .19; small effect = .20 to .49; medium effect = .50 to .79; and large effect ≥ .80.

In the sample of adolescents aged 14-15 in Cycle 5 (i.e., Cohort 1), the children who had complete data were living in a household with a higher income and had a PMK with higher education than the children who had missing data. In addition, more girls than boys reported missing data. For the same age group in Cycle 6 (i.e., Cohort 2), the children who had complete data were living in a household with a higher income than the children who had missing data (see Table 2.5.). Once again, these analyses suggested that the children who had complete data in each cycle had a higher household income and a PMK with higher education than the children who had missing data. In addition, at one time (14-15 in Cycle 5), more girls had complete data in the survey compared to boys. However, the effect size of these differences was small. No other statistically significant differences were found, which includes the parenting variables that are the main focus of this study. Thus, children who had missing values on the items of the child-report parenting questionnaire were removed from the sample. The listwise deletion method was chosen to handle missing data due to the evaluation of a measurement model and the large size of the initial sample.

Based on these analyses, showing only socioeconomic (SES) differences, with a small effect size, it was concluded that although the final sample appears to have a higher SES, the attritions were not deemed to have an impact on the outcomes of this study.

Table 2.5. Independent Samples T Test Results from the Sample Attrition Analyses due to Missing Data: Comparison within 14-15 age group

	Cohort 1							Cohort 2						
	N	*M*	*SD*	*df*	*t*	*p*	*d*	*N*	*M*	*SD*	*df*	*t*	*p*	*d*
Household income				527.07	2.18	.03	.14				1789	2.47	.01	.16
not missing	1024	7.64	1.59					1466	77,318.26	55848.24				
missing	330	7.41	1.70					325	69,100.74	47050.99				
PMK education				1666	3.52	.01	.20				1789	1.95	.06	
not missing	1264	13.40	2.25					1466	13.99	5.89				
missing	404	12.95	2.27					325	13.30	5.38				
Parental nurturance				1338	-1.19	.23					1513	-.24	.81	
not missing	1284	20.08	5.58					1466	20.29	5.61				
missing	56	20.98	5.00					49	20.49	5.82				
Parental rejection				1330	-1.04	.30					1497	.35	.73	
not missing	1284	10.99	4.82					1466	10.94	4.85				
missing	48	11.73	5.28					33	10.64	4.96				
Parental monitoring				1349	.81	.42					1515	.14	.89	
not missing	1284	14.02	2.85					1466	14.13	2.86				
missing	67	13.73	2.99					51	14.08	2.64				

Chi-square tests	*N*	*df*	χ^2	*p*
Gender Cohort 1	1697	1	9.33	.01
Gender Cohort 2	1791	1	2.63	.11

[a]Cohen's *d* (1992) was used as the effect size measure. The interpretation is as follows: trivial effect = .00 to .19; small effect = .20 to .49; medium effect = .50 to .79; and large effect ≥ .80.

The final sample for this study consisted of 1164 children followed biennially for six years. Of these children, 53% were female, 75% were living with their biological parents, 15% were living in a single parent household, and 59% were living in a household with an income greater than or equal to $50,000. The majority of the children (91%) reported their mother as the PMK and 91% of the PMKs reported that they completed a high school degree or beyond, including a college or university degree.

To ensure that there were no systematic differences between the children in two different cohorts, a series of independent sample t-test (or chi-square tests for dichotomous variables) separately for each age group were performed to examine their differences on the three parental behaviors and socio-demographic variables (see Table 2.6.). The children in Cohort 2 were living in a household with a higher income at age 10-11 and at age 12-13 compared to children in Cohort 1 at age 10-11 and at age 12-13. Children in Cohort 1 had significantly higher levels of household income than children in Cohort 2 at age 14-15. Children in Cohort 2 had a PMK with higher education compared to children in Cohort 1 at age 12-13. These findings indicated that the SES is higher for each cohort at some point (for Cohort 1 at age 14-15; for Cohort 2 at age 10-11 and 12-13). Finally, children in Cohort 2 reported significantly higher levels of parental nurturance at age 10-11 and at age 12-13 than the children in Cohort 1 at age 10-11 and at age 12-13. Parental nurturance was the only parenting variable that indicated a statistically significant difference with a small effect size. It should be noted that the effect size measure from these analyses indicated that most of these differences were small; thus, the analyses were performed after combining the two cohorts (see Table 2.6.).

Table 2.6. Independent Samples T Test Results from the Cohort Differences Analyses

10-11 age groups	*N*	*M*	*SD*	*df*	*t*	*p*	*d*
Household income				995	-2.04	.04	.14
Cohort 1	457	7.11	1.70				
Cohort 2	540	7.33	1.58				
PMK education				1149	-.98	.33	
Cohort 1	541	12.74	2.05				
Cohort 2	610	12.86	2.03				
Parental nurturance				1160	-3.32	<.01	.20
Cohort 1	541	22.14	5.09				
Cohort 2	621	23.08	4.56				
Parental rejection				1160	1.67	.10	
Cohort 1	541	8.37	4.74				
Cohort 2	621	7.92	4.51				
Parental monitoring				1160	-1.25	.21	
Cohort 1	541	15.61	3.02				
Cohort 2	621	15.84	3.12				
12-13 age groups							
Household income				980	-2.25	.02	.14
Cohort 1	448	7.45	1.61				
Cohort 2	534	7.67	1.50				
PMK education				1146.14	-7.73	<.01	.45
Cohort 1	540	12.72	2.06				
Cohort 2	617	13.67	2.16				
Parental nurturance				1099.42	-4.28	<.01	.25
Cohort 1	541	21.17	5.29				
Cohort 2	621	22.45	4.80				
Parental rejection				1160	.67	.50	
Cohort 1	541	9.77	4.96				
Cohort 2	621	9.58	4.79				
Parental monitoring				1060.05	.14	.89	
Cohort 1	541	14.86	3.09				
Cohort 2	621	14.84	2.60				
14-15 age groups							
Household income				998.58	11.68	<.01	.72
Cohort 1	436	7.68	1.54				
Cohort 2	616	6.49	1.74				
PMK education				1145	-1.25	.21	
Cohort 1	528	13.53					
Cohort 2	619	13.70					
Parental nurturance				1160	-1.65	.10	
Cohort 1	541	20.17	5.53				
Cohort 2	621	20.71	5.45				

Table 2.6. ***continued***

14-15 age groups	*N*	*M*	*SD*	*df*	*t*	*p*	*d*
Parental rejection				1160	.51	.61	
Cohort 1	541	10.82	4.85				
Cohort 2	621	10.68	4.85				
Parental monitoring				1160	-.66	.51	
Cohort 1	541	14.06	2.89				
Cohort 2	621	14.16	2.72				

Chi-square tests	*N*	*df*	χ^2	*p*
Gender (age 10-11)	1162	1	.61	.44
Gender (age 12-13)	1162	1	.61	.44
Gender (age 14-15)	1162	1	.51	.48

2.5.4. Child-Report Parenting Questionnaire

Three parenting behaviors were measured with the 19-item NLSCY child-report parenting questionnaire originally developed by Lempers et al. (1989). A list of the items is included in Appendix A. Parental Nurturance (7 items; e.g., "my parents smile at me"), Parental Rejection (7 items; e.g., "my parents hit me or threaten to do so"), and Parental Monitoring (5 items; e.g., "my parents want to know exactly where I am and what I am doing") were assessed using a 5-point response scale ranging from 0 (*never*) to 4 (*always*), with higher scores indicating more nurturing, rejecting, and monitoring behaviors perceived by the adolescent. There is one item (i.e., "[my parents] let me go out any evening I want") in the Parental Monitoring scale that should be reverse coded.

We used ordinal coefficient alpha in order to estimate the reliability of the three parenting scales (Zumbo, Gadermann, Zeisser, 2007). Ordinal coefficient alpha – as opposed to Cronbach's coefficient alpha (1951) – is a more accurate estimate of reliability regardless of the number of scale points, and it is not influenced by the skewness of the item response distribution. The estimates of reliability were high for the

Parental Nurturance scale (.90, .92, and .94), good for the Parental Rejection scale (.75, .79, and .83), and acceptable to satisfactory for the Parental Monitoring scale (.63, .65, .70) across 10-11; 12-13; and 14-15 age groups, respectively.

2.5.5. Data Analysis

The decision tree presented in Figure 2.2. shows how we proceeded from the CFA analyses to the MI analyses. First, the three-factor structure of the child-report parenting questionnaire was tested across three age groups (3 CFAs). If the three-factor model showed a good fit for each age group, we moved on to the longitudinal MI analyses. If the three-factor model did not show a good fit across all the age groups, single-factor CFAs were performed for each parenting behavior scale for each of the three age groups (9 single-factor CFAs in total). If the single-factor model showed a good fit for each age group, the longitudinal MI analyses were conducted across three age groups. If the single-factor model did not show a good fit across all three age groups, we asked whether the fit of the single-factor model could be improved through minor modification related to a specific item of particular concern for its conceptual and empirical fit. If a specific item was identified, then the model was revised and a new set of single-factor CFAs were run. If not, then it was concluded that the single-factor model showed a poor fit to the data and further research was needed to refine the model. Once the single-factor parenting behavior model showed a good fit for all age groups, then the longitudinal MI analyses were conducted across the groups. If MI was not obtained across the three age groups, then the models across two age groups were examined (i.e., 10 vs. 12; 12 vs. 14, and 10 vs. 14).

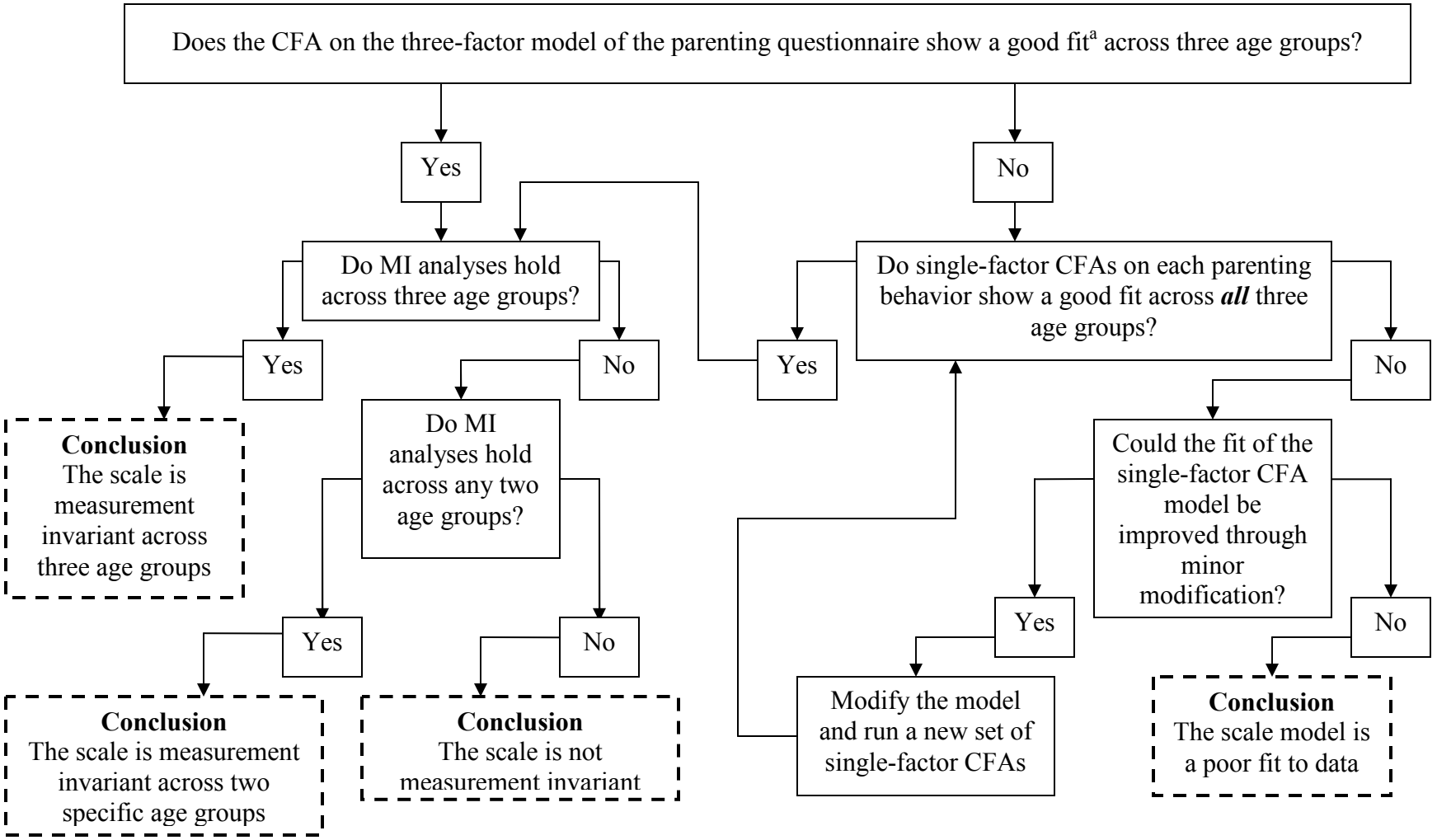

Figure 2.2. The plan for statistical analysis.

[a]Global fit was based on goodness-of-fit statistics criteria. CFA = confirmatory factor analysis. MI = measurement invariance.

The analyses were run using the LISREL 8.80 program (Jöreskog & Sörbom, 2006a) with weighted least squares (WLS) estimation on polychoric covariance and asymptotic variance/covariance matrices that were computed using PRELIS (version 2.80; Jöreskog & Sörbom, 2006b). The WLS method was selected because of the ordinal nature of the data and for violations of multivariate normality (Jöreskog, 2002). Model fit in CFAs was evaluated using the following global goodness-of-fit indices: (a) the root mean square error of approximation (RMSEA; Steiger, 2000), (b) the comparative fit index (CFI; Bentler, 1990), and (c) the standardized version of the Root Mean Squared Residual (SRMR; Jöreskog & Sörbom, 2001). The RMSEA is a parsimonious fit index assessing the closeness of fit of the model in the population (Brown, 2006). The CFI is an incremental fit index reflecting the improvement in fit by comparing the specified model to a restricted baseline model in which correlations among observed variables are fixed to zero (Bentler, 1990). The SRMR is an absolute fit index and reflects the average discrepancy between the correlations in the specified and obtained matrices (Brown, 2006). Following Hu and Bentler's (1999) suggestion, the following criterion values for goodness-of-fit were used: a RMSEA of less than or equal to .06, a CFI of .95 or more, and a SRMR of less than or equal to .08 indicated a good fit of the model to the data. In addition to the criteria for the goodness-of-fit statistics, we considered the parameter estimates of all items (Schumacker & Lomax, 2004), as well as the standardized residual matrix (Jöreskog & Moustaki, 2001) to evaluate model fit. In this study, we expected the standardized factor loading values to be greater than or equal to .30 (Brown, 2006; DiStefano, 2002) and standardized residuals for each item to be consistently less than 4.0 (Jöreskog & Moustaki).

The longitudinal MI analyses involved consecutive tests of the equivalence of the factor structure, factor loadings, and item uniqueness across three age groups. The order of these invariance analyses follows the recommendations of Vandenberg and Lance (2000) and Brown (2006), and has been used in recent longitudinal MI research (e.g., Motl & DiStefano, 2002). The issues surrounding the recommendations for the evaluation of model fit and comparisons of competing models in MI analyses remain unsettled (Vandenberg & Lance, 2000). However, Cheung and Rensvold (2002) recently showed that only RMSEA is unaffected by model complexity (i.e., number of estimated parameters), and that the difference in CFI between two nested models ($CFI_{constrained\ model} - CFI_{unconstrained\ model} = \Delta CFI$) is a robust statistic for evaluating the between-group invariance of CFA models. Thus, a cut-off value of RMSEA ≤ .06 was used as an indication of the configural model fit and a value of $\Delta CFI \leq -.01$ was used as an indication of fit for a given level of MI. It should be noted that a scale was considered as measurement invariant across age only if all three requirements of equality (i.e., factor structure, factor loadings, and item uniqueness) met the established criteria.

2.6. Results

2.6.1. Descriptive Statistics

As mentioned above, the responses to the parenting behavior scales are ordinal. Ordinal scales do not have a unit of measurement or a point of origin (Guilley & Uhlig, 1993), making most descriptive statistics, including means at both the item and scale level, essentially meaningless. Therefore, descriptive statistics from the parental behavior scales are not reported here. Based on visual inspection of frequency histograms, and

consideration of skewness and kurtosis values, we acknowledge there was a clear deviation from a normal distribution for all the parenting behavior scale items[6].

Research has also shown that when the observed data are ordinal, polychoric correlations, which estimate the linear relationship between two unobserved continuous variables given the observed ordinal data, should be used in place of the product moment correlations (Flora & Curran, 2004; Jöreskog, 1990; Muthén, 1984). Polychoric correlations for each parenting behavior scale across three age groups are presented in Tables 2.7.-2.9. In the Parental Nurturance scale, the fourth item (i.e., "[my parents] and I solve a problem together whenever we disagree about something") had consistently low correlations with other items in the scale. In the Parental Rejection scale, item clusters emerged. For example, the fourth (i.e., "[my parents] threaten punishment more often than they use it"), sixth (i.e., "[my parents] hit me or threaten to do so"), and seventh (i.e., "[my parents] get angry and yell at me") items had consistently high correlations among them, while the third item (i.e., "[my parents] only keep rules when it suits them") had low correlations with these items across three age groups. Finally, in the Parental Monitoring scale, the second item (i.e., "[my parents] let me go out any evening I want") had consistently lower correlations with the other items in the scale. Overall though, low-to-moderate relationships were observed between the respective items over time, which suggests a change in adolescents' perceptions of these parenting behaviors across two-year and four-year periods.

[6] It should be noted that a square root transformation was carried out on all items. However, this transformation was not effective in correcting the non-normal distributions; therefore, the original data was used with analyses that do not assume normality.

Table 2.7. Polychoric Correlation Coefficients of the Parental Nurturance Scale Items across Three Age Groups

Variable[a]	110	210	310	410	510	610	710	112	212	312	412	512	612	712	114	214	314	414	514	614
110																				
210	.53																			
310	.53	.52																		
410	.47	.41	.57																	
510	.56	.51	.60	.51																
610	.59	.56	.61	.51	.62															
710	.60	.52	.61	.53	.63	.75														
112	**.45**[b]	.24	.28	.21	.31	.32	.35													
212	.34	**.40**	.29	.22	.31	.37	.31	.59												
312	.31	.25	**.36**	.28	.30	.29	.30	.59	.60											
412	.27	.21	.28	**.30**	.28	.28	.25	.50	.50	.64										
512	.34	.31	.33	.28	**.38**	.36	.34	.60	.58	.66	.55									
612	.36	.30	.34	.26	.29	**.39**	.35	.63	.67	.67	.57	.72								
712	.34	.32	.35	.29	.33	.37	**.39**	.62	.62	.67	.56	.71	.78							
114	**.40**	.28	.25	.19	.26	.31	.30	**.49**	.35	.37	.33	.41	.42	.43						
214	.31	**.28**	.25	.19	.29	.28	.30	.40	**.40**	.38	.33	.43	.46	.45	.71					
314	.24	.24	**.25**	.23	.24	.24	.21	.30	.32	**.46**	.37	.39	.39	.40	.59	.70				
414	.21	.23	.26	**.25**	.24	.26	.17	.25	.27	.40	**.42**	.37	.33	.34	.50	.60	.74			
514	.29	.27	.26	.24	**.32**	.28	.28	.39	.33	.38	.35	**.48**	.44	.45	.65	.77	.71	.61		
614	.28	.25	.21	.20	.27	**.25**	.26	.37	.34	.35	.33	.42	**.45**	.43	.65	.79	.71	.61	.78	
714	.31	.26	.26	.21	.27	.28	**.28**	.39	.37	.38	.36	.46	.45	**.48**	.66	.78	.72	.61	.78	.84

Note. $N = 1164$; $M = 0$; $SD = 1$.

[a]The first digit indicates the number of the item in the scale whereas the last two digits indicate the age range (e.g., 110 is the first item of the scale in the sample of children aged 10-11). [b]Bolded coefficients represent the correlations between the respective items across time.

Table 2.8. Polychoric Correlation Coefficients of the Parental Rejection Scale Items across Three Age Groups

Variable[a]	110	210	310	410	510	610	710	112	212	312	412	512	612	712	114	214	314	414	514	614
110																				
210	.24																			
310	.25	.18																		
410	.24	.36	.12																	
510	.27	.28	.35	.31																
610	.22	.39	.16	.52	.31															
710	.29	.39	.19	.42	.30	.61														
112	**.26**[b]	.11	.13	.18	.15	.05	.17													
212	.17	**.36**	.13	.20	.10	.20	.23	.31												
312	.19	.12	**.28**	.12	.16	.10	.18	.32	.23											
412	.16	.20	.05	**.34**	.08	.22	.21	.30	.39	.19										
512	.24	.20	.22	.22	**.24**	.17	.21	.38	.37	.45	.38									
612	.14	.18	.04	.27	.14	**.49**	.34	.24	.31	.19	.44	.31								
712	.18	.20	.11	.24	.12	.29	**.43**	.32	.42	.32	.51	.37	.59							
114	**.23**	.10	.05	.09	.06	.17	.19	**.37**	.18	.14	.22	.22	.22	.22						
214	.10	**.24**	.08	.18	.10	.19	.25	.16	**.42**	.10	.23	.16	.20	.30	.25					
314	.14	.12	**.13**	.13	.13	.19	.20	.19	.16	**.29**	.14	.27	.18	.19	.31	.38				
414	.10	.15	.07	**.21**	.07	.17	.21	.14	.22	.09	**.40**	.15	.20	.29	.29	.46	.31			
514	.14	.18	.16	.18	**.18**	.19	.25	.19	.21	.18	.23	**.26**	.24	.28	.34	.39	.51	.45		
614	.08	.18	.09	.27	.08	**.37**	.28	.17	.23	.10	.24	.18	**.51**	.36	.25	.40	.38	.50	.44	
714	.17	.17	.10	.21	.14	.24	**.36**	.16	.25	.12	.26	.18	.40	**.48**	.25	.51	.37	.53	.45	.65

Note. $N = 1164$; $M = 0$; $SD = 1$.

[a]The first digit indicates the number of the item in the scale whereas the last two digits indicate the age range (e.g., 212 is the second item of the scale in the sample of children aged 12-13). [b]Bolded coefficients represent the correlations between the respective items across time.

Table 2.9. Polychoric Correlation Coefficients of the Parental Monitoring Scale Items across Three Age Groups

Variable[a]	110	210	310	410	510	112	212	312	412	512	114	214	314	414
110														
210	.06													
310	.38	.10												
410	.29	.08	.33											
510	.48	.07	.36	.40										
112	**.25**[b]	.02	.25	.20	.23									
212	.01	**.37**	.06	.06	.03	.08								
312	.15	.05	**.29**	.19	.17	.46	.08							
412	.17	.07	.14	**.31**	.18	.26	.08	.28						
512	.22	.06	.18	.19	**.35**	.53	.11	.44	.33					
114	**.19**	.08	.21	.18	.22	**.28**	.14	.23	.11	.28				
214	-.04	**.23**	.10	.05	-.01	.08	**.34**	.14	.04	.10	.21			
314	.11	.14	**.21**	.14	.17	.20	.16	**.36**	.14	.26	.51	.25		
414	.14	.12	.13	**.22**	.10	.10	.09	.19	**.28**	.16	.27	.09	.25	
514	.12	.11	.18	.16	**.23**	.25	.13	.22	.15	**.36**	.62	.15	.56	.33

Note. $N = 1164$; $M = 0$; $SD = 1$.

[a]The first digit indicates the number of the item in the scale whereas the last two digits indicate the age range (e.g., 314 is the third item of the scale in the sample of children aged 14-15). [b]Bolded coefficients represent the correlations between the respective items across time.

2.6.2. Confirmatory Factor Analyses of the Three-factor Parenting Questionnaire Model

The completely standardized factor loadings, item uniqueness, and the range of residuals for each item from the analyses testing the three-factor measurement model are presented in Table 2.10. All items loaded significantly on the hypothesized factors, except the second item of the Parental Monitoring subscale for the 12-13 age group. The correlation between the Nurturance and the Rejection factors was negative across three age groups (r = -.65; -.59, and -.54 for 10-11; 12-13, and 14-15 age groups, respectively). The correlation between the Nurturance and the Monitoring factors was positive (r = .75; .67, and .73 for 10-11; 12-13, and 14-15 age groups, respectively). Finally, the correlation between the Rejection and the Monitoring factors was negative across three age groups (r = -.21; -.20, and -.17 for 10-11; 12-13, and 14-15 age groups, respectively). These correlations suggest that the Nurturance factor was highly correlated with the other two factors, but Rejection and Monitoring did not seem to be strongly related to each other. The range of the residuals indicated a large amount of error between the predicted values and the data.

The goodness-of-fit statistics suggest that the three-factor model with 19 items appeared to be an adequate fit to the data among adolescents aged 10-11 (RMSEA = .046; CFI = .906; and SRMR = .079), but not for the sample of adolescents aged 12-13 (RMSEA = .054; CFI = .909; and SRMR = .096) or for ages 14-15 (RMSEA = .061; CFI = .938; and SRMR = .108). Based on the residuals and fit statistics, we decided to perform single-factor CFAs for each parenting scale.

Table 2.10. The Factor Loadings, Item Uniqueness, and Range of Residuals for Each Item in the Three-Factor Model

	Aged 10-11			Aged 12-13			Aged 14-15		
Variable	FL	IU	RES	FL	IU	RES	FL	IU	RES
Parental Nurturance Items									
PN1	.77	.40	-4.44 to 4.68	.74	.46	-3.22 to 8.02	.77	.40	-5.99 to 5.54
PN2	.73	.47	-5.27 to 4.68	.81	.35	-5.75 to 6.61	.90	.18	-7.73 to 6.62
PN3	.83	.31	-5.79 to 4.26	.86	.27	-6.08 to 4.99	.91	.17	-7.67 to 5.07
PN4	.68	.53	-3.43 to 3.97	.72	.49	-4.34 to 4.94	.82	.34	-8.03 to 6.03
PN5	.80	.36	-3.66 to 4.47	.85	.28	-4.76 to 7.30	.89	.21	-6.79 to 5.37
PN6	.85	.27	-4.48 to 4.88	.91	.17	-5.87 to 9.99	.92	.16	-8.72 to 6.11
PN7	.89	.22	-5.79 to 6.68	.90	.19	-4.96 to 7.46	.93	.14	-8.03 to 5.45
Parental Rejection Items									
PR1	.49	.76	-6.57 to 3.66	.60	.64	-7.40 to 5.09	.49	.76	-5.70 to 3.76
PR2	.56	.69	-3.72 to 4.78	.56	.69	-3.13 to 4.76	.71	.49	-5.83 to 7.41
PR3	.32	.90	-4.40 to 6.68	.52	.73	-6.20 to 6.01	.65	.58	-6.66 to 6.03
PR4	.68	.54	-4.08 to 4.68	.69	.53	-6.01 to 5.86	.73	.46	-6.66 to 6.11
PR5	.53	.72	-5.80 to 6.50	.74	.46	-9.54 to 9.99	.73	.47	-6.84 to 6.62
PR6	.89	.21	-6.57 to 2.97	.75	.44	-7.89 to 1.53	.81	.34	-5.97 to 1.32
PR7	.75	.44	-4.08 to 3.47	.82	.33	-9.54 to 2.73	.84	.30	-6.84 to 4.60
Parental Monitoring Items									
PM1	.68	.54	-4.24 to 4.29	.68	.53	-6.08 to 5.14	.75	.44	-7.05 to 6.18
PM2	.01	1.0	-4.95 to 2.64	.04	1.0	-7.40 to 3.18	.18	.97	-8.72 to 4.19
PM3	.58	.66	-3.35 to 3.44	.58	.67	-4.05 to 4.51	.66	.57	-6.26 to 7.41
PM4	.48	.77	-2.59 to 3.70	.43	.81	-3.15 to 4.61	.47	.78	-4.13 to 3.48
PM5	.77	.41	-3.73 to 2.23	.84	.30	-4.41 to 3.55	.90	.19	-6.61 to 4.39

Note. FL = factor loading. IU = item uniqueness. RES = range of residuals.

2.6.3. Single-Factor CFAs on Each Parenting Behavior Scale

Parental Nurturance. The completely standardized factor loadings, item uniqueness, and the range of the residuals for each item across three age groups in the single-factor CFA models are presented in Table 2.11. The NLSCY Parental Nurturance model with 7 items appeared to be a good fit to the data among adolescents at age 10-11 (RMSEA = .038; CFI = .986; and SRMR = .035) and at age 12-13 (RMSEA = .039; CFI = .989; and SRMR = .036), but not for the sample of adolescents at age 14-15 (RMSEA = .078; CFI = .981; and SRMR = .067).

Although all items loaded significantly on the factor at each age group, an inspection of the items revealed that the fourth item (which had consistently lower correlations with other items) may have a conceptually different meaning than nurturing. This item (i.e., "[my parents] and I solve a problem together whenever we disagree about something") clearly taps into the construct of problem solving. An examination of the parental nurturance questionnaires that were recently reviewed by Locke and Prinz (2002), also confirmed this view, such that problem solving items were not included in most commonly used nurturance scales. In addition, five out of six standardized residuals were above 4.0 for the fourth item (range of residuals = -7.29 to 3.90), suggesting a high amount of error in prediction in the 14-15 age group. Based on the criteria mentioned above, we decided that the model could benefit from a minor modification (see Figure 2.2.). As a result, the fourth item (PN4) was removed from the scale, and a new set of single-factor CFAs were performed across three age groups.

Table 2.11. The Factor Loadings, Item Uniqueness, and Range of Residuals for Each Item in the Single-Factor Models

	Aged 10-11			Aged 12-13			Aged 14-15		
Variable	FL	IU	RES	FL	IU	RES	FL	IU	RES
Parental Nurturance Items									
PN1	.75	.44	-2.42 to 1.57	.76	.42	-2.71 to -.05	.77	.41	**-6.16 to 1.19**
PN2	.68	.55	-3.50 to1.57	.78	.40	-3.39 to -.05	.91	.18	**-7.91 to 1.19**
PN3	.78	.40	-3.63 to 2.44	.83	.31	-4.29 to 4.11	.89	.20	**-7.91 to 3.90**
PN4	.67	.55	-3.53 to 2.44	.70	.51	-3.50 to 4.11	.79	.37	**-7.29 to 3.90**
PN5	.78	.40	-2.90 to .15	.83	.32	-3.39 to -1.43	.89	.21	**-6.79 to -2.55**
PN6	.85	.27	-3.53 to .77	.89	.20	-4.29 to .54	.91	.17	**-7.22 to 1.68**
PN7	.87	.25	-3.63 to .77	.87	.24	-3.13 to .54	.91	.17	**-7.29 to 1.68**
Parental Rejection Items									
PR1	.44	.81	-4.11 to 3.38	.55	.70	-4.93 to 1.69	.45	.80	-5.03 to 1.32
PR2	.56	.69	-2.09 to .54	.58	.66	-2.87 to -.03	.66	.57	-4.54 to .09
PR3	.37	.87	-4.72 to 6.08	.50	.75	-5.99 to 5.18	.62	.61	-5.85 to 4.56
PR4	.63	.61	-3.99 to 1.44	.67	.55	-5.99 to -.03	.70	.51	-5.76 to .09
PR5	.55	.70	-5.07 to 6.08	.69	.53	-7.75 to 5.18	.69	.52	-5.51 to 4.56
PR6	.79	.38	-5.07 to 3.11	.68	.54	-6.06 to 4.40	.79	.37	-5.51 to .90
PR7	.72	.48	-4.65 to 3.11	.77	.40	-7.75 to 4.40	.81	.35	-5.85 to .90
Parental Monitoring Items									
PM1	.66	.56	-3.28 to .22	.71	.50	-2.07 to 1.24	.75	.44	-1.20 to 1.22
PM2	**.12**	**.99**	**-.78 to .87**	**.14**	**.98**	**-.91 to .78**	**.25**	**.94**	**-3.38 to 3.02**
PM3	.57	.68	-3.17 to 1.10	.63	.61	-2.26 to 1.24	.69	.52	-2.74 to 3.02
PM4	.54	.71	-3.28 to .68	.42	.82	-2.07 to 1.39	.39	.85	-1.20 to .75
PM5	.73	.47	-3.17 to .59	.75	.44	-2.26 to 1.39	.84	.30	-3.38 to .75

Note. FL = factor loading. IU = item uniqueness. RES = range of residuals.

Revised Parental Nurturance model. The revised Parental Nurturance model with 6 items appeared to be a good fit to the data across all three age groups (RMSEA = .037; .024; .039; CFI = .991; .997; .996; and SRMR = .029; .021; .020 for 10-11; 12-13, and 14-15 age groups, respectively). The measurement model with completely standardized factor loadings, item uniqueness, and the range of residuals for the revised Nurturance model at each age group is presented in Table 2.12. All items loaded significantly on the factor. As can be seen in Table 2.12., by removing the fourth item from the original scale, the standardized residuals were greatly reduced in comparison to the NLSCY model for each age group.

Parental Rejection. The NLSCY Parental Rejection model with 7 items did not show a good fit to the data across any of the three age groups (RMSEA = .069; .078; .070; CFI = .889; .895; .936; and SRMR = .064; .079; .067 for 10-11; 12-13, and 14-15 age groups, respectively). These findings suggest that the model was not confirmed for this sample of adolescents. An inspection of the factor loadings and item uniqueness failed to identify specific items which may have been influencing fit. These items, in general, had low loadings (although all items significantly loaded on the factor), high item uniqueness, and a wide range of residuals across three age groups (see Table 2.11.). Based on this, it was concluded that the Rejection model was a poor fit to data; therefore, no further analyses were conducted with this scale (see Figure 2.2.).

Table 2.12. The Factor Loadings, Item Uniqueness, and Range of Residuals for Each Item in the Revised Parental Nurturance Model

	Aged 10-11			Aged 12-13			Aged 14-15		
Variable	FL	IU	RES	FL	IU	RES	FL	IU	RES
Parental Nurturance (revised model)[a]									
PN1	.74	.45	-2.55 to 1.75	.75	.44	-2.37 to 1.15	.76	.42	-3.45 to 3.35
PN2	.68	.54	-3.52 to1.75	.76	.42	-2.67 to 1.15	.90	.20	-2.65 to 3.35
PN3	.76	.42	-2.80 to 1.12	.80	.36	-2.79 to .10	.80	.36	-1.80 to .47
PN5	.77	.41	-2.99 to 1.12	.82	.32	-2.67 to .10	.88	.22	-2.49 to .47
PN6	.86	.26	-2.99 to .65	.89	.20	-2.79 to 1.01	.91	.18	-3.45 to 3.66
PN7	.86	.26	-3.52 to .65	.87	.25	-2.35 to 1.01	.91	.18	-2.65 to 3.66

Note. FL = factor loading. IU = item uniqueness. RES = range of residuals.
[a]The revised model does not include the fourth item from the original scale.

Parental Monitoring. The NLSCY Parental Monitoring model with 5 items appeared to be a good fit to the data across all three age groups (RMSEA = .035; .001; .041; CFI = .982; .999; .988; and SRMR = .025; .012; .027 for 10-11; 12-13, and 14-15 age groups, respectively). All items loaded significantly on the factor.

However, a close inspection of the second item in the model revealed it had very low factor loadings and high item uniqueness across all three age groups (see Table 2.11.). An examination of the item wording (i.e., "[my parents] let me go out any evening I want") leaves considerable ambiguity in its interpretation. For example, it is possible that younger adolescents interpret 'let me go out' as a lack of parental care, whereas older adolescents may view it as being granted appropriate independence. This item ambiguity problem was further supported by Lempers et al. (1989), who showed that this item weakly loaded (< .30) on the Parental Nurturance scale, rather than on the Parental Monitoring scale. Based on the above-mentioned criteria, we believed that the model could benefit from a minor modification. Consequently, the second item was removed from the scale, and a new set of single-factor CFAs were run.

Revised Parental Monitoring model. The revised Parental Monitoring model, with 4 items, appeared to be a good fit to the data across all three age groups (RMSEA = .060; .033; .000; CFI = .978; .994; 1.00; and SRMR = .027; .018; .010 for 10-11; 12-13, and 14-15 age groups, respectively). All items significantly loaded on the factor. The measurement model with completely standardized factor loadings, item uniqueness and the range of residuals for the revised monitoring model at each age group are presented in Table 2.13. As can be seen in Table 2.13., without the ambiguous item, the problems with parameter estimates have been resolved.

Table 2.13. The Factor Loadings, Item Uniqueness, and Range of Residuals for Each Item in the Revised Parental Monitoring Model

	Aged 10-11			Aged 12-13			Aged 14-15		
Variable	FL	IU	RES	FL	IU	RES	FL	IU	RES
Parental Monitoring (revised model)[a]									
PM1	.66	.56	-3.20 to .29	.71	.44	-2.13 to 1.30	.75	.44	-.92 to 1.15
PM3	.56	.68	-3.18 to 1.35	.62	.36	-2.14 to 1.30	.67	.55	-1.02 to 1.15
PM4	.53	.72	-3.20 to .93	.42	.32	-2.13 to 1.39	.38	.85	-.92 to 1.12
PM5	.73	.47	-3.18 to .93	.75	.20	-2.14 to 1.39	.84	.30	-1.02 to 1.12

Note. FL = factor loading. IU = item uniqueness. RES = range of residuals.
[a]The revised model does not include the second item from the original scale.

2.6.4. Longitudinal Measurement Invariance across Three-Waves

The Parental Nurturance and Monitoring measures (but not Rejection) were examined for MI, using the revised scales. The structural models and parameter estimates used to test for MI among these scales are depicted in Figures 2.3. and 2.4. The goodness-of-fit statistics from the analyses testing the longitudinal MI of single-factor parental behavior scales across three waves of data are presented in Table 2.14. For both Nurturance and Monitoring scales, there was evidence for equal factor structure (i.e., configural invariance) across three waves based on the goodness-of-fit statistics. However, the values of the CFI indicated a change in fit ($CFI_{constrained\ model} - CFI_{unconstrained\ model} = \Delta CFI$) by more than -.01 when the factor loadings were constrained to be equal across time (see Table 2.14.). This means that Parental Nurturance and Monitoring scales did not demonstrate factor loading invariance across three waves. These findings were further supported by examining the factor loadings of the Parental Nurturance and Monitoring scales across three age groups from the results of configural invariance analysis. As can be seen in Figure 2.3., for the Parental Nurturance scale, although the first item had similar loadings across three age groups, the remaining items had different loadings, with the second item having the largest difference in factor loadings across three age groups. Similarly, for the Parental Monitoring scale, most of the items had different factor loadings across three age groups, with the lowest loadings for the 10-11 age group, and highest loadings for the 14-15 age group, except for the third item that had its lowest loading for the 14-15 age group and highest loading for the 10-11 age group (see Figure 2.4.). Finally, a moderate relationship was found across time for both Nurturance and Monitoring scales.

Table 2.14. Goodness of Fit Statistics from the Analyses Testing the Longitudinal Measurement Invariance across Three Age Groups

	Nurturance Scale		Monitoring Scale	
	Configural Invariance	Loading Invariance	Configural Invariance	Loading Invariance
RMSEA	.021	.065	.018	.054
CFI	.995	.950	.992	.917
ΔCFI	-.045		-.075	

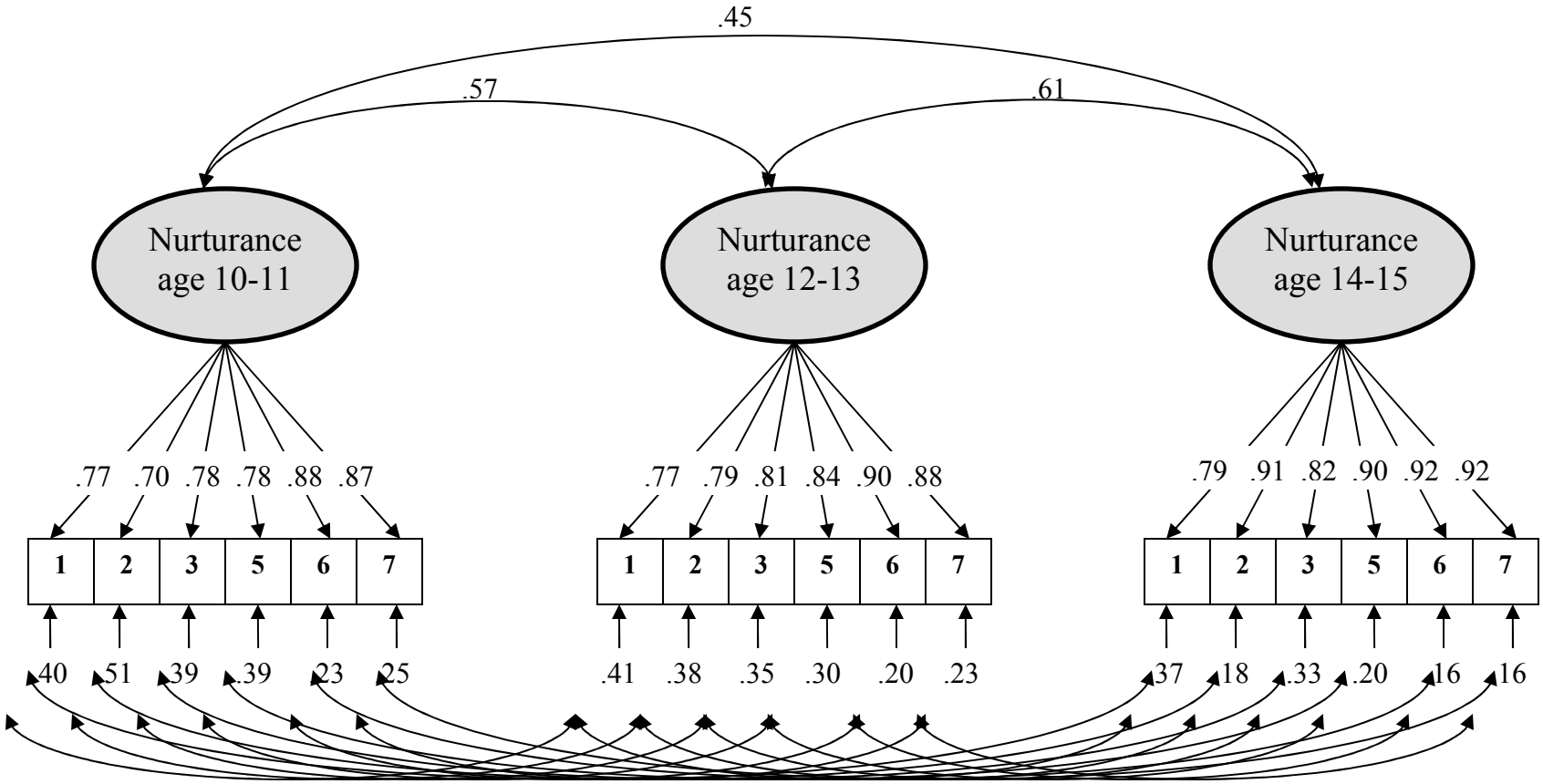

Figure 2.3. The results of configural invariance analysis for the revised parental nurturance scale across three-waves.

Note. The revised model does not include the fourth item from the original scale. The correlation values between errors across waves have been omitted from this figure.

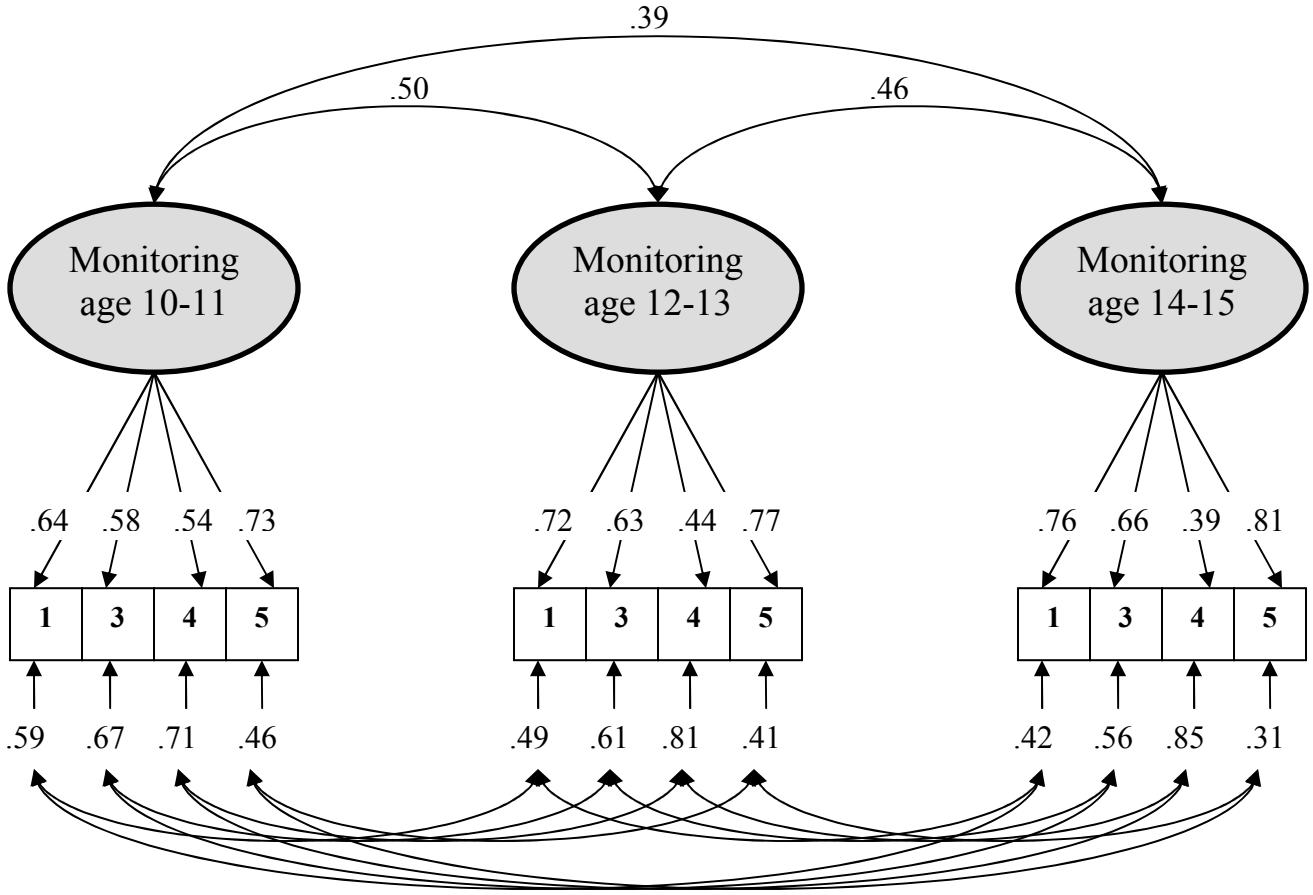

Figure 2.4. The results of configural invariance analysis for the revised parental monitoring scale across three-waves.

Note. The revised model does not include the second item from the original scale. The correlation values between errors across waves have been omitted from this figure.

2.6.5. Longitudinal Measurement Invariance across Two-Waves

In this set of analyses, invariance between 10-11 and 12-13 year olds was tested first. Next, invariance between 12-13 and 14-15 year olds was examined, and finally invariance between 10-11 and 14-15 year olds was tested. The goodness-of-fit statistics from the analyses testing the MI of single-factor parental behavior scales across two-waves are presented in Table 2.15. For both Nurturance and Monitoring scales, there was evidence for equal factor structure (i.e., configural invariance) across all two-wave analyses. However, the values of ΔCFI indicated a change in fit of more than -.01 when the factor loadings were constrained to be equal across time. These findings suggest that Parental Nurturance and Monitoring scales did not demonstrate loading invariance across any of the waves. Based on all the conducted MI analyses, we concluded that Parental Nurturance and Monitoring scales did not demonstrate MI across time. Results for the Parental Nurturance scale and the Parental Monitoring scale seem to indicate that both item 2 and item 3 exhibit very different factor loading values across three age groups, which may be the reason for the lack of loading invariance.

Table 2.15. Goodness of Fit Statistics from the Analyses Testing the Longitudinal Measurement Invariance across Two Age Groups

	Nurturance Scale						Monitoring Scale					
	Age 10 vs. 12		Age 12 vs. 14		Age 10 vs. 14		Age 10 vs. 12		Age 12 vs. 14		Age 10 vs. 14	
	CI	LI	CI	LI	CI	LI	CI	LI	CI	LI	CI	LI
RMSEA	.024	.075	.022	.077	.024	.087	.023	.057	.012	.045	.026	.078
CFI	.993	.924	.996	.951	.995	.926	.987	.921	.998	.967	.991	.891
ΔCFI	-.069		-.045		-.069		-.066		-.031		-0.10	

Note. CI = configural invariance. LI = loading invariance.

2.7. Discussion

Measurement of parenting behaviors has long been recognized as a major challenge in social science research. Given the abundance of parenting behavior scales that "vary greatly with respect to construct definition, item content, and emphasis" (Locke & Prinz, 2002, p. 921), the need for psychometrically sound measures is still a central issue in parenting literature. In an attempt to address this issue, the current study aimed to provide evidence for construct and score validity in the child-report parenting questionnaire used in the NLSCY. In order to show construct validity, a strict CFA framework was used to confirm the fit of the three-factor parenting behavior model previously revealed by Statistics Canada. In order to show score validity, a MI approach to CFA was used to test the equivalence of the parenting behavior model across three adolescent age groups.

2.7.1. Evaluation of the Factor Structures of the Parenting Scales

The original three-factor model was tested first. The findings indicated three, low to moderately interrelated, but conceptually distinct constructs. We found an adequate fit for 10-11 years old, but a poor fit was obtained for 12-13 and 14-15 years old. Therefore, we decided to conduct single-factor CFAs for each parenting scale separately for each age group.

The only NLSCY model which indicated a good fit (based on global goodness-of-fit statistics criteria) across all three age groups was the Parental Monitoring scale. However, one weak item – both conceptually and empirically – was removed in order to improve the measurement properties of the scale. Based on our findings, we recommend the use of the revised model, which omitted the ambiguous item. Future research is

needed to evaluate the predictive utility of this scale by examining its association with adolescent outcomes.

An important theoretical remark should be made here with respect to the use of the term parental monitoring. Monitoring has often been conceptualized as a "prevention or intervention" technique used by parents (Laird, Pettit, Dodge, & Bates, 2003 p. 420). Montemayor (2001) defined monitoring as an "activity that allows parents to be knowledgeable about their adolescent's whereabouts, activities, and companions" (p. 481). Recent work has questioned this operationalization and has broadened our conceptualization of monitoring to acknowledge both parents' and adolescents' roles in this activity (Crouter & Head, 2002). Specifically, research has shown that most measures of monitoring assess parental knowledge, which mainly originates from the child's willingness to disclose rather than parents' efforts at monitoring (Kerr & Stattin, 2000; Stattin & Kerr, 2000). Given this evidence, we recommend using the term "monitoring efforts" in future research as a new label for the Parental Monitoring scale to reflect the conceptual advancements in the literature.

The Parental Nurturance scale was initially confirmed only for the 10-11 and 12-13 age groups, but not for the 14-15 age group. We believed that the use of the problem solving item (i.e., item 4) could not be conceptually justified. After removing this item from the scale, the model was confirmed for all age groups. Future research is needed to examine the extent to which this revised model is related to adolescent outcomes.

Regarding Parental Rejection, we failed to confirm the factor structure of this construct. A close inspection of the Rejection scale revealed that the items encompass several related constructs, such as (but not limited to) rejection, inconsistency, and

harshness. In fact, the original name given to this scale was the "inconsistent rejection-oriented discipline" scale (Lempers et al., 1989, p. 29). Sabatelli and Waldron (1995) stated that although an EFA may provide support for the interrelationships among the specific items of a scale, those items may not represent a theoretically coherent set of indicators for a particular construct. Our results provided empirical support for this statement. Consequently, we do not recommend the use of this scale to assess parental rejection, but future research is warranted in order to establish the usefulness of these items in assessing other related parenting constructs. Thus, an important line of future research is to clarify the defining features of the rejection construct based on existing theoretical work, and review other related constructs (e.g., harsh parenting) to elucidate the conceptual relationships between the existing constructs and the items in the scale.

Overall, although the findings of this study raised various concerns related to three NLSCY parenting scales (i.e., construct conceptualization and problems with item content), the two revised models that we proposed appear to be potentially useful in assessing nurturance and monitoring in adolescents aged 10 to 15. In our attempt to ensure legitimate comparison of scores on these scales across age, we assessed the extent to which these two scales achieved MI across three waves (i.e., 10-11; 12-13; and 14-15 age groups), encompassing the transition from childhood to adolescence.

2.7.2. Test of the Longitudinal Measurement Invariance of the Parenting Scales

Neither the Nurturance nor the Monitoring scales passed the equality of factor loadings constraint, even across two-wave analyses. For the Nurturance scale, the highest factor loadings and lowest error variances were observed for the 14-15 age group and the opposite was found for the 10-11 age group. Thus, indicating a better fit of the model for

the older age group. A somewhat similar pattern was observed for the Monitoring scale, except that the lowest error variances were observed in the 12-13 age group. These results suggest that new items may be needed to attain a better operationalization of the Nurturance and Monitoring construct in younger adolescents.

The presence of configural invariance indicated that the Nurturance and Monitoring constructs were perceived as unidimensional across all adolescents in different age groups; however, because our findings failed to demonstrate complete MI, it is not possible to infer equal meaning of these constructs across three age groups. Stated differently, while the configuration of the constructs was the same across the various ages (i.e., one single parenting behavior), the weight or the manifestation of the items in the scales was different over time. An important implication of these findings is that although the scales were found to be useful in assessing nurturance and monitoring constructs across three age groups, caution should be taken when making score comparisons between these three age groups. The lack of MI of these scales indicates that any inferences regarding differences across age may not reflect true differences, but only a dissimilarity in measurement.

As an illustrative example, we reviewed the findings from a longitudinal NLSCY study that examined the effects of parental nurturance and rejection on drug use, using a sample of adolescents aged 10 to 17 (Pires & Jenkins, 2006). Pires and Jenkins found that Parental Rejection predicted initial drug use, but its effect decreased over time. In addition, Parental Nurturance was positively associated with drug use for younger adolescents; however, an inverse relationship was observed for older adolescents. They concluded that "the effects of parental rejection and warmth change as adolescent

mature" (p. 179). Unfortunately, such an interpretation of their results may be erroneous, in that these results may simply be a reflection of differences in the measurement of nurturance and rejection as a result of a change in the meaning of these behaviors for adolescents.

Despite the paucity of research examining MI of parenting behaviors between children of different age groups, there is a pattern emerging from research examining MI of behaviors between mothers and fathers. In a recent study conducted with a sample of mothers and fathers of toddlers, the MI of five parent-report parenting constructs, including support, structure, positive discipline, psychological control, and physical punishment was determined (Verhoeven, Junger, van Aken, Dekovic, & van Aken, 2007). However, Adamsons and Buehler (2007) found that although mothers and fathers of 6th grade students had a similar frame of reference for the construct of acceptance, they did not interpret it with the same meaning. It seems that as children mature, the perceived meaning of parenting behaviors change across time based on parent-reports. The lack of loading invariance in the Nurturance scale across age groups in our study builds on this reasonable assumption by supporting the viewpoint that the meaning of nurturance as perceived by children changes as they move into adolescence. In accordance with this view, Locke and Prinz (2002) also suggested that some parenting behaviors may remain consistent, but some may change form across different developmental periods, reflecting developmental shifts in parenting. In other words, the same scale items tapping a particular parenting construct may be perceived as different behaviors at different child ages. An intriguing line of research would be studying these changes by using the same items across the life-span.

In summary, our results suggest that the revised Nurturance and Monitoring scales are good models for this data, but the underlying behaviors of Nurturance and Monitoring did not manifest themselves similarly across 10-11 year-olds, 12-13 year-olds, and 14-15 year-olds. Therefore, researchers should be cautious about generalizing the effects of these behaviors across this age range; alternative interpretations may be required depending on which age group is being examined.

2.7.3. Limitations and Future Directions

Certain methodological limitations of this study should be mentioned. First, although our sample was relatively large, it may be somewhat unrepresentative because of the participants that were excluded from the study due to attrition or non-completion of the parenting questionnaire. Our missing data analyses indicated that the final sample had a higher SES compared to the initial sample in this study. Given this, we should note that our findings may not apply to a sample with a low SES background. An important remark should also be made with respect to omission of missing data imputation. Despite the availability of different imputation techniques (see Allison, 2003; Graham, Cumsille, & Elek-Fisk, 2003), we did not impute the missing data in our analyses because of the construct-confirming nature of our study. Moreover, all the existing techniques assume multivariate normality, which was not a characteristic of our data. In the future, a replication study would be useful in order to compare our findings with those obtained from a larger and more representative sample. It should be noted that although the NLSCY is a large representative sample of Canadian children and youth, this characteristic of the sample was lost because of the use of the deletewise method to handle missing data.

A second limitation is the use of the WLS method of estimation for our factor analyses. The WLS method of estimation shows a small bias in estimating model parameters, but the bias is greatly reduced when the sample size is increased (DiStefano, 2002). However, the prevailing recommendation is to use a robust WLS approach (e.g., WLSM and WLSMV; see Finne & DiStefano, 2006), but this method was not available in the LISREL program. Given our large sample size, we remain reasonably confident about using the WLS method in our analyses.

A third potential limitation is related to our use of the same sample to confirm the NLSCY models as for our revised models. It is recommended that a different sample be used for factor exploration and confirmation because multiple tests on a single dataset may risk the validity of the interpretations of the findings (Kühnel, 2001). Thus, from a strict CFA point of view, removing one item from a CFA model may require a new and independent dataset in order to confirm the revised model. However, we believe that our revisions to the original models were minor, and not exploratory in nature, but conceptually-driven based on careful inspection of items.

Another methodological limitation could be the lack of partial MI analysis in this study (i.e., testing the equivalence of some, but not all the measurement parameters). Although this approach has been identified as practical by some researchers (e.g., Byrne, Shavelson, & Muthén, 1989), questions have been raised about the utility of this strategy, and it is not recommended in the presence of many non-invariant items (Vandenberg, 2002; Vandenberg & Lance, 2000). Following this recommendation, we did not pursue an analysis of partial MI.

Other limitations of this study can be traced to the content of the NLSCY dataset. For example, we were limited to the use of CFA to provide validation evidence. There are different approaches to examine construct validation (see Bagozzi, 1993); however, most of these approaches require the use of MTMM data, which was not available in the NLSCY dataset. It should be noted that the use of CFA has been shown to be a useful approach in providing evidence for construct validation (see DiStefano & Hess, 2005 for a review and recommendations).

Reliance on child-report data representing only adolescents' subjective perceptions of their parents' behavior is another limitation. The study of parenting behaviors is challenging in the sense that most of the naturally occurring parenting behaviors are not readily accessible to researchers due to ethical and practical reasons. Therefore, despite the problems that have long been identified with the use of self-report data (see Holden & Edwards, 1989 for a review), most researchers choose to use self-report or child-report questionnaires in their data collection as the next best option. A good strategy to overcome the shortcomings of using self-report data is the collection of data from multiple sources. For example, although one can argue that parenting behaviors are meaningful in the way they are perceived by the adolescents, using parent-report in addition to child-report may also provide information about parenting behaviors and enhance our interpretation of the findings.

A further limitation pertains to the question stem for the NLSCY parenting measures. More specifically, the use of the word 'my parents' instead of 'my mother' or 'my father' initiates a faulty generalization of parenting behaviors across mothers and fathers. Although most studies still focus on mothers as the template for parenting, extent

research has shown that there are differences in mothers' and fathers' parenting, which differentially impact child outcomes (see Parke, 2002 for a review). Therefore, making an assessment of mothers' and fathers' behaviors separately would provide an important advancement in this field of research.

Despite these limitations, the current study provided a unique contribution to the measurement of parenting by evaluating and refining the scales of a child-report parenting questionnaire used in a national longitudinal dataset. The analysis of MI also provided insight to our understanding of adolescents' interpretations of parenting behaviors across time. Based on our findings, we recommend the use of the revised Nurturance and Monitoring scales with adolescents aged 10 to 15 years old. We also would like to alert researchers and users of the NLSCY to the need for caution in interpreting findings which compare the scores of these scales across adolescent age groups.

This study focused on child-reported parenting behaviors. An important goal for future research will be to repeat these analyses with parent-report parenting behavior scales to provide evidence for validation and measurement equivalence of these scales. Another important future direction will be to examine measurement equivalence of these scales across cultural groups. There is evidence that adolescents from different ethnic groups interpret parenting behaviors differently due to cultural norms (Crockett, Brown, Russell, & Shen, 2007). Given that Canada and other countries such as the United States represent a multicultural society, it would be important to ensure that these parenting behaviors are perceived as the same across adolescents from different ethnic backgrounds.

The research field in parenting is vital and rich, it is clear that we need to establish closer ties between theory and measurement to examine the issues central to parenting by considering applications to real relationships and interactions. Unfortunately, few parenting measures specify the ages for which the measures are developed and theoretically ambiguous items are still present in many parenting scales. Furthermore, vague response options (e.g., rarely) that can be interpreted differently by different respondents are still being used in scale construction. Likert (1932), the father of ordered categorical response scales, over seven decades ago, suggested that every kind of ambiguity or vagueness should be avoided when developing questionnaires. Future research should continue to conduct a more comprehensive investigation of parenting behavior scales and focus on enhancing our understanding of how these behaviors influence child and adolescent outcomes.

2.8. References

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3. STUDY 2 - An Analysis of Measurement Invariance of the Child-Report Externalizing Problem Behavior Scales across Gender and Age[7]

3.1. Introduction

The study of problem behaviors during adolescence has long been a popular research area. Researchers have aimed to define problem behavior and examine risk and protective factors for the occurrence as well as amelioration of problem behaviors. The basis of the wealth of literature in this area can be traced back to Hall's (1904) assertion about adolescence as a 'storm and stress' period due to the increase in mood disruptions, conflict with parents, and problem behaviors. Although researchers have shown that most adolescents go through this period without developing any lasting social-emotional and behavioral problems (see Arnett, 1999; Steinberg & Morris, 2001), the study of problem behaviors during adolescence has dominated the research literature to the extent that the occurrence of problem behavior has been accepted as part of adolescent normal development (Steinberg & Morris, 2001). However, relatively few studies focused solely on the measurement of problem behaviors. The main objective of this study was to contribute to this gap by evaluating an important aspect of measurement of problem behavior scales, namely, measurement equivalence or invariance of problem behavior scales across gender and age groups in adolescence.

3.1.1. Different Approaches to Conceptualizing Adolescent Problem Behaviors

One of the overarching conceptual frameworks to explain adolescent problem behavior in adolescence has been the Problem-Behavior Theory (Jessor & Jessor, 1977),

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which is rooted in developmental, social and personality psychology. Jessor and Jessor defined problem behavior as "behavior that is socially defined as a problem, a source of concern, or as undesirable by the norms of conventional society…and its occurrence usually elicits some kind of social control response" (p. 33). According to Problem-Behavior Theory, the likelihood of occurrence of problem behavior depends on the dynamic interrelationships between two systems: personality system (e.g., self-esteem), perceived environment system (e.g., parental control). These two systems along with the behavior system (e.g., drinking) are also influenced by two background variables: demographics (e.g., parent education) and socialization (e.g., peer influence). Thus, the theory is based on the various interrelationships that can be observed within and between each of the three systems and two background variables (Jessor & Jessor). An important remark is that Problem-Behavior Theory defines problem behavior as a single construct, including six domains: activist behavior, drug use, sexual intercourse, drinking, problem drinking, and general deviant behavior, which are influenced by multiple factors (Jessor & Jessor).

Contrary to the notion of one syndrome of problem behavior offered by Jessor and Jessor (1977), Achenbach (1966, 1974) classified problem behaviors under two broad syndromes: *internalizing and externalizing* problem behaviors. Internalizing symptoms (also known as overcontrolled and personality disorder) involved problems within self, including phobias, worrying, obsessions, fearfulness, withdrawal, stomach pains, and vomiting; whereas externalizing symptoms (also known as undercontrolled and conduct disorder) involved conflict with the outside world, including disobedience, stealing, lying, fighting, and destructiveness (Achenbach & Edelbrock, 1978). Although

many researchers have advocated that two distinct syndromes of problem behaviors exist, it should be noted that there is also evidence for the existence of comorbidity between internalizing and externalizing problem behavior (see Angold & Costello, 1993; Loeber & Keenan, 1994; Zoccolillo, 1992 for reviews).

Recently, a more differentiated approach has become popular. That is, researchers have aimed to distinguish different types of internalizing and externalizing problem behaviors. For example, anxiety disorders were distinguished from depressive disorders (see Essau, 2006). Similarly, several different dimensions of conduct disorder have been identified. For example, delinquent behaviors were distinguished from substance abuse (Loeber, 1998) and aggressive behaviors were distinguished from property violations (Frick et al., 1993). Additionally, researchers focused on different forms of aggression such as physical, verbal, and indirect aggression (Björkvist, 1994). Different terms have been used to describe indirect aggression, such as social aggression (Galen & Underwood, 1997) and relational aggression (Crick & Grotpeter, 1995).

The present study also used a differentiated approach and focused on three externalizing types of problem behaviors, namely, indirect aggression, direct aggression, and property offence. Previous research has provided support for the use of separate scales in assessing distinct types of problem behaviors in adolescence (Farrell, Kung, White, & Valois, 2000).

Both indirect and direct aggression can be defined as a type of behavior where an individual intends to harm another individual (Björkqvist, Lagerspetz, & Kaukiainen, 1992). The difference lies within the strategies that are used to harm the other person. Direct aggression can involve both physical (e.g., kicking) and verbal (e.g., threatening)

means of attacking (Björkqvist et al.). However, in indirect aggression, an individual intends to harm another individual in "circuitous ways" (Österman et al., 1998, p. 1) as if "there has been no intention to hurt at all" (Björkqvist et al., p. 118). Researchers suggested that a common way of using indirect aggression during adolescence is through manipulating friendship patterns (Lagerspetz, Björkqvist, & Peltonen, 1988). In this study, indirect aggression was assessed in this manner. Finally, for this study, property offence was conceptualized as delinquent acts such as theft and vandalism (Achenbach & Edelbrock, 1981; Boyle et al., 1993).

3.1.2. Gender and Age Differences: Two Major Focus Areas in the Study of Adolescent Problem Behaviors

Considerable research has focused on gender and age differences in problem behaviors during adolescence. Given differences in the normative development of boys and girls across childhood through adolescence, researchers have a long-standing interest in examining how the development of problem behaviors vary as a function of gender and age (see Dodge, Coie, & Lynam, 2006; Foster & Hagan, 2003; Zahn Waxler, Crick, Shirtcliff, & Woods, 2006 for reviews).

Gender Differences. Research evidence suggests that gender differences in direct aggression emerge as early as toddler years. For example, using teachers' ratings, boys between the ages of 3 and 5 years were found to be more aggressive than girls of the same age (Crick, Casas, & Mosher, 1997). This difference appears to remain stable throughout childhood and adolescence. For example, Moffitt, Caspi, Rutter, and Silva (2001), using data from New Zealand's Dunedin Longitudinal Study, showed that boys scored higher on externalizing problem behaviors from age 5 to 21 years, and this was

based on parent-, teacher-, and self-reports, which shows consistency across multiple informants. Similarly, using both parent- and adolescent-reports of aggression as well as their combined reports, Lahey et al. (2000) found that boys between the ages of 9 to 17 years were more likely to engage in aggressive behaviors than girls.

Several population-based studies also indicated that adolescent boys between 11 and 17 years of age reported more externalizing type of problem behaviors (e.g., conduct disorder, delinquency) than girls (Aneshensel & Sucoff, 1996; Pederson & Wichstrom, 1995). Moreover, using the aggression subscale of the Child Behavior Checklist (CBCL) in a sample of over 2,000 Dutch children, Stanger, Achenbach, and Verhulst (1997) found that boys were more aggressive than girls at every age from 4 to 18 years. In Canada, using parent-reports in the National Longitudinal Survey of Children and Youth (NLSCY) data, Tremblay et al. (1996) found that boys across the 4- to 11-years of age range reported higher means of aggression than girls.

More recently, Broidy et al. (2003) examined the developmental trajectories of direct aggression in six well-known large longitudinal samples from the United States, New Zealand, and Canada and found that girls in all groups reported lower mean levels of aggression than boys. Overall, these findings suggest that there are gender differences in direct aggression across childhood and adolescence. However, Broidy et al. noted that substantial differences may exist in the etiology of aggression across boys and girls because the association between trajectories of childhood aggression and later delinquent outcomes was stronger for boys than for girls.

There is also an agreement that indirect aggression rather than direct aggression is more commonly observed among girls. However, researchers disagree about when girls

start using indirect aggression more than boys. For example, the results from a 3-year prospective study indicated that there were no gender differences in indirect aggression among 9 year-olds; however, by age 12, girls tended to report more indirect aggression than boys (Zimmer-Gembeck, Geiger, & Crick, 2005). Although this finding was in line with Bjorkqvist et al. (1992) study's results indicating that gender differences in indirect aggression emerged around age 10, other researchers suggested that indirect aggression may be more common among girls as early as preschool years (Crick & Grotpeter, 1995). For example, Crick et al. (1997) found that preschool girls were found to use more indirect aggression according to teacher ratings but not according to peer nominations. Interestingly, Tomada and Schneider (1997), who also used peer nominations, found that 8 to 10 year-old boys were using more indirect aggression than their same age female peers. A more recent study indicated that adolescent girls in three different age groups (10, 12, and 14 years) were rated by peers as using more indirect aggression than boys (Salmivalli & Kaukiainen, 2004). Another recent longitudinal study using the NLSCY data found that girls were using more indirect aggression than boys between 4 and 10 years of age (Vaillancourt, Miller, Fagbemi, Côté, & Tremblay, 2007). Other researchers failed to find gender differences for indirect aggression in both preschool (Kupersmidt, Bryant, & Willoughby, 2000) and school-aged children (Hart, Nelson, Robinson, Olsen, & McNeilly-Choque, 1998; Rys & Bear, 1997).

Relatively less research has been conducted to examine gender differences in property offence. However, findings have been consistent, such that adolescent boys exhibited more property offences than adolescent girls according to both self-reports (Harford, & Muthén, 2000; Windle, 1990) and parent-reports (Lahey et al., 2000). When

different forms of offences were considered, research findings indicated that boys were more likely to engage in property offences, such as car theft; whereas girls were more likely to engage in status offences, such as running away from home (Rhodes & Fischer, 1993). More recently, based on the NLSCY Cycle 3 (1998-99) data, a research report prepared for the Department of Justice Canada indicated that both frequency and severity of delinquent problems, including destroying property and stealing were higher among adolescent boys between the ages of 12 and 15 years compared to same age girls (Latimer, Kleinknecht, Hung, & Gabor, 2003).

These findings suggest that boys, in general, are more likely to exhibit direct aggression and property offence problems from childhood through adolescence. In addition, although findings have been somewhat less consistent, girls are more likely to use indirect aggression compared to boys. Accordingly, the results from a recent meta-analytic review of 148 studies that examined the magnitude of gender differences in direct and indirect aggression during childhood and adolescence confirmed previous findings of direct aggression (suggesting that boys exhibit more direct aggression than girls) and trivial gender differences in indirect aggression (Card, Stucky, Sawalani, & Little, 2008).

Despite the abundance of research findings in the area of gender differences in problem behaviors, research pioneers in developmental psychopathology, Rutter and Sroufe (2000) argued that the meaning of these gender differences has not been well-conceptualized in research. In line with this critique to the literature, other researchers highlighted the need to discover whether there is a difference in the measurement of these problem behaviors across boys and girls (Zahn-Waxler et al., 2006).

Age Differences. Another developmental difference that has received much attention in the study of problem behaviors has been age differences. Researchers indicated that although the capacity of showing an expression of anger is present by 1 month of age (Stenberg & Campos, 1990), frequency and intensity of anger and physical aggression increase across the second year of life (Tremblay et al., 1999). During preschool years, children learn to inhibit physical aggression (Tremblay et al.); thus while physical aggression decreases, verbal aggression increases as children experience a growth in their vocabulary (Dodge et al., 2006). Indirect aggression can also be observed as early as 3 years old (Crick et al., 1997). In other words, with the gradual decline in the rate of physical aggression, from preschool through elementary years, other forms of aggression, such as indirect or relational aggression (Crick & Bigbee, 1998), lying, cheating, and stealing behaviors emerge (Loeber, Farrington, Stouthamer-Loeber, & van Kammen, 1998).

Direct aggression (physical or verbal) can become stable (Loeber & Hay, 1997) or show a peak around age 12 through 13 (Lahey et al., 2000); whereas indirect aggression has been found to show a peak around age 11 through 12 (Björkqvist et al., 1992). Relatively less research has been conducted on the stability or change in property offence, but findings from a recent household survey of 1,285 adolescents between the ages of 9 and 17 years suggested that property offence was more prevalent at older ages (Lahey et al., 2000). This is in line with the assertion that as children enter adolescence, aggressive behavior may be expressed in the form of serious acts of violence (Dodge et al., 2006).

Longitudinal studies have suggested differences in the trajectories of aggression. For example, Loeber and Hay (1997) previously identified three different trajectories for

direct aggression in boys that: (a) start in early childhood and stabilize or show an increase, (b) start in childhood and show a decrease, or (c) appear for the first time in adolescence. In contrast, in a more recent study conducted with a large sample of boys from Montreal, little evidence for late-onset of physical aggression was observed. Specifically, based on group-based trajectories, boys who had high-level of childhood aggression were more likely to continue with a higher-level trajectory than boys with a low-level trajectory of physical aggression (Brame, Nagin, & Tremblay, 2001). Yet other researchers distinguished between adolescent-limited antisocial behavior, which represents a large group of individuals who engage in delinquent behaviors only during adolescence and life-course persistent antisocial behavior, which represents a small group of individuals who engage in delinquent behaviors at every stage in their lives (Moffitt, 1993; Moffitt, Caspi, Harrington, & Milne, 2002). More recently, findings from a longitudinal multiple birth cohort study of 2,076 children between the ages of 4 and 18 years indicated that both average and group-based trajectories of aggression and property offence showed a decrease over time (Bongers, Koot, van der Ende, & Verhulst, 2004).

Several studies using nationally representative samples also indicated a decline in the rate of aggression across time. For example, in Canada, using a cross-sectional sample of 4- to 11-year-olds from the NLSCY, Tremblay et al. (1996) found that parent-reported physical aggression ratings showed a decrease, in particular from early to middle childhood. McDermott (1996) also found age-related declines for teacher-report aggression only in 5- to 17- year old boys. In contrast, in the Ontario Child Health Study (OCHS), both adolescent girls and boys between the ages of 12 and 16 reported higher rates of conduct disorder than 4- to 11-year-old children (Offord et al., 1987). However,

this study used different informants at different ages (i.e., parent- and teacher-reports at younger ages and parent- and adolescent-report at older ages). Therefore, the difference between younger and older children may be due the difference between informants. It should be noted that several population studies that used a variety of informants did not find any significant age differences in the prevalence of externalizing type of problem behaviors (Costello et al., 1996; Lewinsohn, Hops, Robert, Seeley, & Andrews, 1993; Offord et al., 1996).

In a longitudinal-experimental study (i.e., with a nested intervention) conducted with boys from kindergarten up to 17 years of age in Montreal, researchers examined the group-based trajectories of physical aggression, vandalism, and theft (Lacourse et al., 2002). They identified six different types of trajectories for each of these problem behaviors from 11 to 17 years of age. These results provided support for earlier studies that indicated a similar heterogeneity in antisocial behavior trajectories (e.g., Brame et al., 2001; Broidy et al., 2003). A majority of the boys were found to have a low-level trajectory or showed a decline in all three problem behavior trajectories; whereas less than 6% of the boys followed chronic antisocial behavior trajectory. When disruptive and nondisruptive kindergarten boys were compared, the findings indicated that boys who were disruptive in preschool were at high risk for high-level trajectories of frequent antisocial behavior in adolescence. However, it was found that parent training and social skills training programs between 7 and 9 years of age could change disruptive kindergarten boys' developmental trajectories of physical aggression, vandalism, and theft (Lacourse et al.). Another recent study, using parent-report data from the NLSCY, examined group-based trajectories of indirect aggression in children between the ages of

4 and 10 (Vaillancourt et al., 2007). The authors identified two different group-based trajectories: increasing users (35%) and stable low users (65%) of indirect aggression. In addition, higher stability in the trajectories of indirect aggression was observed for girls than boys. The authors concluded that there is a need for more longitudinal studies before any firm conclusions can be made regarding the trajectories of indirect aggression.

3.1.3. Measurement Issues in the Study of Adolescent Problem Behaviors

The study of problem behaviors during adolescence has been motivated by examining gender and age differences, using multiple informants, and using both cross-sectional and longitudinal samples, and finding inconsistent or biased results. Some of the inconsistencies and biases across studies may be due to differences in methods (i.e., parent- versus teacher-reports, versus self-reports) or the use of statistical procedures that are based on the assumption of normal distribution of data (Lahey et al., 2000). However, it is also possible that the quality of measurement properties of the problem behavior scales is unsatisfactory for drawing solid conclusions regarding gender and age differences. Specifically, assessment of construct validity and construct comparability (Cronbach & Meehl, 1955; Messick, 1975, 2000) may not have been adequately addressed.

The assessment of dimensionality of problem behaviors across groups can be an essential step in providing support for construct validity. For example, the factor structure of a particular aggression construct may differ across gender, such that the latent variable can be explained as a single-factor in boys but a two-factor model may show a better fit for girls. Similarly, different items can have more weight in defining a latent problem behavior variable at different age groups. In other words, some items may be functioning

differently at different groups. As a result, even though we may observe equivalent scores for boys and girls, for example, on a particular scale, these scores may not have the same meaning in terms of the amount or level of construct of interest. Based on these reflections, it can be concluded that a major methodological limitation in current studies can be the lack of evaluation of measurement equivalence or the invariance of measurement across groups to ensure that measurement properties of these scales are equivalent across groups.

The validity of score comparisons (i.e., construct comparability), which requires that the same problem behavior construct is measured on the same metric across groups, needs to be ascertained prior to conducting comparison analyses. This evaluation is essential given that problem behavior scales are usually administered to a heterogeneous sample (e.g., different gender and age groups). Thus, this study attempts to respond to this need by examining the measurement equivalence (i.e., measurement invariance) of three problem behaviors between adolescent boys and girls in three different age groups.

The establishment of measurement equivalence of the scales that are commonly used in developmental psychology, such as problem behavior scales, requires further insight in the sense that the evaluation of invariance across age groups should consider the possibility that the parameters for the manifest or latent variables may change because of a developmental process (e.g., physical maturation). For example, we may observe differences in children's versus adolescents' responses to an indirect aggression scale because research has shown that children engage in this type of aggressive behavior as they cognitively mature (Björkqvist et al., 1992). Thus, it is important to interpret the results in light of the nature of developmental changes. From this perspective, an

expectation of complete measurement invariance may rather lead to an inaccurate representation of the true developmental changes. Although some researchers may argue that the developmental literature may not benefit much from the establishment of invariance due to the presence of a large number of constructs that change in nature during the course of development, I believe that this issue deserves serious consideration in order to enhance our ability to understand qualitative changes in psychosocial constructs across different developmental periods, in particular, when assessing change and growth.

Lack of measurement invariance can cause bias in the interpretation of the findings such that without this evaluation, we cannot determine whether an observed difference is due to true difference or difference in the structure or measurement of the construct (Brown, 2006). As a result, existing reports of gender and age differences in problem behaviors should be treated with caution because the observed differences may not mean that a particular problem behavior construct functions the same way for boys and girls or adolescents at different age groups. Furthermore, these observed differences without an indication of true differences may also jeopardize the effectiveness of intervention and prevention programs for at-risk youth.

Measurement invariance (MI) is considered an essential phase in contemporary scale development (Brown, 2006) although it has not yet been commonly adapted in practice (Millsap, 2007). The establishment of MI across groups denotes that a particular scale is appropriate for use in groups and legitimate comparison across groups or time can be made (Vandenberg & Lance, 2000). Within a CFA framework, there are two approaches to determine MI across groups: multiple indicators, multiple causes (MIMIC)

and multiple-groups confirmatory factor analysis (MG-CFA). In MIMIC modeling, only the equivalence of item intercepts and factor means can be examined (Brown, 2006). Due to our interest in examining the equivalence of factor loadings and item uniqueness, in this study, I used an MG-CFA approach to evaluate MI of three aforementioned externalizing problem behavior scales. The examination of MI using an MG-CFA approach allowed us to provide evidence for both construct validity and score comparability of these scales across gender and age groups.

In a MG-CFA, the measurement model is simultaneously estimated across groups (e.g., girls versus boys). Configural invariance (i.e., equality of factor structure) is attained when the same factor structure across groups is observed, which indicates that the pattern of parameters is the same across groups. Loading invariance (i.e., equality of factor loadings) is obtained when factor loadings for each item are equal across groups, indicating that each item can be interpreted on a common metric across groups. Error invariance is achieved when item uniqueness of each item are equal across groups, which suggests that measurement error is the same across groups; hence, reliability estimates are equivalent (Meredith, 1993; Vandenberg & Lance, 2000). When all three levels of invariance are achieved, the scale is said to be measurement invariant across groups. In contrast to this premise, several researchers argued that obtaining loading invariance is the most important evaluation (Raffalovich & Bohrnstedt, 1987) because error invariance is an unrealistic expectation with the real-life data (Chan, 1998).

Little is known about the MI of problem behavior scales in youth. Most research in the area of measurement of youth problem behaviors has focused on the establishment of the same factor structure across cultures. For example, researchers examined the

generalizability of the Youth Self-Report (Achenbach & Rescorla, 2001) completed by 30,243 adolescents between the ages of 11 and 18 years from 23 societies. The findings indicated that the 8-syndrome model showed a good fit to the data from each society (Ivanova et. al., 2007). Similarly, using a sample of urban and rural middle school students, Farrell et al. (2000) examined the factor structure of self-report aggression, drug use, and delinquent behaviors. The findings provided support for the existence of three separate scales, although a higher-order structure was also confirmed. These findings were consistent across gender in both urban and rural samples. Overall, although empirical evidence has been provided to support the factor structure of different problem behavior scales, an important measurement property was omitted to ensure legitimate score comparisons was omitted. Specifically, to our knowledge, no studies have provided evidence for the measurement equivalence of a particular problem behavior construct across groups using self-report data.

Recently, using parent-report data from the National Longitudinal Survey of Youth (NLSY) 1979, researchers found that the CBCL-based Problem Behavior Index (PBI; Peterson & Hill, 1986) showed measurement equivalence (i.e., factor structure, factor loading and intercept invariance) across three ethnic groups and within each ethnic group over three time points during middle childhood (Guttmannova, Szanyi, & Cali, 2008). This study provided evidence for the use of the PBI when the scores were derived from internalizing and externalizing problem behavior syndromes and ensured the legitimate comparison of scores for children between the ages of 5 and 11 across three ethnic groups. Although the authors did not test for the equality of measurement error in

scores, this study is still an important contribution to the literature in an attempt to establish an accurate assessment of problem behaviors in children and youth.

To our knowledge, only one Canadian study has examined longitudinal MI of problem behavior scales across gender and age. Using a sample of children between the ages of 4 and 11 drawn from the first three cycles of the NLSCY, researchers investigated the longitudinal MI of the Direct and Indirect Aggression scales (Vaillancourt, Brendgen, Boivin, & Tremblay, 2003). They found that the factor structure and factor loadings of both Indirect and Direct Aggression scales were equal across gender and age. It should be noted that the researchers used parent-reports of Direct and Indirect Aggression and did not examine for the presence of error invariance (i.e., equal item uniqueness). The present study aimed to extend these analyses by using child-report of Indirect and Direct Aggression and also by examining Property Offences.

In summary, the study of problem behaviors in adolescence has received much attention in research. Most researchers have focused on individual differences in the development of problem behaviors. Specifically, gender and age differences have kept an important place in this literature. Although several researchers questioned the validity of the current results, very few studies focused on an important aspect of measurement of problem behaviors, namely, measurement equivalence or invariance of problem behavior scales. Thus, this study aimed to address this important gap in the literature. More specifically, the two major objectives of this study were to: (a) examine the MI of the three NLSCY child-report problem behavior scales across gender, and (b) examine the MI of these scales across three adolescent age groups (i.e., 10-11, 12-13, and 14-15 year-olds). It is crucial to provide empirical evidence for the equivalence and utility of these

scales across groups because most researchers who examine children's health and development using the NLSCY data use these scales to assess problem behaviors in adolescence over time both as a function of gender and age. While MI cannot be used to determine the utility of a scale per se, it does provide strong evidence for construct comparability.

3.2. Method

3.2.1. Source of Data

Data for this study were drawn from the ongoing Canadian National Longitudinal Survey of Children and Youth (NLSCY) survey, which is jointly conducted by Statistics Canada and Human Resources and Social Development Canada (HRSDC). The survey is designed to collect information about children's development and well-being from birth to adulthood. The first cycle of the survey, based on a stratified probabilistic sample design, began in December 1994, with follow-up surveys administered biennially. The sample in the first cycle included 22,831 children, from newborn to 11 years of age (Statistics Canada, HRDC, 1995). Children who were living in institutional settings and in households located in the Yukon, Nunavut, and Northwest Territories were excluded from the sample.

Information about the children's household context was collected from the person most knowledgeable (PMK) about the child, usually the biological mother, during a face-to-face or telephone interview using computer-assisted interviewing (CAI). For children who were 10 years old and older, the PMK's permission was obtained to administer a self-complete questionnaire, which was completed by the child in a private setting to

ensure confidentiality. The household data collection was approximately two hours, including the interview with the PMK (Statistics Canada, HRDC, 1998).

3.2.2. Sample

The cross-sectional sample for this study was drawn from the last released cycle (i.e., Cycle 6) of the NLSCY survey, which was conducted in 2004-5 (Statistics Canada, HRDC, 2006). The longitudinal response rate of the original sample (i.e., children who were recruited in Cycle 1) was 62% at the household level (Statistics Canada, HRDC). The sample for this study included only adolescents who responded to the child-report problem behavior scales in the NLSCY; that is, children from 10 to 15 years old (N = 6,611).

3.2.3. Missing Data

Of the 6,611 participants, 1,141 (17%) had at least one missing value on at least one item of the child-report externalizing problem behavior scales. To identify the impact of missing data on the study, a series of independent sample t-tests (or chi-square tests for dichotomous variables) were conducted to examine the differences between the children who had complete data, and those who had missing values. I chose to examine differences on four socio-demographic variables (i.e., gender, age, household income[8], and PMK education[9]), and on total scores from the three externalizing problem behavior scales (i.e., Indirect Aggression, Direct Aggression, and Property Offence). It should be noted that if the amount of missing values was less than 10% per scale, Statistics Canada imputed the missing values before calculating the total scores, using the PRINQUAL procedure in Statistical Analysis Software (SAS).

[8] The household income was estimated by income from all household members in the past 12 months, with values ranging from 6,000-936,600.
[9] The PMK education was indicated by the number of years of education, with values ranging from 0 to 20.

The independent samples t-test analyses indicated that children who had missing values were more likely to come from households with lower income, and with a PMK with lower education than children who had complete data. In addition, younger adolescents had more missing values than older adolescents, and there were more boys with missing values than girls. However, the effect size of these differences was trivial (see Table 3.1.). No other statistically significant differences were found among the variables, including the problem behavior scales, which were the main focus of this study. Based on the missing values analysis, showing only trivial socio-demographic differences, it was concluded that the missing data did not have an impact on the outcomes of this study.

The final sample for this study included 5,470 children from 10 to 15 years old (M = 12.22, SD = 1.70) in Cycle 6 (2004-5) with complete data on the three externalizing problem behavior scales. Of these children, 50% were female, 71% were living with their biological parents, 17% were living in a single parent household, and 71% were living in a household with an income greater than or equal to $50,000.

Table 3.1. Independent Samples t-Test and Chi-square Test Results from the Missing Data Analyses

T-tests	*N*	*M*	*SD*	*df*	*t*	*p*	*d*[a]
Child age				6609	3.82	<.001	.12
not missing	5470	12.22	1.70				
missing	1141	12.01	1.72				
Household income				6609	3.12	.002	.10
not missing	5470	76178.03	51356.48				
missing	1141	71022.71	48133.69				
PMK education				6565	3.37	.001	.01
not missing	5439	13.81	2.19				
missing	1128	13.56	2.29				
Indirect aggression				5659	-.27	.78	
not missing	5470	1.33	1.69				
missing	191	1.36	1.80				
Direct aggression				5649	-1.08	.28	
not missing	5470	1.11	1.75				
missing	181	1.25	1.91				
Property offence				5622	-.77	.44	
not missing	5470	.92	1.37				
missing	154	1.01	1.64				

Chi-square test	*N*	*df*	χ^2	*p*
Gender	6611	1	7.65	.006

[a] Cohen's *d* (1992) was used as the effect size measure. The interpretation is as follows: trivial effect = .00 to .19; small effect = .20 to .49; medium effect = .50 to .79; and large effect ≥ .80.

3.2.4. Measures

Three child-report externalizing problem behavior scales were administered as part of the Feelings and Behavior section of the NLSCY survey to measure indirect aggression, direct aggression, and property offence. Answers were given on a 3-point response scale ranging from 0 ("never" or "not true") to 2 ("often" or "very true"), with higher scores indicating the presence of problem behavior.

Indirect Aggression. Five items were taken from a previously existing scale of 'child behavior while angry' (Lagerspetz, Bjorkqvist, & Peltonen, 1988), and used to assess indirect aggression (e.g., "when I am mad at someone, I tell that person's secrets to a third person"). Based on ordinal coefficient alpha (Zumbo, Gadermann, & Zeisser, 2007)[10], the estimate of reliability among the five items for each sub-sample was good: girls (α = .85), boys (α = .86), 10-11 (α = .85), 12-13 (α = .86), and 14-15 (α = .85) age groups.

Direct Aggression. Six items were used to assess direct aggression. Five of these items were taken from the Ontario Child Health Study (OCHS; Offord, Boyle, Fleming, Blum, & Grant, 1989) and one item was taken from the antisocial behavior questionnaire used in the Montreal Longitudinal and Experimental Study (Tremblay, Pihl, Vitaro, & Dobkin, 1994). A sample item is "I get into many fights". The estimate for ordinal coefficient alpha for each sub-sample was high girls (α = .89), boys (α = 90), 10-11 (α = .90), 12-13 (α = .91), and 14-15 (α = .90) age groups.

Property Offence. Six items taken from the OCHS (Offord et al., 1989) were used to assess property offence. A sample item is "I destroy my own things". For this scale,

[10] The ordinal coefficient alpha – as opposed to Cronbach's coefficient alpha (1951) – is a more accurate estimate of reliability because it is not influenced by the skewness of the item response distribution.

the estimate for ordinal coefficient alpha for each sub-sample was also good: girls (α = .87), boys (α = .87), 10-11 (α = .85), 12-13 (α = .89), and 14-15 (α = .87) age groups. It should be noted that the items in the Direct Aggression and Property Offence scales were originally derived from the Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1981). All items are listed in Appendix B.

3.2.5. Data Analysis

The plan for statistical analysis is presented in Figure 3.1. First, the factor structure of the three externalizing problem behavior measurement models was confirmed for each gender and age group (i.e., 10-11, 12-13, 14-15 years old) using CFA. Second, MI of each measurement model across gender and age groups (i.e., 10-11 vs. 12-13 and 12-13 vs. 14-15 years old) was tested using MG-CFA. Given the focus on developmental differences, such as gender and age, which imply differences in socialization and cognition, I expect to observe non-invariance across gender and age groups.

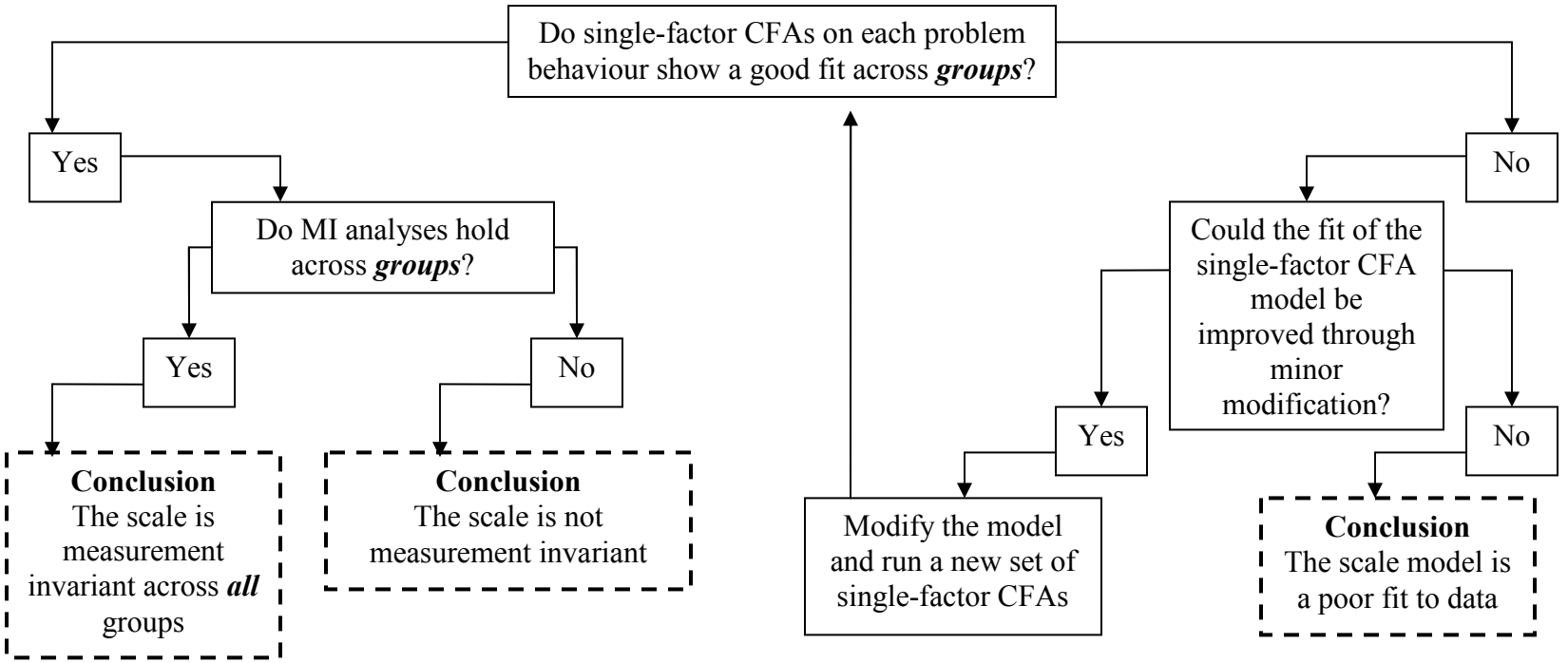

Figure 3.1. The plan for statistical analysis.

Note. Groups refer to boys and girls and the three age groups in the first and second set of analyses, respectively.

The analyses were run using the LISREL 8.80 program (Jöreskog & Sörbom, 2006a) with weighted least squares (WLS) estimation on polychoric covariance and asymptotic variance/covariance matrices computed in PRELIS 2.80 (Jöreskog & Sörbom, 2006b). The WLS method was selected for its ability to handle violations of multivariate normality associated with the ordinal nature of the variables in this dataset (Jöreskog, 2002). Researchers have suggested using polychoric correlations, which estimate the linear relationship between the two unobserved continuous variables that underlie the given observed ordinal variables (Flora & Curran, 2004), when the observed data are ordinal.

The fit of the CFA models was evaluated using the following global goodness-of-fit statistics: (a) the root mean square error of approximation (RMSEA; Steiger, 2000), (b) the comparative fit index (CFI; Bentler, 1990), and (c) the standardized version of the Root Mean Squared Residual (SRMR; Jöreskog & Sörbom, 2001). The following criterion values for goodness-of-fit were used based on Hu and Bentler's (1999) recommendations: (a) RMSEA should be less than or equal to .06, (b) CFI should be .95 or higher, and (c) SRMR should be less than or equal to .08. When all three of these criteria are met, it indicates the model is a good fit to the data. In addition to the criteria for the goodness-of-fit statistics, I considered the parameter estimates of all items (Schumacker & Lomax, 2004), as well as the standardized residual matrix (Jöreskog & Moustaki, 2001), to evaluate model fit. Specifically, I expected the standardized factor loading values to be greater than or equal to .30 (Brown, 2006; DiStefano, 2002), and standardized residuals for each item to be consistently less than 4.0 (Jöreskog & Moustaki).

The MG-CFAs involved a series of tests of model equivalence across groups. Each test is more restrictive than the previous, starting with equivalence of factor structure (i.e., configural invariance), equivalence of factor loadings (i.e., loading invariance), and lastly, equivalence of item uniqueness (i.e., error invariance). There is continued debate about standard criteria for establishing model fit among comparisons of competing models in MI analyses (Vandenberg & Lance, 2000). However, Cheung and Rensvold (2002) recently showed that only the RMSEA is unaffected by model complexity (i.e., number of estimated parameters), making it uniquely effective for establishing configural invariance between models in a multiple-groups context. These authors also showed that the difference in CFI between two nested models ($CFI_{constrained\ model} - CFI_{unconstrained\ model} = \Delta CFI$) is a robust statistic for comparing the between-group invariance of restricted and unrestricted CFA models. Therefore, the configural model fit was evaluated using a cut-off value of RMSEA $\leq .06$. In addition, a value of $\Delta CFI \leq -.01$ was used as an indication of model fit for subsequent levels of MI. A χ^2 difference test was not used in this study because several researchers have recommended the use of $\Delta CFI \leq -0.01$ criterion over a statistically non-significant $\Delta\chi^2$ when invariance constraints are imposed on a measurement model (Cheung & Rensvold, 2002; Wu, Li, & Zumbo, 2007). The problem behavior models were considered measurement invariant across gender or across age only if all three requirements of equality (i.e., factor structure, factor loadings, and item uniqueness) met the established criteria.

3.3. Results

3.3.1. Descriptive Statistics

Means and standard deviations of the variables are not reported here due to the ordinal nature of the responses to the problem behavior scales. Ordinal scales do not have a unit of measurement or a point of origin (Guilley & Uhlig, 1993); thus, descriptive statistics on such variables have no real meaning. I observed clear deviations from a normal distribution for all three problem behavior scale items based on visual inspection of frequency histograms and consideration of skewness and kurtosis values.

Polychoric correlations between all problem behavior items for each gender and age group are presented in Tables 3.2.-3.5. In the Indirect Aggression scale, the second item (i.e., "When I am mad at someone, I become friends with another as revenge") had the lowest correlations with other items in the scale, the lowest of which were between the second and the third items (i.e., "When I am mad at someone, I say bad things behind his/her back"). In the Direct Aggression scale, the highest correlation was observed between the third (i.e., "I physically attack people") and the sixth item (i.e., "I kick, bite, hit other children"). Finally, in the Property Offence scale, the first item (i.e., "I destroy my own things") had consistently low correlations with the fourth (i.e., "I tell lies or cheat") and the sixth (i.e., "I steal outside the home") items in the scale. The highest correlations were observed between the sixth and the fifth (i.e., "I vandalize") item. Overall, moderate relationships were observed between the items pertaining to each problem behavior scale in each sub-sample.

Table 3.2. Polychoric Correlations between Items from the Three Problem Behavior Scales for Girls and Boys (ngirls = 2739 - nboys = 2731)

Item[a]	IA1	IA2	IA3	IA4	IA5	DA1	DA2	DA3	DA4	DA5	DA6	PO1	PO2	P03	PO4	PO5	PO6
IA1	-	**.54**[b]	**.55**	**.60**	**.53**	.34	.39	.42	.42	.43	.41	.35	.36	.50	.37	.37	.37
IA2	**.54**	-	**.50**	**.49**	**.52**	.44	.45	.41	.39	.43	.41	.32	.34	.44	.34	.44	.34
IA3	**.58**	**.38**	-	**.57**	**.59**	.36	.44	.49	.48	.51	.44	.33	.31	.45	.42	.41	.31
IA4	**.59**	**.51**	**.59**	-	.56	.37	.45	.42	.44	.48	.45	.29	.31	.40	.35	.36	.36
IA5	**.55**	**.49**	**.57**	**.53**	-	.37	.42	.46	.48	.44	.45	.33	.34	.45	.35	.42	.46
DA1	.29	.39	.32	.29	.22	-	**.54**	**.66**	**.54**	**.54**	**.63**	.45	.40	.48	.39	.50	.41
DA2	.37	.39	.44	.41	.34	**.49**	-	**.59**	**.49**	**.52**	**.56**	.38	.34	.49	.38	.42	.42
DA3	.33	.32	.38	.30	.33	**.60**	**.55**	-	**.68**	**.62**	**.73**	.43	.47	.54	.47	.59	.57
DA4	.42	.36	.47	.33	.38	**.55**	**.50**	**.65**	-	**.67**	**.63**	.37	.51	.55	.49	.68	.63
DA5	.44	.32	.51	.36	.38	**.49**	**.48**	**.61**	**.65**	-	**.65**	.43	.45	.54	.50	.58	.54
DA6	.30	.30	.41	.32	.38	**.58**	**.52**	**.74**	**.66**	**.67**	-	.38	.43	.51	.51	.51	.54
PO1	.28	.30	.28	.27	.26	.42	.39	.51	.42	.43	.49	-	**.44**	**.58**	**.39**	**.44**	**.33**
PO2	.27	.23	.28	.21	.27	.45	.31	.48	.52	.43	.46	**.46**	-	**.52**	**.50**	**.56**	**.69**
PO3	.38	.38	.35	.35	.35	.53	.46	.54	.58	.51	.58	**.56**	**.56**	-	**.45**	**.58**	**.51**
PO4	.39	.31	.48	.37	.37	.43	.36	.42	.49	.52	.45	**.37**	**.54**	**.48**	-	**.46**	**.51**
PO5	.41	.32	.38	.28	.37	.51	.39	.63	.73	.59	.61	**.50**	**.50**	**.58**	**.55**	-	**.71**
PO6	.32	.23	.40	.20	.35	.40	.34	.46	.57	.43	.47	**.40**	**.61**	**.48**	**.55**	**.74**	-

Note. The correlations below the diagonal are for girls and the correlations above the diagonal are for boys.
[a]The first two letters of the variable name indicate the scale it belongs to: IA = Indirect Aggression; DA = Direct Aggression; PO = Property Offence. The last digit of the variable name indicates the item number in the scale. All items are listed in the Appendix. [b]Bolded coefficients represent the correlations among the items pertaining to each problem behavior scale.

Table 3.3. Polychoric Correlations between Items from the Three Problem Behavior Scales for 10-11 age group (*n* = 2272)

Item[a]	IA1	IA2	IA3	IA4	IA5	DA1	DA2	DA3	DA4	DA5	DA6	PO1	PO2	P03	PO4	PO5	PO6
IA1	-																
IA2	**.53**[b]	-															
IA3	**.56**	**.48**	-														
IA4	**.58**	**.50**	**.57**	-													
IA5	**.50**	**.47**	**.59**	**.56**	-												
DA1	.32	.40	.39	.33	.28	-											
DA2	.41	.40	.44	.44	.39	**.52**	-										
DA3	.38	.33	.55	.39	.39	**.64**	**.62**	-									
DA4	.42	.38	.55	.43	.48	**.53**	**.51**	**.63**	-								
DA5	.40	.42	.56	.45	.43	**.52**	**.49**	**.60**	**.63**	-							
DA6	.37	.37	.53	.43	.42	**.63**	**.56**	**.73**	**.60**	**.63**	-						
PO1	.32	.31	.30	.28	.25	.47	.38	.47	.34	.43	.45	-					
PO2	.29	.25	.34	.26	.29	.39	.34	.40	.44	.39	.39	**.47**	-				
PO3	.42	.37	.46	.37	.37	.46	.44	.55	.53	.51	.55	**.58**	**.48**	-			
PO4	.34	.32	.48	.36	.35	.44	.41	.46	.48	.49	.52	**.37**	**.52**	**.47**	-		
PO5	.35	.46	.48	.35	.37	.50	.42	.60	.64	.56	.51	**.46**	**.47**	**.60**	**.44**	-	
PO6	.34	.37	.41	.36	.40	.41	.34	.45	.59	.46	.46	**.39**	**.69**	**.49**	**.46**	**.56**	-

[a]The first two letters of the variable name indicate the scale it belongs to: IA = Indirect Aggression; DA = Direct Aggression; PO = Property Offence. The last digit of the variable name indicates the item number in the scale. All items are listed in the Appendix. [b]Bolded coefficients represent the correlations among the items pertaining to each problem behavior scale.

Table 3.4. Polychoric Correlations between Items from the Three Problem Behavior Scales for 12-13 age group (*n* = 1688)

Item[a]	IA1	IA2	IA3	IA4	IA5	DA1	DA2	DA3	DA4	DA5	DA6	PO1	PO2	P03	PO4	PO5	PO6
IA1	-																
IA2	**.55**[b]	-															
IA3	**.57**	**.48**	-														
IA4	**.58**	**.51**	**.63**	-													
IA5	**.57**	**.55**	**.59**	**.54**	-												
DA1	.30	.41	.34	.34	.32	-											
DA2	.35	.47	.41	.46	.33	**.53**	-										
DA3	.41	.42	.36	.45	.40	**.68**	**.57**	-									
DA4	.46	.47	.53	.50	.44	**.59**	**.57**	**.73**	-								
DA5	.50	.42	.49	.48	.42	**.55**	**.55**	**.63**	**.68**	-							
DA6	.38	.40	.37	.42	.42	**.65**	**.57**	**.75**	**.68**	**.68**	-						
PO1	.37	.36	.32	.36	.35	.46	.44	.52	.51	.47	.48	-					
PO2	.40	.39	.32	.37	.35	.48	.37	.54	.55	.49	.48	**.46**	-				
PO3	.47	.49	.43	.44	.40	.58	.52	.61	.66	.60	.58	**.57**	**.60**	-			
PO4	.36	.38	.44	.39	.36	.41	.39	.48	.51	.53	.51	**.44**	**.53**	**.48**	-		
PO5	.44	.45	.39	.43	.45	.54	.48	.67	.77	.61	.60	**.50**	**.59**	**.60**	**.54**	-	
PO6	.37	.38	.31	.35	.51	.42	.43	.60	.63	.47	.56	**.40**	**.68**	**.56**	**.56**	**.75**	-

[a]The first two letters of the variable name indicate the scale it belongs to: IA = Indirect Aggression; DA = Direct Aggression; PO = Property Offence. The last digit of the variable name indicates the item number in the scale. All items are listed in the Appendix. [b]Bolded coefficients represent the correlations among the items pertaining to each problem behavior scale.

Table 3.5. Polychoric Correlations between Items from the Three Problem Behavior Scales for 14-15 age group (*n = 1510*)

Item*	IA1	IA2	IA3	IA4	IA5	DA1	DA2	DA3	DA4	DA5	DA6	PO1	PO2	P03	PO4	PO5	PO6
IA1	-																
IA2	**.58**[b]	-															
IA3	**.58**	**.36**	-														
IA4	**.64**	**.46**	**.53**	-													
IA5	**.61**	**.50**	**.57**	**.50**	-												
DA1	.33	.38	.23	.31	.25	-											
DA2	.34	.33	.38	.36	.36	**.54**	-										
DA3	.30	.36	.26	.25	.38	**.63**	**.60**	-									
DA4	.37	.33	.29	.28	.39	**.60**	**.48**	**.68**	-								
DA5	.39	.30	.40	.37	.40	**.55**	**.51**	**.63**	**.68**	-							
DA6	.29	.28	.21	.31	.35	**.60**	**.57**	**.78**	**.67**	**.66**	-						
PO1	.23	.24	.21	.16	.28	.42	.40	.47	.38	.39	.40	-					
PO2	.28	.26	.18	.16	.29	.44	.30	.51	.57	.48	.48	**.42**	-				
PO3	.45	.36	.23	.28	.43	.50	.55	.51	.57	.51	.50	**.60**	**.58**	-			
PO4	.42	.31	.35	.33	.37	.43	.35	.47	.50	.50	.46	**.38**	**.53**	**.48**	-		
PO5	.35	.29	.24	.25	.40	.56	.41	.60	.70	.60	.58	**.47**	**.58**	**.59**	**.52**	-	
PO6	.32	.24	.30	.24	.39	.48	.43	.55	.60	.54	.54	**.32**	**.65**	**.53**	**.56**	**.79**	-

[a]The first two letters of the variable name indicate the scale it belongs to: IA = Indirect Aggression; DA = Direct Aggression; PO = Property Offence. The last digit of the variable name indicates the item number in the scale. All items are listed in the Appendix. [b]Bolded coefficients represent the correlations among the items pertaining to each problem behavior scale.

3.3.2. Confirmatory Factor Analyses on Each Problem Behavior Scale[11] in Each Sub-sample

***Indirect Aggression*.** The Indirect Aggression measurement model with 5 items indicated a good fit to the data from each sub-sample; for girls (RMSEA = .048; CFI = .979; and SRMR = .033), for boys (RMSEA = .021; CFI = .996; and SRMR = .019), and for each adolescent age group (RMSEA = .024, .030, .039; CFI = .994, .994, .986; SRMR = .022, .024, .036 for 10-11, 12-13, and 14-15 age groups, respectively). The completely standardized factor loadings, item uniqueness, and the range of residuals for each item in each of the measurement models are presented in Table 3.6. All items loaded significantly on the factor, and all factor loadings were greater than .65 in each measurement model. In addition, the range of residuals for all of the items in each measurement model (except the residual between the second and the third item in the girls model) was consistently less than 4.0, indicating a good fit between the predicted values and the data.

[11] The three-factor models were also tested to confirm that each item loaded on the hypothesized factor. The results indicated an adequate fit of the three-factor models to data for each sub-sample , with each item loading on the hypothesized factor (RMSEA= .026, .027, .026, .022, .030; CFI= .949, .958, .956, .976, .965; SRMR= .136, .123, .128, .129, .143 for girls, boys, 10-11, 12-13, and 14-15 age groups, respectively).

Table 3.6. The Factor Loadings, Item Uniqueness, and Range of Residuals for Each Item in the Indirect Aggression Measurement Models

	Girls n = 2739			Boys n = 2731			10-11 years old n = 2272			12-13 years old n = 1688			14-15 years old n = 1510		
Item	FL	IU	RES	FL	IU	RES	FL	IU	RES	FL	IU	RES	FL	IU	RES
1.	.79	.38	-1.91 to 1.22	.76	.42	-2.81 to 1.56	.75	.44	-2.87 to 1.92	.76	.42	-1.86 to 1.41	.77	.40	-2.44 to 1.23
2.	.66	.56	-5.88 to 1.22	.68	.53	-1.74 to 1.18	.67	.56	-1.61 to 1.92	.69	.52	-2.89 to 1.41	.67	.55	-3.39 to 1.23
3.	.75	.43	-5.88 to 0.86	.75	.43	-1.74 to 1.63	.76	.42	-1.29 to 2.47	.79	.38	-2.89 to 2.15	.75	.44	-3.39 to 1.55
4.	.77	.41	-2.47 to 0.77	.76	.42	-1.74 to 1.56	.77	.40	-1.29 to 0.43	.77	.41	-1.98 to 2.15	.76	.42	-2.10 to 0.73
5.	.74	.46	-2.47 to 0.86	.76	.43	-2.81 to 0.41	.74	.46	-2.87 to 2.47	.76	.43	-1.98 to 1.24	.74	.45	-2.44 to 1.55

Note. FL = factor loading. IU = item uniqueness. RES = range of residuals.

***Direct Aggression*.** The Direct Aggression measurement model with 6 items also indicated a good fit to the data from each sub-sample; for girls (RMSEA = .016; CFI = .994; and SRMR = .025), for boys (RMSEA = .031; CFI = .989; and SRMR = .030), and for each adolescent age group (RMSEA = .017, .024, .032; CFI = .995, .993, .988; and SRMR = .026, .026, .039 for 10-11, 12-13, and 14-15 age groups, respectively). The completely standardized factor loadings, item uniqueness, and the range of residuals for each item in each of the measurement models are presented in Table 3.7. All items loaded significantly on the factor, and all factor loadings were greater than .65 in each measurement model. In addition, the range of residuals appeared to be less than 4.0 for all of the items in each measurement model (except the residual between the third and the fifth item in the boys model), suggesting a good fit between the predicted values and the data.

Table 3.7. The Factor Loadings, Item Uniqueness, and Range of Residuals for Each Item in the Direct Aggression Measurement Models

	Girls n = 2739			Boys n = 2731			10-11 years old n = 2272			12-13 years old n = 1688			14-15 years old n = 1510		
Item	FL	IU	RES	FL	IU	RES	FL	IU	RES	FL	IU	RES	FL	IU	RES
1.	.70	.51	-2.49 to 1.72	.75	.43	-3.29 to 1.61	.74	.45	-2.05 to 0.59	.76	.43	-2.32 to 0.91	.75	.44	-2.37 to 1.12
2.	.65	.57	-1.83 to 1.72	.68	.53	-2.70 to 1.61	.69	.52	-1.63 to 1.02	.69	.52	-1.54 to 0.24	.69	.53	-3.27 to 1.12
3.	.85	.27	-2.56 to 0.49	.87	.24	-4.06 to 0.44	.86	.26	-2.55 to 1.02	.88	.23	-3.05 to -0.91	.89	.21	-3.13 to 0.20
4.	.80	.36	-1.56 to 1.43	.80	.36	-3.28 to 3.12	.76	.42	-1.75 to 3.00	.84	.30	-2.01 to 0.85	.83	.31	-3.27 to 1.52
5.	.78	.39	-2.56 to 1.43	.79	.37	-4.06 to 3.12	.76	.43	-2.55 to 3.00	.79	.37	-3.05 to 0.85	.79	.37	-3.13 to 1.52
6.	.86	.26	-1.83 to 0.49	.84	.30	-2.33 to 0.38	.84	.30	-1.75 to 0.45	.86	.26	-1.38 to 0.10	.88	.23	-2.56 to 0.20

Note. FL = factor loading. IU = item uniqueness. RES = range of residuals.

Property Offence. The Property Offence measurement model with 6 items suggested an adequate fit to the data from each sub-sample; for girls (RMSEA = .034; CFI = .968; and SRMR = .074), for boys (RMSEA = .051; CFI = .956; and SRMR = .090), and for each adolescent age group (RMSEA = .038, .033, .050; CFI = .962, .979, .965, and SRMR = .081, .065, .096 for 10-11, 12-13, and 14-15 age groups, respectively). The completely standardized factor loadings, item uniqueness, and the range of residuals for each item in each of the measurement models are presented in Table 3.8. All items loaded significantly on the factor, and all factor loadings were greater than .60 in each measurement model. However, the range of residuals appeared to be more than 4.0 for most of the items across each measurement model, providing some evidence of poor model fit, especially for the boys.

Table 3.8. The Factor Loadings, Item Uniqueness, and Range of Residuals for Each Item in the Property Offence Measurement Models

	Girls n = 2739			Boys n = 2731			10-11 years old n = 2272			12-13 years old n = 1688			14-15 years old n = 1510		
Item	FL	IU	RES	FL	IU	RES	FL	IU	RES	FL	IU	RES	FL	IU	RES
1.	.64	.59	-3.80 to 2.28	.64	.59	-7.09 to 4.53	.67	.55	-3.84 to 3.22	.67	.55	-4.19 to 1.22	.62	.61	-5.51 to 3.19
2.	.77	.41	-3.99 to 0.61	.82	.33	-4.90 to 4.53	.81	.34	-4.83 to 0.16	.81	.34	-2.92 to -0.41	.77	.40	-3.27 to 0.09
3.	.80	.36	-4.35 to 2.28	.80	.37	-6.55 to -0.89	.80	.37	-4.83 to 3.22	.81	.34	-3.48 to 1.22	.84	.29	-5.05 to 3.19
4.	.68	.54	-3.36 to 0.61	.64	.59	-3.92 to -2.08	.64	.59	-2.97 to 0.53	.66	.57	-1.82 to -0.01	.68	.54	-2.55 to 0.09
5.	.85	.28	-3.99 to 0.68	.81	.35	-3.92 to -0.74	.72	.48	-2.89 to 0.88	.86	.26	-3.06 to 0.55	.88	.23	-4.17 to -1.21
6.	.85	.28	-4.35 to 0.68	.90	.19	-7.09 to -0.74	.85	.27	-4.45 to -0.02	.86	.27	-4.19 to 0.55	.91	.17	-5.51 to -1.21

Note. FL = factor loading. IU = item uniqueness. RES = range of residuals.

3.3.3. Measurement Invariance of Problem Behavior Scales across Gender

The three problem behavior scales were examined for MI across gender, using a MG-CFA approach (Brown, 2006). The goodness-of-fit statistics from the MG-CFAs are presented in Table 3.9. For the Indirect Aggression scale, there was evidence for equal factor structure (i.e., configural invariance) and equal factor loadings (i.e., loading invariance) across gender, but not equal error variance. The completely standardized solution is presented in Table 3.10., indicating that the fourth item (i.e., "When I am mad at someone, I say to others: let's not be with him/her") has the largest difference in item uniqueness across gender.

For the Direct Aggression scale, only equal factor structure (i.e., configural invariance) across gender was achieved. As can be seen in Table 3.11., all items (except the second item) had different factor loading and item uniqueness values across gender, with the third (i.e., "I physically attack people") and the sixth (i.e., "I kick, bite, hit other children") items having the largest difference in factor loadings. These findings suggest that physically attacking, kicking, biting, and hitting defines the construct of direct aggression more fully for girls than they do for boys. The fact that girls ascribe more importance to these items compared to boys does not mean that girls will necessarily have higher scores than boys.

A similar pattern was observed for the Property Offence scale. That is, only equal factor structure (i.e., configural invariance) across gender was obtained. As can be seen in Table 3.12., all items had different factor loading and item uniqueness values across gender, with the third item (i.e., "I destroy things belonging to my family or other children") having the largest difference in factor loadings across gender. This finding

suggests that the act of destroying things belonging to others defines the construct of property offence more fully for girls than it does for boys. Again, these findings should not be interpreted as girls having higher scores than boys on these items. Overall, these results indicated that complete measurement invariance across gender was not attained for any of the problem behavior scales.

3.3.4. Measurement Invariance across Three Age Groups

In this set of MG-CFAs, invariance between 10-11 and 12-13-year-olds was tested first for each of the three problem behaviors separately. Next, invariance between 12-13 and 14-15-year-olds was examined. The goodness-of-fit statistics are presented in Table 3.9.

For the Indirect Aggression scale, there was evidence for equal factor structure (i.e., configural invariance) for both 10 versus 12 and 12 versus 14-year-olds. However, equal factor loading was achieved only for 12 versus 14-year-olds. Error invariance failed for both age comparison models (see Table 3.9.). This suggests that while the factor structure of the Indirect Aggression scale is equal across all age groups, the items do not have the same meaning for 10-year-olds as they do for 12- and 14-year-olds. As can be seen in Table 10, the lack of loading invariance among 10- versus 12-year-olds may be indicated by the large difference in the factor loadings for the first item (i.e., “When I am mad at someone, I try to get to others to dislike him/her”). The lack of error invariance among 12 versus 14 year-olds may be indicated by the large difference in the item uniqueness for the third item (i.e., “When I am mad at someone, I say bad things behind his/her back”).

For the Direct Aggression scale, there was evidence for equal factor structure (i.e., configural invariance) for both 10 versus 12 and 12 versus 14 year olds. In contrast to Indirect Aggression scale, equal factor loading was achieved for 10 versus 12 year-olds, but not for 12 versus 14 year-olds. Error invariance failed for both age comparison models (see Table 3.9.). This suggests that while the factor structure of the Direct Aggression scale is equal across all age groups, the items do not have the same meaning for 14 year-olds as they do for 10 and 12 year-olds. As can be seen in Table 11, the lack of loading invariance among 12 versus 14 year-olds may be indicated by the largest difference in the factor loadings for the third item (i.e., "I physically attack people").The lack of error invariance among 10 versus 12 year-olds may be indicated by the large difference in the item uniqueness for the fourth item (i.e., "I threaten people").

For the Property Offence scale, configural invariance was the only level of MI obtained across age groups (see Table 3.9.). As can be seen in Table 3.12., results for the Property Offence scale indicated that all items exhibited different factor loadings across the three age groups. The largest inequality between factor loadings were observed for the sixth item (i.e., "I steal outside the home") between 10 versus 12 and 12 versus 14 year-olds, which may be the cause of the lack of loading invariance.

Table 3.9. Goodness of Fit Statistics from the Multiple-Groups Confirmatory Factor Analyses across Gender and Three Age Groups

	Girls vs. Boys			Age 10 vs. 12			Age 12 vs. 14		
	CI	LI	EI	CI	LI	EI	CI	LI	EI
Indirect Aggression									
RMSEA	.04	.03	.06	.03	.04	-	.03	.03	.05
CFI	.987	.984	.942	.994	.983	-	.990	.987	.966
ΔCFI		-.003	-.042		-.011			-.003	-.021
Conclusion	**pass**	**pass**	**fail**	**pass**	**fail**		**pass**	**pass**	**fail**
Direct Aggression									
RMSEA	.03	.05	-	.02	.03	.07	.03	.04	-
CFI	.990	.951	-	.994	.986	.900	.990	.973	-
ΔCFI		-.039			-.008	-.086		-.017	
Conclusion	**pass**	**fail**		**pass**	**pass**	**fail**	**pass**	**fail**	
Property Offence									
RMSEA	.04	.05	-	.04	.04	-	.04	.06	-
CFI	.960	.919	-	.970	.951	-	.971	.931	-
ΔCFI		-.041			-.019			-.040	
Conclusion	**pass**	**fail**		**pass**	**fail**		**pass**	**fail**	

Note. Dashes indicate that the analyses were not performed because of the failure to obtain equality in the previous step. CI = configural invariance. LI = loading invariance. EI = error invariance.

Table 3.10. Completely Standardized Solution from the Multiple-Groups Confirmatory Factor Analyses for Indirect Aggression Scale across Gender and Three Age Groups

Item	Girls vs. Boys				Age 10 vs. 12				Age 12 vs. 14			
	Girls		Boys		Age 10		Age 12		Age 12		Age 14	
	FL	IU	FL	IU	FL	IU	FL	IU	FL	IU	FL	IU
1	.78	.38	.77	.43	.80	.51	.68	.33	.75	.41	.86	.28
2	.65	.54	.70	.56	.70	.62	.64	.44	.66	.48	.69	.61
3	.72	.40	.79	.47	.80	.46	.73	.32	.77	.36	.72	.53
4	.73	.36	.80	.47	.81	.44	.72	.36	.74	.38	.76	.50
5	.73	.46	.76	.43	.77	.50	.71	.38	.76	.43	.75	.42

Note. The estimates represent the solution from the configural invariance analyses. FL = factor loading. IU = item uniqueness.

Table 3.11. Completely Standardized Solution from the Multiple-Groups Confirmatory Factor Analyses for Direct Aggression Scale across Gender and Three Age Groups

	Girls vs. Boys				Age 10 vs. 12				Age 12 vs. 14			
Item	Girls		Boys		Age 10		Age 12		Age 12		Age 14	
	FL	IU	FL	IU	FL	IU	FL	IU	FL	IU	FL	IU
1	.69	.48	.77	.45	.77	.48	.72	.39	.76	.44	.74	.43
2	.68	.62	.66	.49	.70	.52	.69	.52	.70	.53	.68	.51
3	.96	.34	.75	.18	.82	.23	.94	.26	.96	.27	.79	.17
4	.88	.44	.71	.28	.80	.46	.78	.26	.80	.27	.87	.35
5	.83	.44	.74	.33	.80	.48	.73	.31	.81	.38	.77	.36
6	.96	.32	.73	.23	.84	.30	.86	.26	.83	.24	.91	.25

Note. The estimates represent the solution from the configural invariance analyses. FL = factor loading. IU = item uniqueness.

Table 3.12. Completely Standardized Solution from the Multiple-Groups Confirmatory Factor Analyses for Property Offence Scale across Gender and Three Age Groups

	Girls vs. Boys				Age 10 vs. 12				Age 12 vs. 14			
Item	Girls		Boys		Age 10		Age 12		Age 12		Age 14	
	FL	IU	FL	IU	FL	IU	FL	IU	FL	IU	FL	IU
1	.71	.73	.56	.45	.70	.60	.63	.48	.71	.61	.58	.53
2	.86	.51	.71	.25	.86	.39	.74	.28	.89	.42	.67	.30
3	.95	.50	.61	.22	.85	.41	.74	.28	.82	.34	.84	.29
4	.69	.56	.63	.57	.68	.67	.60	.47	.59	.46	.75	.66
5	.95	.34	.70	.27	.77	.55	.77	.21	.81	.23	.94	.26
6	.90	.32	.84	.17	.95	.34	.70	.18	.77	.22	.99	.20

Note. The estimates represent the solution from the configural invariance analyses. FL = factor loading. IU = item uniqueness.

3.4. Discussion

Extensive research has examined gender-specific and developmental patterns in adolescent problem behaviors. Specifically, comparison of problem behavior scores between girls and boys, as well as between younger and older children has been a primary focus in this line of research. To date, much of this research has investigated the basic psychometric properties of commonly used problem behavior scales (e.g., CBCL; Achenbach & Rescorla, 2001); however, further investigation of measurement properties of these scales should be considered to ensure legitimate comparison of scores across groups (Vandenberg & Lance, 2000). In this regard, establishing MI not only ensures measurement of the same construct across groups and/or time points, but also provides equivalence in the way a particular construct is being measured (Chan, 1998; Vandenberg & Lance, 2000). Lack of MI can create bias in the interpretation of the score comparisons, prevalence rates, and developmental trajectories (Tyson, 2004). This is a very real concern given that very few researchers investigate the MI of problem behavior scales prior to conducting any multiple-groups or longitudinal analyses. In an attempt to address this major gap in the literature, this study, using a nationally representative sample of Canadian adolescents, examined MI for three externalizing problem behavior scales across gender and age.

The results, in line with previous research (Ivanova et al., 2007), showed that the factor structure of these scales is appropriate for assessing indirect and direct aggression, and property offence in adolescents. However, the findings showed that the three problem behavior scales failed to demonstrate complete MI across gender or age. Although all three problem behavior scales achieved configural invariance (i.e., the construct is related

to the same set of items) across gender and age, only the Indirect Aggression scale exhibited loading invariance across gender (i.e., the items are perceived similarly for boys and girls). This scale also showed loading invariance for 12 versus 14-year-olds (but not for any other age groups) and the Direct Aggression scale achieved loading invariance for the 10 versus 12 year-olds. The Property Offence scale did not achieve loading invariance across gender or for any age group comparisons. These results suggest that substantial differences may exist in the manifestation of each problem behavior construct across gender (especially for Direct Aggression and Property Offence scales) and across age (especially for the Property Offence scale).

3.4.1. Measurement Invariance Analyses across Gender

The results from the MI across gender analyses allowed us to open a new window on our understanding of the role of gender in problem behaviors. More specifically, the lack of loading invariance across gender prevents a meaningful comparison between adolescent boys and girls on the Direct Aggression and Property Offence scales. Configural invariance indicates that the factor structure of the direct aggression and property offence latent variables was similar for boys and girls in our sample (i.e., the items represented one latent variable); however, the expression of these two constructs were different for boys and girls. Evidence for this was shown by the discrepancy in the factor loading values for both the Direct Aggression and Property Offence scales across boys and girls. For example, in the Direct Aggression scale, the items that indicate physically attacking and kicking, biting, hitting others had more weight for girls than boys in relation to the construct; whereas for boys almost all the items in the scale had an equal weight in defining the construct of direct aggression. Similarly, the items that

indicate destroying things that belong to others, vandalizing, and stealing outside the home explained more of the Property Offence construct for girls compared to boys. These differences provide insight into the different expression of problem behaviors by boys and girls, a long-standing issue in gender and the development of psychopathology (see Zahn-Waxler et al., 2006).

Overall, these findings provide evidence for the lack of the same measurement construct for Direct Aggression and Property Offence across boys and girls in this sample. As a result, making comparisons across gender becomes problematic and strategies for alternative interpretations for boys and girls need to be developed. Although these findings are not generalizable to other samples, they bring an important question to our discussion: How can we obtain comparable scores of problem behaviors when the items do not have the same meaning across comparison groups?

The Indirect Aggression scale was the only scale which achieved loading invariance across gender (i.e., equal factor loadings), indicating that the magnitude of the relationship between the items and the Indirect Aggression construct was the same for boys and girls. Although achievement of loading invariance is not the sole standard in the establishment of MI, for some researchers it is the most important one (Raffalovich & Bohrnstedt, 1987) since achieving error invariance is viewed as an unrealistic expectation with the real-life data (Chan, 1998). Given the multiple sources for error in non-laboratory settings, the possibility of achieving this level of invariance is marginalized. However, a lack of error invariance suggests that there is no equivalence in error variance values across groups, which may affect the stability of factor loadings across groups at different measurement points and may make comparative analyses questionable. At the

very least, based on the results of this study, it is imperative that researchers determine the MI of problem behavior scales before embarking on gender and/or age comparisons.

3.4.2. Measurement Invariance Analyses across Age

Regarding MI across age, for the Property Offence scale, only configural invariance was achieved, indicating that meaningful comparisons cannot be made across the three adolescent age groups that were examined in this study. This finding brings to our attention the need to question previous findings from the longitudinal studies which utilized NLSCY child-report problem behavior scales to examine the developmental trajectories of Property Offence from childhood to adolescence (e.g., Lacourse et al., 2002). For these studies, it is possible that the difference in the trajectories may be due to the difference in the measurement of the Property Offence construct across different developmental periods rather than a true difference across age.

Results from the Direct Aggression scale indicated that this construct was interpreted similarly across adolescents between the ages of 10 and 12 years, but uniquely for adolescents between the ages of 12 and 14 years. Previous research has consistently shown that the use of direct aggression emerges early in the life-span and become stable during early adolescence (Brame et al., 2001; Broidy et. al., 2003; Tremblay et al., 1999). Thus, children may have a similar perception of Direct Aggression during the transition from childhood to adolescence. However, by age 12, their interpretation of direct aggression may change as they are learning or developing other forms of aggression, such as indirect aggression. It is important to note that the change in adolescents' perceptions of direct aggression should not be interpreted as having an incremental transition or a shift from direct aggression to other forms of aggression (e.g., indirect aggression) as

suggested by several researchers (Björkqvist et al., 1992; Vaillancourt et al., 2003). Rather the existence of a complex developmental mechanism suggesting differences in adolescents' perceptions of direct aggression as they mature should be considered. Within this perspective, a qualitative examination of the meaning of direct aggression among children who have different trajectories between 10 and 12 years old rather than examining the magnitude of the gender differences even after accounting for the differences in the sample (Côté, 2007) may be helpful in mapping the transition from equal meaning of Direct Aggression to a different meaning of Direct Aggression.

In contrast to Direct Aggression scale, for the Indirect Aggression scale, loading invariance was achieved for 12 versus 14 year-olds, but not for 10 versus 12 year-olds. These findings are consistent with the pervasive argument in the literature that indirect aggression may not be ''fully developed'' in 8-year-olds and be still in the developing phase in 11 year-olds (Björkqvist et al., 1992). Thus, from a developmental perspective, the reason why we don't observe equivalence in the meaning of indirect aggression in younger ages may be due to the fact that children are in the learning stage of using indirect aggression and as they mature socially, a similar meaning of indirect aggression will be observed in older ages, as we did between 12 and 14 year-olds.

Overall, these findings suggest that the meaning of the construct and the composition of these problem behaviors change over time. Our findings indicated that there is a conceptual equivalence in each problem behavior across all groups; however, similar meaning of these problem behaviors cannot be concluded across all age groups.

3.4.3. Limitations and Future Directions

The establishment of a stable measurement structure of problem behaviors across gender and over time is important because without such equivalence a meaningful examination of gender or age differences in the mean levels of these different types of problem behaviors may not be possible. It is possible that some of the items (if not all) have equivalence across gender or age. Future studies should focus the identification of differential item functioning (DIF) in these scales in order to create a sub-set of equally functioning items across groups.

It should also be noted that in this study, I focused on only two individual variables, gender and age, the assessment of problem behaviors may be further complicated by the influences of other contextual factors such as culture (Spencer, Fitch, Grogan-Kaylor, & McBeath, 2005) or differential expectations for an appropriate behavior at specific ages (Guttmannova et al., 2008). Thus, researchers in future studies should ensure that the problem behavior scores based on non-DIF items reflect only the underlying problem behavior construct and are not affected by any individual or group membership such as gender, age, or culture (Guttmannova et al., 2008). The first step in achieving this goal would be having precise conceptual definition of constructs in assessments and invariant measurement properties of the scales or items across groups under examination.

This is the first study that has examined the equivalence of measurement structures of the problem behavior scales across gender and age, using a nationally representative sample of children between the ages of 10 and 15 years. A major contribution of this study to the literature is that the measurement properties of problem

behavior scales may not be equivalent in gender and age groups. Therefore, comparison of scores may yield biased results. For example, a cut-off score for a specific problem behavior may not represent the same level of problem behavior between boys and girls. Similarly, a scale would be biased against younger adolescents if, for a given level of cognitive ability, older adolescents tended to score higher on the scale compared to younger adolescents.

Several limitations of this study should be noted. First, we should interpret the results in light of the fact that our sample was cross-sectional. Although I initially attempted to examine longitudinal measurement invariance, the amount of missing data for each scale at each time point was substantial and listwise deletion was not a viable option because none of the children in Cycles 3 through 6 had complete data for the problem behavior scales that were examined in this study. This leaves open the possibility that there might have been increased instances of MI if the question had been examined from a within-person perspective instead of the between-person method (e.g., cross-sectional) that I was forced to utilize.

On a related note, our final cross-sectional sample excluded some of the children who did not have complete data, although as discussed earlier, the effect size of the differences between the two samples of children (i.e., removed versus kept) was trivial, which gives us confidence in our ability to generalize our findings to the representative NLSCY sample of children.

Measurement invariance is a property of scores and not an indicator of the quality of a measure (Guttmannova et al., 2008). Therefore, the results from this study should be interpreted as an indication of the absence of invariant scores across groups based on the

data rather than the absence of invariant problem behavior scales. Moreover, the findings may not be replicated in a longitudinal sample or within other cultures. As such, it is recommended that investigation of MI should be included as a standard step in data and measurement evaluation prior to conducting any comparative analyses.

It is important to acknowledge that because the same sample was parsed both by gender and then by age, the age factor was confounded in our gender analyses and vice versa (i.e., the gender variable was confounded in our age analyses). For practical reasons and to preserve power in our statistical analyses, it was decided not to make the comparisons with sub-samples of the data (i.e., 10-11 year-old girls versus 12-13 year-old girls), however, this leaves open the possibility that different results might have emerged had separate samples been used for each comparison. This issue is worth addressing in future with a larger longitudinal sample.

The clinical diagnosis of externalizing problem behaviors is estimated to be 4.2 percent in children and adolescents between the ages of 4 and 17 (Waddell & Sheppard, 2002). Thus, researchers appear to agree that problem behavior tends to occur throughout childhood and early adolescence; however, there seem to be differences in observed gender and age differences. Given that the assessment of problem behaviors has been an interest to researchers, educators, and clinicians, the utility of establishing an accurate assessment will certainly be useful in improving the accuracy of our conceptualization of problem behaviors, developing appropriate interventions and preventions programs, and finally implementing effective policies. This study aimed to question current views on gender and age differences in externalizing type of problem behaviors by examining MI of three commonly used scales (i.e., Indirect Aggression, Direct Aggression, and Property

Offence) across gender and age in a transition period from childhood to adolescence. The findings provide evidence for the importance of a growing concern that MI across groups cannot be assumed and should be tested prior to any comparisons.

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4. STUDY 3 - An Examination of the Reciprocal Relationships between Parental Nurturance and Adolescent Aggressive Behaviors[12]

4.1. Introduction

The study of aggression during adolescence has been a popular topic of research due to the dominant view of adolescence as a time of increased risk for problem behaviors. Although aggression has been defined in various ways, a common feature in all definitions is that aggression is a behavior that is intended to harm another individual or a group of individuals (Dodge, Coie, & Lynam, 2006; Parke & Slaby, 1983). Researchers have distinguished among different forms of aggression, including indirect versus direct aggression. Indirect aggression has also been termed as social aggression (Galen & Underwood, 1997) and relational aggression (Crick & Grotpeter, 1995). Direct aggression involves physical harm (e.g., hitting) or verbal attack (e.g., threatening; Björkqvist, Lagerspetz, & Kaukiainen, 1992); whereas indirect aggression involves intention to harm another individual in "circuitous ways" (Österman et al., 1998, p. 1) such as damage to friendships (Lagerspetz, Björkqvist, & Peltonen, 1988).

Research has shown that the determinants of adolescent aggression can be diverse ranging from genetic to environmental factors, such as peer influence and socialization in the family (Dodge et al., 2006). Within the domain of socialization in the family, parenting behaviors have received much attention as a correlate of adolescent aggressive behaviors. Most studies have examined maladaptive parenting practices, such as harsh discipline (Prinzie, Onghena, & Hellinckx, 2006), coercion (Reid, Patterson, & Synder,

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2000), and physical punishment (see Gershoff, 2002 for a meta-analytic review), in relation to adolescent aggression. Relatively less research has focused on the role of positive parenting behaviors, such as nurturance, warmth, and support in adolescent aggressive behaviors. This study aimed to address this gap in the literature by examining the relationship between parental nurturance and two different forms of aggression (i.e., indirect and direct aggression). A unique contribution of this study is to examine this relationship in a transactional model in which reciprocal effects between parental nurturance and adolescent aggression can be tested.

4.1.1. Parental Nurturance

Nurturance is a highly salient aspect of parenting. However, the conceptualization of parental nurturance has been ambiguous because of the various definitions of the construct in the literature. Recently, Dishion and Bullock (2002) have suggested that nurturance involves "pervasive attention, emotional investment, and behavior management" by caregivers to foster child social and emotional development (p.231). In line with this conceptualization, one of the earliest operationalization of nurturance included comforting behaviors, such as helping, supporting, and talking (Siegelman, 1965). More recent measures of parental nurturance denote emotional expressions, such as affection and communication of acceptance, as well as instrumental acts, such as playing a game together (see Locke & Prinz, 2002 for a list of measures). In this study, parental nurturance was assessed by adolescents' perceptions of parenting behaviors that included expression of affection, positive evaluation, and equalitarian treatment. An important remark should be made here regarding the use of terms similar to nurturance. Dimensions of parenting, such as warmth (Becker, 1964), responsiveness (Baumrind,

1971), and acceptance (Rohner, 2004) are related to (but not the same as) parental nurturance (see Maccoby & Martin, 1983 for a discussion).

4.1.2. Parental Nurturance and Adolescent Aggression

Little is known about the relationship between parental nurturance and adolescent aggression. Most research has focused on the role of nurturance or related constructs, such as warmth, in relation to aggression during childhood. For example, maternal warmth at age 4 predicted lower levels of externalizing problem behaviors at age 8 (Booth, Rose-Krasnor, McKinnon, & Rubin, 1994). Based on these results, one can expect that parental nurturance may protect children from becoming aggressive. Despite this potential role in childhood, parental nurturance has been a neglected construct in research pertaining to aggression in adolescence. Similarly, relatively less is known about whether adolescent aggressive behaviors affect their parents' nurturing behaviors.

The expectation of a negative relationship between parental nurturance and adolescent aggression may seem to be commonsense, but needs an explanation. Attachment theory (Bowlby, 1969), which defines attachment behavior as seeking and maintaining proximity to another individual for self-protection, provides some basis for understanding this relationship. Secure attachment refers to a sense of security that allows adolescents to engage in the outside world and know that they will always be welcomed, when they return to their parents for safety (Bowlby, 1988). Secure attachment is a closely related construct to parental nurturance because it denotes parents' physical and emotional nurturing behaviors, including comforting and reassuring when the adolescent is overwhelmed or frightened. The concept of secure attachment has been used to explain the occurrence of adolescent problem behaviors, such as conduct disorder (see Bowlby,

1988 for clinical applications of attachment theory). Research findings suggest that adolescents who are securely attached to their parents are less likely to have mental health and problem behaviors than their peers (see Moretti & Peled, 2004 for a review), such as substance abuse (Rosenstein & Horowitz, 1996; Turner, Irwin, & Millstein, 1991), conduct disorder (Rosenstein & Horowitz), and delinquency (Loeber, Farrington, Stouthamer-Loeber, & van Kammen, 1998), and report fewer mental health problems, such as depression (Papini, Roggman, & Anderson, 1991; Sund & Wichstrom, 2002) and anxiety (Nada-Raja, McGee, & Stanton, 1992; Papini et al.).

According to Bowlby (1969, 1988), a threat to feelings of security creates anxiety and generates anger, which may lead to disturbances in behavior. From this perspective, it is possible that lack of parental nurturance during adolescence may predict an increase in aggressive behaviors because adolescents who are not securely attached to their parents may be feeling unsafe, fearful, and angry, which, in turn, may increase their likelihood to engage in aggressive behaviors. Bowlby also acknowledged both the mother's and the child's roles in forming the pattern of attachment. Specifically, just like the characteristics and responses of a mother can influence the way the child responds to her, the initial characteristics of a child can influence the way the mother cares for the child.

From this perspective, it is also possible that parental nurturance is sensitive to the presence of adolescent aggression. As an example, Brunk and Henggler (1984) conducted an experimental investigation with mothers who were observed in a play situation with an adolescent confederate who was trained to exhibit conduct disorder. The results indicated that mothers showed higher rates of ignoring the behavior, and giving

disciplining commands, including threat of punishment rather than nurturing behaviors, such as helping and praising. An early review of parents' behaviors also indicated that mothers of children with conduct disorder were using more negative behaviors toward their children (Rogers, Forehand, & Griest, 1981). Thus, it seems reasonable to argue that parents may react to adolescent aggression by decreasing their nurturing behaviors.

Another theory that can be useful to explain the relationship between parental nurturance and adolescent aggression can be Hirschi's (1969, 1977) restraint or control theory of delinquency. According to Hirschi, delinquent acts are contrary to conventional and moral values in the society. Thus, adolescents who are engaging in delinquent acts are least likely to care about the moral and conventional rules of the society. Hirschi states that control theories focus on the restraints that prevent the occurrence of delinquent acts. For example, child socialization (e.g., teaching law-abidings) may play a key role in restraining delinquent acts. Similarly, the effectiveness of different social context, such as family context may also account for delinquency.

Hirschi (1977) discusses the role of the family and attachment to parents as a traditional cause of delinquency. Specifically, he argues that the quality of parent-adolescent relationships can be judged by the adolescents' engagement in delinquent behaviors. Adolescents who do not have close attachments to their parents are more likely to engage in delinquent behaviors because these adolescents do not adopt the moral and conventional values of their parents. Similarly, adolescents who do not care about their parents' reactions are more likely to engage in delinquent acts because they have nothing to lose. It is apparent that family, including child socialization and attachment to

parents, plays an important role in the occurrence of delinquent behaviors. Hirschi does not, however, account for the effects of adolescent behaviors on parents' nurturance.

More recently, Moretti and colleagues have applied attachment theory in the design of an intervention program for parents with severely conduct-disordered adolescents (Moretti, Holland, Moore, & McKay, 2004). Specifically, the program promoted the enhancement of parental attunement and empathy, and encouraged parents to reframe conflict and to improve communication and limit-setting. The preliminary results indicated that parents reported significantly less child externalizing problem behaviors and high parental acceptance of the intervention. Results of a subsequent evaluation conducted at the end of the program showed that there were positive changes in parents' reports of their parenting and their relationship with their child, such as greater child acceptance and autonomy support, as well as decreases in parents' reports of adolescent problem behaviors (Obsuth, Moretti, Holland, Braber, & Cross, 2006). These findings provide support for attachment theory-based interventions to enhance parenting and strengthen parent-adolescent relationships in order to reduce conduct disorder in adolescents. In this context, parental nurturance can be considered as an essential component of parenting to promote a secure attachment to parents and thus play a critical role in reducing the potential occurrence of aggressive behaviors during adolescence.

4.1.3. Overview of Research Models Examining the Relationship between Parenting Behaviors and Adolescent Problem Behaviors

Due to the paucity of empirical studies that have focused specifically on the relationship between parental nurturance and adolescent aggression, this review of the literature draws on research that has been conducted on various parenting behaviors and

externalizing type of problem behaviors, such as conduct disorder, delinquency, and aggression.

Unilateral models. Historically, researchers who have examined the relationship between various parenting behaviors and adolescent problem behaviors have used unilateral models that can be characterized by a unidirectional causality, usually from parent to child, and unequal parent and child agency by assigning a more passive role usually to the child (Kuczynski, 2003; Kuczynski, Marshall, & Schell, 1997). Relatively little research has focused on the positive aspects of parenting, such as support, nurturance, and warmth, in relation to adolescent problem behaviors. The results from these few studies indicated that all positive parenting behavior constructs, including support (Stice, Barrera, & Chassin, 1993), nurturance (Pires & Jenkins, 2007), and warmth (Suchman, Rounsaville, DeCoste, & Luthar, 2007) were negatively associated with adolescent externalizing problem behaviors such as aggression and substance use.

A common feature of these models, independent of whether they were tested with cross-sectional or longitudinal data, is that adolescent problem behaviors were generally interpreted as the outcome of parents' behaviors. That is, the direction of influence is assumed to be from parent to adolescent. It is well-documented in the social sciences that a correlation does not imply causation (Kenny, 1975); thus a correlation between parenting behavior and adolescent behavior does not necessarily indicate parental influence (Maccoby, 2002). It is possible that parenting behaviors cause problem behaviors; however, the correlation may also occur because adolescent problem behaviors are causing specific parenting behaviors. Alternatively, the effects may be

reciprocally related, or a third variable may be responsible for the existing correlation (Cohen, Cohen, West, & Aiken, 2003).

Several studies have examined the reverse direction of influence – that is, from child to parent. For example, the findings from an observation study indicated that mothers were using more negative responses, such as showing a dislike to the child's action, and more requests, including gestures and words intended to produce a change in child's behavior when interacting with 6- to 11- year-old boys diagnosed with conduct disorder compared to mothers of boys who did not have conduct disorder problem (Anderson, Lytton, & Romney, 1986). More recently, Kerr and Stattin (2003) found that parenting behaviors in middle adolescence did not influence delinquent problem behaviors but, rather, they were reactions to problem behaviors. Specifically, their results indicated that parenting behaviors did not predict a change in adolescent delinquent problem behaviors over time, but earlier delinquency was associated with change in parenting behavior (e.g., less parental control, less emotional support) over time. These results offered a new insight to our understanding of the relationship between parenting behaviors and child outcomes. Less parental control and support, also identified as neglectful parenting, did not produce delinquent problem behaviors, but was an outcome of problem behaviors.

Bilateral models. In the 1960's, since Bell's (1968) reinterpretation of the effects of child socialization, the bidirectional nature of parenting and adolescent outcome has increasingly been recognized. As a result, bilateral models of parent-adolescent relations are emerging. These models, in contrast to unilateral models, include bidirectional causality and assign equal roles to the parent and the adolescent to influence and initiate

change (Kuczynski, 2003; Kuczynski et al., 1997). In other words, in contrast to unilateral models which emphasize parents' influence on adolescents, bilateral models assume that the relationship between parenting behaviors and adolescent behaviors is bidirectional (Bugenthal & Grusec, 2006; Kuczynski, 2003; Lollis & Kuczynski, 1997). Adolescents and their parents interact in a reciprocal fashion and each influences the other's behavior.

The first recognition of the reciprocal nature of parent-child relations was reported in the early 1950s. Sears (1951) argued that it is essential to consider a dyadic sequence in the conceptualization of parent-child relationships; however, at the time, methodological challenges did not allow the empirical study of the reciprocal nature of parent-child relations (Maccoby, 2007). In a similar way, Bell's control system model (Bell, 1971; Bell & Harper, 1977) suggested that parents and children react to each other's behaviors with a certain upper and lower limit of tolerance, based on previous interactions. For example, when children display a problem behavior, parents may react in an aversive way, indicating that their upper limit of tolerance has been reached. This aversive reaction may, in turn, exceed the upper limit of children's tolerance and lead to increases in their problem behavior. Although the first attempt to conceptualize the reciprocity in parent-child relations was made by Sears in 1951, Bell's control systems model was the first model to be empirically tested (see Bell & Chapman, 1986).

Recently, transactional models (Sameroff, 1975a; Sameroff, 1975b) have became popular as a means of examining the reciprocal nature of the relationship between parenting behaviors and adolescent problem behaviors over time, and several studies have confirmed full reciprocal influences between parents and adolescents in the

maintenance of problem behaviors. For example, Stice and Barrera (1995), using a community sample of adolescents between the ages of 10 and 16, found that parental support at Time 1 was not only negatively associated with adolescent substance abuse after one year at Time 2, but parental support at Time 2 was also negatively related to adolescents' substance abuse at Time 1. However, full reciprocity was not observed between parental support and externalizing symptoms (i.e., rule-breaking and aggressive behaviors; Stice & Barrera). Using data from the Rochester Youth Development Study, which included a sample of adolescents in Grade 7 and 8 followed for four and a half years, Jang and Smith (1997) found reciprocal relationships between poor parental supervision and adolescent delinquent behaviors. Similarly, in a sample of adolescents from Grade 9 through 12, full reciprocal relationships were found between parental knowledge of adolescents' whereabouts, companions, and activities and adolescent delinquent behavior, indicating that low levels of parental knowledge predicted increases in delinquent behavior and that high levels of delinquent behavior predicted decreases in parental knowledge of adolescents' whereabouts, companions, and activities (Laird, Pettit, Bates, & Dodge, 2003). More recently, full reciprocal associations between parenting practices, such as supervision and involvement, and conduct problems were found from childhood to adolescence in a sample of boys (Pardini, Fite, & Burke, 2008).

Other studies have only found child effects. For example, although Kerr and Stattin (2003) showed that there was a reciprocal relationship between adolescent behavior and parents' reactions between the ages of 14 and 16, the adolescent effect was found to be stronger compared to the parent effect. This finding provides support for

Maccoby's (2002) argument suggesting that as children go through adolescence parents' influences on children start to diminish compared to adolescents' influences on parents.

It is also possible that certain parenting behaviors are more open to change and less influential on children outcomes. For example, although Jang and Smith (1997) found reciprocal relationships between parental supervision and delinquency, indicating mutual influences, they found only child effects for affective ties, which suggested that parent-adolescent affective relations were less influential on adolescent delinquent behaviors than vice versa. Similarly, adolescent externalizing and internalizing problem behaviors were found to predict parenting, as indicated by responsiveness, knowledge, and quality of the parent/child relationship within a 1-year interval (Reitz, Deković, Meijer, & Engels, 2006). More recently, researchers have found that higher internalizing behavior and physical and relational aggression of adolescents between the ages of 12 and 19 at Time 1 were associated with increases in adolescents' perceptions of their mothers' use of psychological control two years later (Albrecht, Galambos, & Jansson, 2007). Child effects were also confirmed in adolescent clinical samples. For example, using a clinic-referred sample of boys between the ages of 7 and 12 who were followed up annually for five years, researchers found a stronger influence of adolescent conduct disorder behavior on parental supervision (poorer) than of parental supervision on adolescent conduct disorder (Burke, Pardini, & Loeber, 2008).

Recently, in a six-year prospective study using a large community sample of girls between the ages of 7 and 12, researchers found only parent effects between parental warmth and conduct disorder, after controlling for the effects of socioeconomic status and ethnicity (Hipwell et al., 2008). In contrast, child effects were observed between

parental punishment and conduct disorder. It appears that the presence of child effects versus parent effects may depend on both child's age and the specific parenting behavior. It is possible that some parenting behaviors, such as punishment, may be more prone to child effects, and that the child effects may become stronger compared to parent effects as children move toward late adolescence.

In contrast to the above-mentioned studies, other researchers who examined reciprocal effects found neither parent nor child effects. For example, using data from the Minnesota Twin Family Study, researchers failed to find reciprocal effects between parent-adolescent conflict and externalizing problem behaviors over a three-year interval (Burt, McGue, Iacono, & Krueger, 2006). Similarly, no evidence of reciprocity was observed between maternal overreactive discipline and toddler's externalizing problem behaviors over a two and a half year period (O'Leary, Smith-Slep, & Reid, 1999). Overall, these findings indicate the presence of mixed findings in the literature. Clearly, there is a need for further research in order to elucidate the reciprocal effecs between parenting and adolescent behaviors.

4.1.4. Transactional Models

Kuczynski and Parkin (2007) identified the transactional model (Sameroff, 1975a, 1975b) as the most influential conceptual framework for studying reciprocal relationships in social and developmental psychology. The transactional model emphasizes continuous interactions between adolescents and their family environments: "the child alters his environment and in turn is altered by the changed world he has created" (Sameroff, 1975a, p.281). An important underlying feature of this model is that adolescents' continuous transactions with the environment over time lead to qualitative changes in

their interpretation of the environment. These qualitative changes are cumulative and can be observed both in the behaviors and in the cognitions of parents and adolescents over time (Kuczynski & Parkin, 2007).

Patterson's (1982, 2002) coercive processes provide a good demonstration of a transactional model. In coercive family process models, the sequence of reciprocal effects that occur between parents and children can be summarized as follows: the parent makes a demand, the child engages in problem behavior. Then, the parent withdraws or reduces the demand (parent effect) and the child stops the behavior (child effect). According to Patterson, the parent's aversive reaction to child's problem behavior reinforces the behavior and leads to coercive interaction cycles, where both child problem behaviors and ineffective parenting practices are maintained over time.

Recently, Sameroff and MacKenzie (2003) reviewed examples of transaction models and the research strategies used for testing these models. They pointed out the need to demonstrate qualitative changes in the behaviors of parents and children as a result of bidirectional influences over time, emphasizing the dialectical or rational element of a transactional model. In other words, transactional models assume that both parent and the adolescent are constantly changing, therefore, the influences between the parent and the adolescent cannot be interpreted in a linear fashion in the sense that a particular stable parenting behavior is causing a particular stable adolescent outcome. Sameroff and MacKenzie also acknowledged the need for "a mechanistic measurement model, in which dynamic processes are reduced to static scores that can be entered in statistical analyses" (p.617). In this regard, transactions can be examined with a variety of statistical analyses, such as two-way analysis of variance (ANOVA) and regression

techniques as well as with more advanced statistical techniques, such as structural equation modeling (SEM). Moreover, a complete test of a quantified transactional model requires longitudinal data for parent and child variables measured at least at three time points. The child's age, which is often the primary indicator of time in a transactional model, represents developmental periods where outcomes are influenced by a continuous interaction among the child, the experiences provided by the child's environment, and the child's effect on the environment (Eyberg, Schuhmann, & Rey, 1998; Sameroff & MacKenzie, 2003). Based on these research strategies, this study used three time points and SEM to test a transactional model between parental nurturance and adolescent aggression.

4.1.5. The Present Study

Most research on reciprocal associations between parenting behaviors and adolescent problem behaviors has focused on negative parenting behaviors, such as harsh parenting. Relatively less is known about the reciprocal associations between positive parenting behaviors and adolescent aggression. Thus, the present study aimed to test a transactional model between parental nurturance and two adolescent aggressive behaviors (i.e., indirect and direct aggression) over a four-year period. From a transactional perspective, the association between parental nurturance and adolescent aggression is conceptualized as a dynamic process in which parental nurturance and adolescent aggression continuously change through reciprocal processes (i.e., mutual influence) over time. More specifically, the development or the maintenance of adolescent problem behavior can occur as a result of lack of parental nurturance. At the same time, a decrease

in parental nurturance can be a reaction to adolescent aggression. These parent-adolescent transactions may reinforce aggressive behaviors over time.

As can be seen in Figure 4.1., adolescents' aggressive behavior at Time 1 (age 10-11) elicits certain reactions from the parents, which influence adolescents' aggression at Time 2 (age 12-13), and this behavior then influences parental nurturance at Time 3 when adolescents are 14 to 15 years old. It is arguable that the model captures a transition from childhood to adolescence because the period around 10 and 11 years of age can be considered as the end of childhood and beginning of adolescence during which children may be more open to influences from diverse sources, such as parents. There is evidence that individuals are more susceptible to influences at transition periods (Caspi & Moffitt, 1991). As a result, it is possible that parental nurturance may influence children's aggressive behavior more at age 10-11 than at age 14-15. Conversely, child effects (aggression influencing parental nurturance) are likely greater during mid-adolescence at age 14-15 compared to late childhood or early adolescence because as children mature physically and cognitively, they have more opportunities to exert power or influence on their parents.

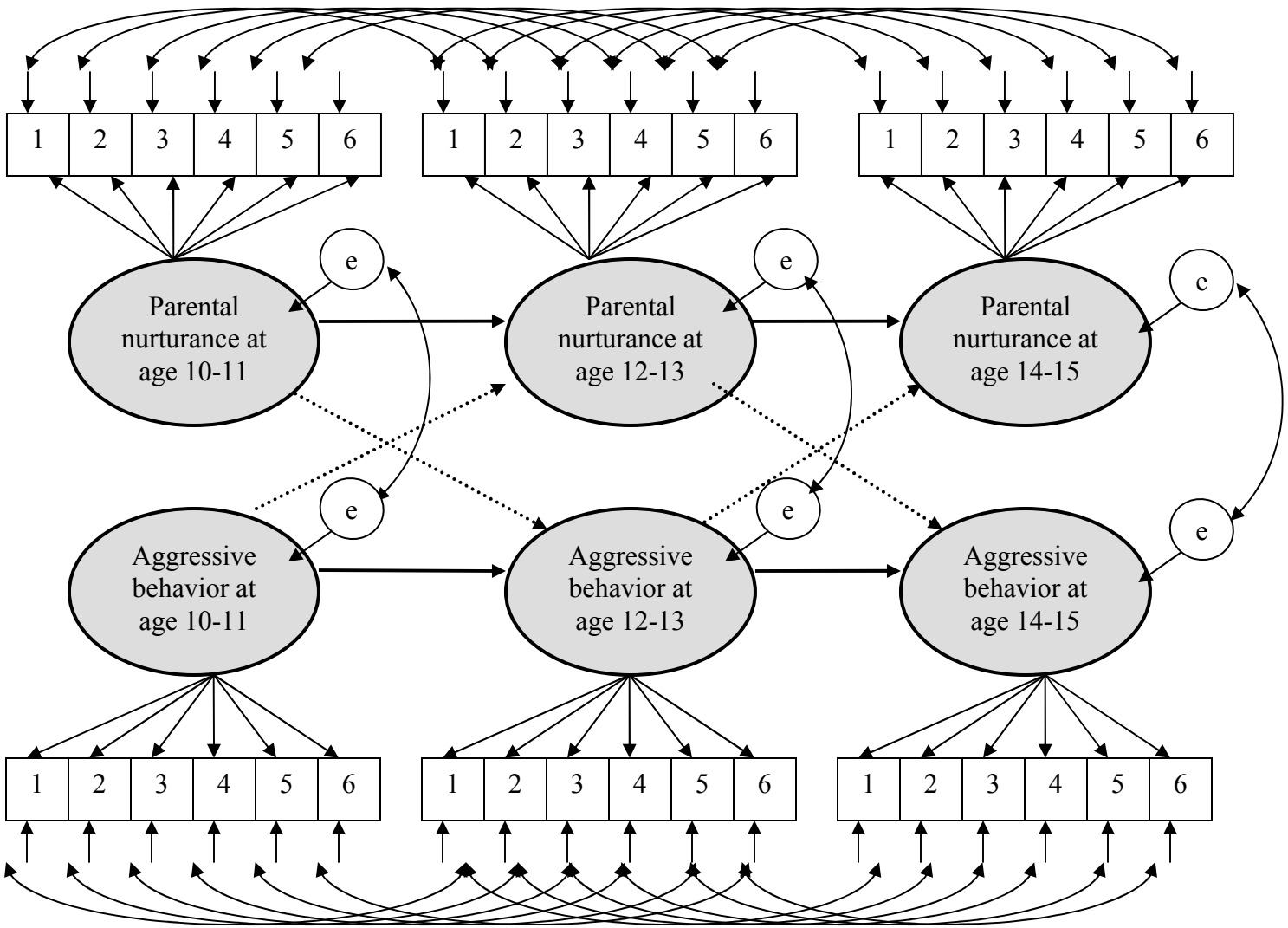

Figure 4.1. The transactional model between parental nurturance and adolescent aggressive behaviors

4.2. Method

4.2.1. Source of Data

The longitudinal data for this study were drawn from the ongoing Canadian National Longitudinal Survey of Children and Youth (NLSCY) survey which is designed to collect information about children's development and well-being from birth to adulthood, based on a stratified probabilistic sample design. The NLSCY, which is jointly conducted by Statistics Canada and Human Resources and Social Development Canada (HRSDC), began in December 1994, with follow-up surveys administered biennially. Children who were living in institutional settings and in households located in the Yukon, Nunavut, and Northwest Territories were excluded from the sample. There were 22,831 children from newborn to 11-year-olds in the first cycle (Statistics Canada, HRDC, 1995).

The person most knowledgeable (PMK) about the child, usually the biological mother, provided information about the child's household context during a face-to-face or telephone interview using computer-assisted interviewing (CAI). The PMK's permission was obtained to administer a self-report questionnaire for children who were 10 years old and older. These children were asked to complete the questionnaire in a private setting to ensure confidentiality. Data collection in the household took approximately two hours, including the interview with the PMK (Statistics Canada, HRDC, 1998).

4.2.2. Sample

Two longitudinal cohorts of children were selected from Cycles 3 through 6 of the NLSCY for this study. The first cohort consisted of children who were 10 and 11 years old in Cycle 3 (1998-99) and became 14 and 15 years old by Cycle 5 (2002-03). The

second cohort consisted of children who were 10 and 11 years old in Cycle 4 (2000-01) and became 14 and 15 years old by Cycle 6 (2004-05). The longitudinal attrition rate for this sample from ages 10-11 to ages 12-13 was small (9%), as was the attrition rate from ages 12-13 to ages 14-15 (8%)[13]. These attrition rates were previously examined and it was shown that the children who remained in the survey had a higher level of socioeconomic status (SES) than children who did not remain in the study.[14] In examining cohort differences (based on socio-demographic variables), it was found that SES was higher for each cohort at some point (for Cohort 1 at age 14-15; for Cohort 2 at age 10-11 and 12-13), but the effect sizes of these differences were mostly small (range of effect size values = .14 to .72)[15]. Based on these results, it was concluded that there were no systematic differences between the children in two different cohorts.

The initial sample (N = 3,144) for this study included only the adolescents who participated in all three selected cycles: for cohort 1 (Cycles 3 to 5) and for cohort 2 (Cycles 4 to 6). Missing values for each item in each scale (i.e., parental nurturance, indirect aggression, and direct aggression) were examined. Sixty-three cases were removed from the sample because they had missing data on each item of all the three scales. The percentage of missing values in the remaining data (N = 3,081) was 21%. Imputation by a matching technique (Jöreskog, 2002) was used to handle the missing values among the ordinal variables in our data. After the imputation, the percentage of missing values in the data was 18%. The description of this imputation technique, including its application in this study is provided below.

[13] Please refer to Study 1, Table 2.1, p.32.
[14] Please refer to Study 1, Table 2.2, p.34-35.
[15] Please refer to Study 1, Table 2.6, p.42-43.

To examine the impact of the use of the imputation by matching technique, three independent sample t-tests and a chi-square test were conducted to examine the demographic differences between children who remained in the final sample, and those who were removed because their scores could not be imputed (because items that have missing values can not be used in further analyses in this study). Children were compared for differences in gender, age, PMK education, and household income. The analyses suggested that children who still had missing data after the imputation, and thus were removed from the final sample, had a PMK with a lower education level than children whose data was successfully imputed. In addition, there was a gender difference in the amount of data that was imputed, with more girls' scores than boys' scores being imputed. However, the effect size of these differences was trivial (see Table 4.1.). The results from these analyses are in line with the missing data pattern in the NLSCY; that is, more boys than girls, and more children living in low SES households than children living in high SES households, tend to have more missing values.

The final sample for this study included 1,416 children between the ages of 10 and 15 years. Of these children, 52% were female, 87% were living with their biological parents, and 66% were living in a household with an income greater than or equal to $50,000; only 8% were living in a household with an income less than $30,000. For 93% of the children, the PMK was the mother of the child, and 65% of the PMKs reported having education beyond high school; 9% of the PMKs had less than secondary schooling.

Table 4.1. Independent Samples T Test and Chi-square Test Results from the Analyses Comparing Children who still had Missing Data after Imputation and those who did not

T-tests	*N*	*M*	*SD*	*df*	*t*	*p*	*d*[a]
Child age				2993.61	-1.94	>.05	
imputed	1416	10.47	.50				
not imputed	1665	10.44	.50				
PMK education				3046	-3.50	<.001	.12
imputed	1416	12.76	2.01				
not imputed	1632	12.51	2.02				
Household income				2612	-1.04	.30	
imputed	1416	7.11	1.70				
not imputed	1198	7.04	1.77				
Chi-square tests	*N*			*df*	χ^2	*p*	
Gender	3081			1	4.28	.04	

[a]Cohen's *d* (1992) was used as the effect size measure. The interpretation is as follows: trivial effect = .00 to .19; small effect = .20 to .49; medium effect = .50 to .79; and large effect ≥ .80.

4.2.3. Missing Data Imputation

Following Jöreskog's (2002) recommendation for the imputation of ordinal variables, the missing values in the data were imputed, using the LISREL 8.80 program (Jöreskog & Sörbom, 2006a), by substituting them with a real value taken from a case with a similar pattern of responses. For example, if child *a* has a missing value on variable X (i.e., the input variable) but has the same response pattern as child *b* on variables Y and Z (i.e., the matching variables), then child *b*'s value for variable X is a reasonable guess for what child *a*'s value would have been. More details about the imputation by matching technique can be found in the PRELIS 2 user's reference guide (Jöreskog & Sörbom, 1999).

For this study, all the items in the parental nurturance, indirect aggression and direct aggression scales were selected as input variables for imputation. Jöreskog (2002) recommends that the matching variables should not be the same as those included in the transactional model, and that they have few missing values. Thus, our matching list included demographic variables, such as gender, age, child's living status, PMK education, household income, and two harsh parenting behavior variables (i.e., "get angry and yell at me", and "hit me or threaten to do so"). The demographic variables were chosen to preserve the descriptive characteristics of the sample. Less than 2% of the cases had missing values on PMK education variable; whereas household income variable had missing values on less than 15% in the data. The harsh parenting behavior variables were chosen because these variables were significantly correlated with both parental nurturance and problem behavior scores at each age. These variables had 15 to 20% missing values at different age groups. The imputation was performed in the LISREL

8.80 program (Jöreskog & Sörbom, 2006a). It should be noted that cases that still had missing values after the imputation were automatically deleted by the LISREL program. These cases would have been removed from the final sample in any case because the statistical analyses for this study uses listwise deletion.

4.2.4. Measures[16]

Parental Nurturance. Parental nurturance was assessed with six items that were taken from the Parenting Questionnaire in the NLSCY (Lempers, Clark-Lempers, & Simon, 1989). The response scale for each item (e.g., "my parents smile at me") ranged from 0 (*never*) to 4 (*always*), with higher scores indicating more nurturing behaviors perceived by the adolescent. The estimate for ordinal coefficient alpha[17] (Zumbo, Gadermann, & Zeisser, 2007) was high for both girls' and boys' sample at 10-11, 12-13, and 14-15 age groups (α = .89, .93, .95 for girls and α = .87, .90, .93 for boys).

Indirect Aggression. Indirect aggression was assessed by five items that were taken from a previously existing scale called 'Child Behavior While Angry' (Lagerspetz et al., 1988). The response scale for each item (e.g., "when I am mad at someone, I tell that person's secrets to a third person") ranged from 0 (*never* or *not true*) to 2 (*often* or *very true*), with higher scores indicating more indirect aggression. The estimate for ordinal coefficient alpha was good for both girls' and boys' sample at 10-11, 12-13, and 14-15 age groups (α = .82, .87, .86 for girls and α = .83, .79, .86 for boys).

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[16] The parental monitoring scale was excluded from this study because previous research has shown that parental monitoring efforts were only weakly associated with adolescent problem behaviors (Kerr & Stattin, 2000; Stattin & Kerr, 2000). The property offence scale was not included in this study for two reasons: (a) research has shown that this problem behavior is more likely to occur at older ages compared to adolescent ages (Lahey et al., 2000), and (b) the scale had a very large amount of missing data. For example, 57% of the cases had a missing value on the second item in the scale (i.e., I steal at home).

[17] The ordinal coefficient alpha is not influenced by the skewness of the item response distribution.

Direct Aggression. Direct aggression was measured by six items. Five of these items were taken from the Ontario Child Health Study (OCHS; Offord, Boyle, Fleming, Blum, & Grant, 1989) and one item belonged to the Antisocial Behavior Questionnaire used in the Montreal Longitudinal and Experimental Study (Tremblay, Pihl, Vitaro, & Dobkin, 1994). The response scale for each item (e.g., "when I am mad at someone, I tell that person's secrets to a third person") ranged from 0 (*never* or *not true*) to 2 (*often* or *very true*), with higher scores indicating more direct aggression. The estimate for ordinal coefficient alpha was good for both girls' and boys' sample at 10-11, 12-13, and 14-15 age groups (α = .86, .89, .90 for girls and α = .88, .85, .90 for boys).

4.2.5. Data Analysis

Structural equation modeling was used to test the transactional relationships between parental nurturance and adolescent problem behavior as illustrated in Figure 4.1. The analyses were performed using the LISREL 8.80 program (Jöreskog & Sörbom, 2006a), with polychoric correlations and asymptotic variance/covariance matrices computed in PRELIS 2.80 (Jöreskog & Sörbom, 2006b). Polychoric correlations were used in order to accommodate the non-normally distributed ordinal variables in the dataset. The diagonally weighted least squares (DWLS; Jöreskog & Sörbom, 2001) method of estimation was used because of its ability to handle violations of multivariate normality associated with the ordinal nature of the variables (Jöreskog, 2002). This method, also known as robust weighted least squares (WLS), is also recommended when there are a large number of indicators in the model and a relatively small sample size (Flora & Curran, 2004).

The WLS method requires a minimum sample size of $(k+1)(k+2)/2$, where k indicates the number of observed variables in the model in order to estimate the weight matrix (Jöreskog & Sörbom, 2001). When the model includes a large number of indicators, obtaining a positive-definite matrix may not be possible due to the requirement of a large sample size when calculating the inverse of the weight matrix (Flora & Curran, 2004). To address this problem, the DWLS method uses the diagonal elements of the original weight matrix (Jöreskog & Sörbom, 1999).

Structural equation modeling, with crossed-lagged effects, was used to examine the direction of effects between parental nurturance and each of the two adolescent problem behaviors in the transactional models. The models were run separately for boys and girls, for each of the adolescent self-reported problem behaviors (i.e., four models in total). As mentioned before, the transactional model is designed for use with longitudinal data. The transactional model used in this study included two variables (i.e., parental nurturance and adolescent aggressive behavior) measured at three time points. With three time points, there are six measurements, eight paths, and three correlations between measures. As can be seen in Figure 4.1., there are four *autoregressive paths* (i.e., paths between the same variable across time indicated with solid direct arrows), four *crossed-lagged paths* (i.e., paths between two different variables across time indicated with dotted arrows), and three *synchronous correlations* (i.e., correlation between two different variables at the same time point indicated with arcs). Depending on the strength of the crossed-lagged paths (i.e., from parental nurturance to adolescent problem behaviors or vice versa), simple inferences can be made regarding the direction of effects (i.e., parent or child effects) between variables. According to the transactional model, full reciprocal

relationships can be observed when crossed-lagged paths at a developmental time are statistically significant.

Following the two-step method in SEM (Anderson & Gerbing, 1988), the relationships between the observed variables and their hypothesized latent variables were evaluated in the measurement model prior to examining the structural paths between parental nurturance and each of the problem behaviors. As can be seen in Figure 4.1., both the factor loadings and the error variances of the observed variables for each latent variable (i.e., parental nurturance, indirect aggression, and direct aggression) were estimated. The metric of the latent variables in the measurement models was specified by setting the variance of the factor to one. The metric of the latent variables in the structural models was specified by setting the factor loading of the first item on each scale to one. The fit of the models was evaluated using four global goodness-of-fit statistics: (a) Satorra-Bentler scaled Chi-Square (SBS χ^2; Satorra & Bentler, 1994), (b) the root mean square error of approximation (RMSEA; Steiger, 2000), (c) the comparative fit index (CFI; Bentler, 1990), and (d) the standardized version of the Root Mean Squared Residual (SRMR; Jöreskog & Sörbom, 2001). The following criterion values for these goodness-of-fit statistics were used based on Hu and Bentler's (1999) recommendations: (a) SBS χ^2 test should be statistically non-significant, (b) RMSEA should be less than or equal to .06, (b) CFI should be .95 or higher, and (c) SRMR should be less than or equal to .08.

4.3. Results

4.3.1. Descriptive Statistics

Ordinal scales do not have a standard unit of measurement or a point of origin (Guilley & Uhlig, 1993); thus, descriptive statistics, such as means and standard deviations on such variables cannot be meaningfully interpreted. Therefore, they are not reported in this study. An inspection of the frequency histograms and skewness and kurtosis values indicated a clear deviation from a normal distribution for all items across all three scales. Polychoric correlations between all items at each age group, separately for each gender and problem behavior are presented in Tables 4.2.-4.7.

Table 4.2. Polychoric Correlations between the Parental Nurturance and the Indirect Aggression Scale Items at Age 10

Item[a]	PN1	PN2	PN3	PN5	PN6	PN7	IA1	IA2	IA3	IA4	IA5
PN1	-	.52	.49	.46	.56	.54	-.23	-.13	-.23	-.14	-.19
PN2	.47	-	.45	.46	.50	.46	-.20	-.16	-.22	-.18	-.16
PN3	.53	.47	-	.58	.55	.56	-.23	-.19	-.23	-.15	-.21
PN5	.56	.49	.60	-	.54	.59	-.24	-.16	-.15	-.10	-.23
PN6	.57	.49	.61	.60	-	.67	-.23	-.17	-.26	-.19	-.21
PN7	.58	.45	.59	.62	.70	-	-.27	-.23	-.21	-.20	-.22
IA1	-.23	-.17	-.22	-.19	-.16	-.24	-	.49	.51	.58	.54
IA2	-.26	-.20	-.29	-.21	-.23	-.19	.52	-	.40	.44	.46
IA3	-.27	-.15	-.25	-.26	-.24	-.26	.54	.35	-	.48	.51
IA4	-.27	-.20	-.26	-.22	-.18	-.25	.59	.50	.60	-	.47
IA5	-.18	-.10	-.20	-.23	-.18	-.18	.41	.35	.42	.46	-

Note. The correlations below the diagonal are for girls and the correlations above the diagonal are for boys.
[a]The first two letters of the variable name indicate the scale it belongs to: PN = parental nurturance IA = indirect aggression. The digit in the variable name indicates the item number in the scale. All items are listed in the Appendix A and B.
n = 735 for girls and n = 681 for boys; $M = 0$; $SD = 1$.

Table 4.3. Polychoric Correlations between the Parental Nurturance and the Indirect Aggression Scale Items at Age 12

Item[a]	PN1	PN2	PN3	PN5	PN6	PN7	IA1	IA2	IA3	IA4	IA5
PN1	-	.52	.57	.54	.57	.51	-.10	-.03	-.13	-.07	-.11
PN2	.63	-	.53	.57	.62	.54	-.10	-.14	-.21	-.12	-.17
PN3	.57	.65	-	.62	.65	.66	-.15	-.10	-.23	-.11	-.11
PN5	.66	.65	.70	-	.64	.65	-.10	-.13	-.15	-.12	-.19
PN6	.68	.67	.67	.74	-	.71	-.10	-.12	-.23	-.13	-.21
PN7	.71	.67	.71	.74	.80	-	-.04	-.06	-.15	-.10	-.16
IA1	-.25	-.26	-.16	-.17	-.21	-.26	-	.36	.36	.53	.25
IA2	-.24	-.28	-.24	-.08	-.19	-.26	-.57	-	.29	.40	.44
IA3	-.19	-.24	-.19	-.14	-.20	-.21	.70	.55	-	.48	.57
IA4	-.22	-.20	-.24	-.20	-.27	-.24	.60	.52	.55	-	.54
IA5	-.11	-.12	-.11	-.04	-.07	-.06	.53	.49	.52	.53	-

Note. The correlations below the diagonal are for girls and the correlations above the diagonal are for boys.
[a]The first two letters of the variable name indicate the scale it belongs to: PN = parental nurturance IA = indirect aggression. The digit in the variable name indicates the item number in the scale. All items are listed in the Appendix A and B.
n = 735 for girls and n = 681 for boys; $M = 0$; $SD = 1$.

Table 4.4. Polychoric Correlations between the Parental Nurturance and the Indirect Aggression Scale Items at Age 14

Item[a]	PN1	PN2	PN3	PN5	PN6	PN7	IA1	IA2	IA3	IA4	IA5
PN1	-	.68	.56	.62	.65	.65	-.11	-.19	-.07	-.09	-.23
PN2	.75	-	.67	.74	.75	.71	-.15	-.08	-.12	-.12	-.19
PN3	.64	.70	-	.70	.66	.69	-.10	-.06	-.08	-.09	-.16
PN5	.71	.80	.74	-	.76	.78	-.11	-.11	-.14	-.14	-.20
PN6	.67	.82	.74	.81	-	.80	-.15	-.04	-.15	-.14	-.20
PN7	.72	.83	.74	.81	.85	-	-.13	-.12	-.10	-.10	-.17
IA1	-.15	-.18	-.17	-.24	-.18	-.22	-	.57	.62	.57	.49
IA2	-.08	-.13	-.15	-.18	-.14	-.18	.58	-	.50	.46	.66
IA3	-.11	-.13	-.11	-.17	-.14	-.10	.60	.35	-	.58	.53
IA4	-.13	-.07	-.10	-.13	-.06	-.12	.69	.58	.56	-	.54
IA5	-.03	-.16	-.15	-.17	-.10	-.13	.56	.54	.49	.56	-

Note. The correlations below the diagonal are for girls and the correlations above the diagonal are for boys.
[a]The first two letters of the variable name indicate the scale it belongs to: PN = parental nurturance IA = indirect aggression. The digit in the variable name indicates the item number in the scale. All items are listed in the Appendix A and B.
n = 735 for girls and n = 681 for boys; $M = 0$; $SD = 1$.

Table 4.5. Polychoric Correlations between the Parental Nurturance and the Direct Aggression Scale Items at Age 10

Item[a]	PN1	PN2	PN3	PN5	PN6	PN7	DA1	DA2	DA3	DA4	DA5	DA6
PN1	-	.52	.49	.46	.56	.54	-.19	-.25	-.28	-.24	-.20	-.23
PN2	.47	-	.45	.46	.50	.46	-.36	-.28	-.30	-.27	-.19	-.32
PN3	.53	.47	-	.58	.55	.56	-.21	-.23	-.27	-.22	-.19	-.32
PN5	.56	.49	.60	-	.54	.59	-.16	-.21	-.22	-.22	-.21	-.29
PN6	.57	.49	.61	.60	-	.67	-.21	-.24	-.36	-.23	-.20	-.33
PN7	.58	.45	.59	.62	.70	-	-.23	-.26	-.29	-.23	-.17	-.26
DA1	-.21	-.17	-.23	-.24	-.16	-.23	-	.56	.49	.35	.42	.56
DA2	-.24	-.16	-.23	-.27	-.20	-.26	.47	-	.58	.50	.46	.54
DA3	-.36	-.21	-.35	-.28	-.33	-.39	.43	.38	-	.62	.59	.63
DA4	-.25	-.18	-.28	-.27	-.17	-.30	.39	.43	.63	-	.64	.59
DA5	-.20	-.25	-.25	-.25	-.26	-.24	.40	.43	.55	.61	-	.64
DA6	-.31	-.18	-.37	-.27	-.21	-.29	.40	.52	.60	.63	.64	-

Note. The correlations below the diagonal are for girls and the correlations above the diagonal are for boys.
[a]The first two letters of the variable name indicate the scale it belongs to: PN = parental nurturance DA = direct aggression. The digit in the variable name indicates the item number in the scale. All items are listed in the Appendix A and B.
n = 735 for girls and n = 681 for boys; $M = 0$; $SD = 1$.

Table 4.6. Polychoric Correlations between the Parental Nurturance and the Direct Aggression Scale Items at Age 12

Item[a]	PN1	PN2	PN3	PN5	PN6	PN7	DA1	DA2	DA3	DA4	DA5	DA6
PN1	-	.52	.57	.54	.57	.51	-.16	-.08	-.18	-.17	-.12	-.25
PN2	.63	-	.53	.57	.62	.54	-.15	-.17	-.13	-.13	-.10	-.25
PN3	.57	.65	-	.62	.65	.66	-.21	-.19	-.16	-.24	-.21	-.27
PN5	.66	.65	.70	-	.64	.65	-.11	-.12	-.12	-.08	-.12	-.15
PN6	.68	.67	.67	.74	-	.71	-.18	-.18	-.14	-.14	-.18	-.24
PN7	.71	.67	.71	.74	.80	-	-.11	-.26	-.29	-.15	-.13	-.23
DA1	-.30	-.33	-.30	-.26	-.31	-.31	-	.43	.42	.56	.40	.53
DA2	-.17	-.23	-.20	-.16	-.25	-.22	.51	-	.18	.43	.29	.34
DA3	-.33	-.32	-.29	-.25	-.27	-.33	.65	.49	-	.55	.66	.66
DA4	-.31	-.37	-.39	-.35	-.27	-.39	.75	.60	.80	-	.53	.61
DA5	-.24	-.22	-.23	-.25	-.24	-.27	.52	.23	.64	.79	-	.60
DA6	-.35	-.35	-.38	-.31	-.29	-.38	.73	.46	.76	.84	.68	-

Note. The correlations below the diagonal are for girls and the correlations above the diagonal are for boys.
[a]The first two letters of the variable name indicate the scale it belongs to: PN = parental nurturance DA = direct aggression. The digit in the variable name indicates the item number in the scale. All items are listed in the Appendix A and B.
n = 735 for girls and n = 681 for boys; $M = 0$; $SD = 1$.

Table 4.7. Polychoric Correlations between the Parental Nurturance and the Direct Aggression Scale Items at Age 14

Item[a]	PN1	PN2	PN3	PN5	PN6	PN7	DA1	DA2	DA3	DA4	DA5	DA6
PN1	-	.68	.56	.62	.65	.65	-.26	-.17	-.19	-.29	-.19	-.31
PN2	.75	-	.67	.74	.75	.71	-.13	-.19	-.21	-.24	-.08	-.28
PN3	.64	.70	-	.70	.66	.69	-.23	-.22	-.18	-.27	-.25	-.35
PN5	.71	.80	.74	-	.76	.78	-.24	-.18	-.20	-.29	-.24	-.30
PN6	.67	.82	.74	.81	-	.80	-.22	-.20	-.25	-.27	-.15	-.32
PN7	.72	.83	.74	.81	.85	-	-.23	-.22	-.23	-.27	-.21	-.34
DA1	-.34	-.34	-.33	-.39	-.30	-.36	-	.56	.66	.59	.54	.62
DA2	-.18	-.17	-.18	-.22	-.18	-.16	.49	-	.57	.54	.42	.50
DA3	-.24	-.30	-.25	-.29	-.21	-.24	.75	.51	-	.70	.61	.75
DA4	-.31	-.36	-.37	-.39	-.31	-.34	.61	.50	.72	-	.59	.65
DA5	-.18	-.24	-.22	-.20	-.21	-.22	.58	.43	.64	.78	-	.64
DA6	-.20	-.31	-.32	-.29	-.28	-.31	.69	.57	.75	.73	.66	-

Note. The correlations below the diagonal are for girls and the correlations above the diagonal are for boys.
[a]The first two letters of the variable name indicate the scale it belongs to: PN = parental nurturance DA = direct aggression. The digit in the variable name indicates the item number in the scale. All items are listed in the Appendix A and B.
n = 735 for girls and n = 681 for boys; $M = 0$; $SD = 1$.

4.3.2. The Indirect Aggression Scale

Girls. The measurement model of the indirect aggression model for girls indicated a good fit to the data (SBS χ^2 (480) = 591.19, $p < .001$; RMSEA = .02; CFI = .997; SRMR = .04). All the factor loadings were statistically significant at $\alpha = .001$ which corresponds to $z_{crit} \geq 3.10$, and they strongly loaded on their hypothesized latent variable (see Appendix C for factor loadings and z-values, and Appendix G for correlations among latent variables). The z-values associated with the standardized residual correlations ranged from -3.38 to 3.81. Jöreskog and Moustaki (2001) suggested that standardized residuals should be consistently less than 4.0. Thus, these results indicate only a small amount of error between the predicted values and the data.

The girls' structural model also suggested a good fit to the data (SBS χ^2 (484) = 608.05, $p < .001$; RMSEA = .02; CFI = .997; SRMR = .05). As can be seen in Figure 4.2., a statistically significant negative association was observed between parental nurturance and indirect aggression over time. Parental nurturance showed a relatively higher stability in the autoregressive paths than indirect aggression. Parental nurturance at age 10 was negatively associated with indirect aggression at age 12, suggesting parent effects. None of the other crossed-lagged paths were statistically significant. The findings failed to confirm reciprocal relationships between parental nurturance and girls' indirect aggression.

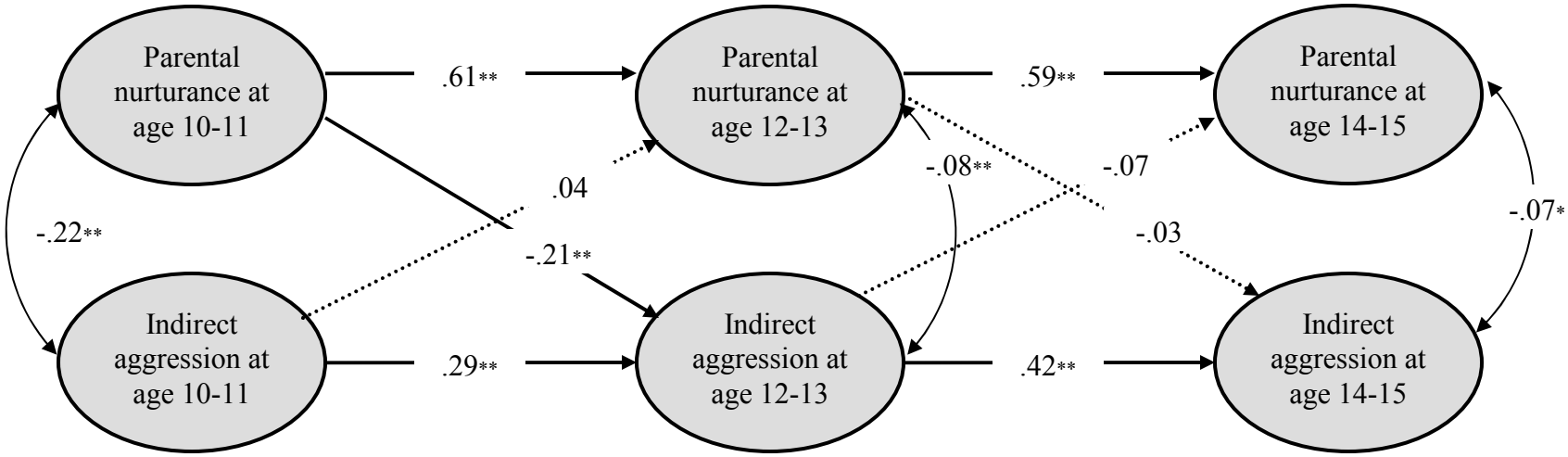

Figure 4.2. The results for the transactional model between parental nurturance and girls' indirect aggression

Note. Completely standardized values are reported. The statistically significant crossed-lagged paths are shown in solid arrows. **p* < .05. ***p* < .01. n = 735.

Boys. The measurement model of the indirect aggression model for boys indicated a good fit to the data (SBS χ^2 (480) = 558.55, $p < .01$; RMSEA = .02; CFI = .997; SRMR = .04). All the factor loadings were statistically significant at $\alpha = .001$, and they strongly loaded on their hypothesized latent variable (see Appendix D for factor loadings and z-values, and Appendix G for correlations among latent variables). The z-values associated with the standardized residual correlations ranged from -3.10 to 2.60, suggesting only a small amount of error between the predicted values and the data (Jöreskog & Moustaki, 2001).

The boys' structural model suggested a good fit to the data (SBS χ^2 (484) = 568.92, $p < .001$; RMSEA = .02; CFI = .997; SRMR = .05). As can be seen in Figure 4.3., similar to girls' indirect aggression model, a statistically significant negative association was observed between parental nurturance and indirect aggression over time, except for at age 14. Both parental nurturance and indirect aggression showed stability in the autoregressive paths over time. Parental nurturance at age 12 was negatively associated with indirect aggression at age 14. None of the other crossed-lagged paths were statistically significant. The findings failed to confirm reciprocal relationships between parental nurturance and boys' indirect aggression.

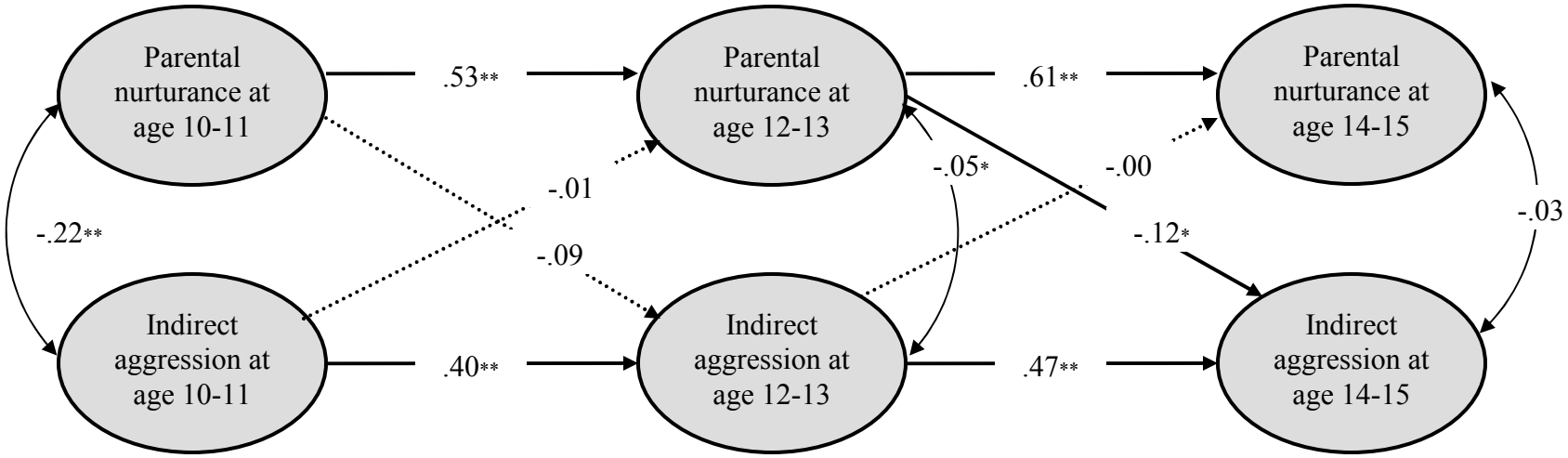

Figure 4.3. The results for the transactional model between parental nurturance and boys' indirect aggression

Note. Completely standardized values are reported. The statistically significant crossed-lagged paths are shown in solid arrows. *$p < .05$. **$p < .01$. n = 681.

4.3.3. The Direct Aggression Scale

***Girls*.** The measurement model of the direct aggression model for girls indicated a good fit to the data (SBS χ^2 (579) = 625.81, $p < .08$; RMSEA = .01; CFI = .999; SRMR = .06). All the factor loadings were statistically significant at $\alpha = .001$, and they loaded on their hypothesized latent variable (see Appendix E for factor loadings and z-values, and Appendix G for correlations among latent variables). The z-values associated with the standardized residual correlations ranged from -2.78 to 3.90, indicating only a small amount of error between the predicted values and the data (Jöreskog & Moustaki, 2001).

The girls' structural model suggested a good fit to the data (SBS χ^2 (583) = 632.71, $p < .001$; RMSEA = .01; CFI = .999; SRMR = .06). As can be seen in Figure 4.4., a statistically significant negative association was observed between parental nurturance and direct aggression over time. Parental nurturance showed relatively a higher stability in the autoregressive paths than direct aggression. Parental nurturance at age 10 was negatively associated with direct aggression at age 12, suggesting parent effects. None of the other crossed-lagged paths were statistically significant. The findings failed to confirm reciprocal relationships between parental nurturance and girls' direct aggression.

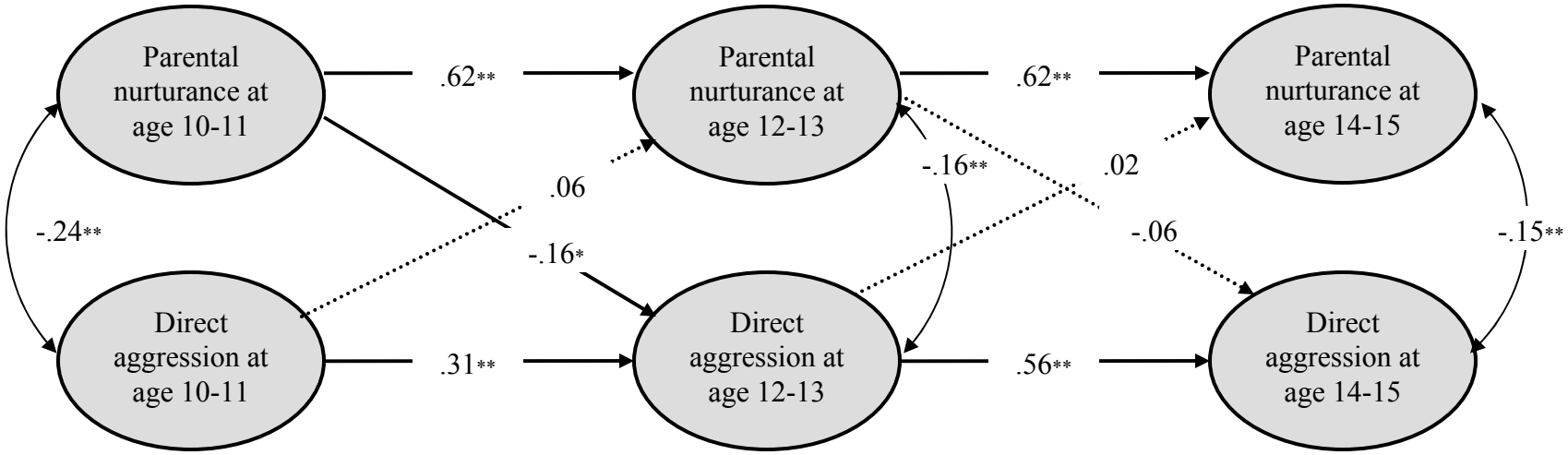

Figure 4.4. The results for the transactional model between parental nurturance and girls' direct aggression

Note. Completely standardized values are reported. The statistically significant crossed-lagged paths are shown in solid arrows. *$p < .05$. **$p < .01$. n = 735.

Boys. The measurement model of the direct aggression model for boys indicated a good fit to the data (SBS χ^2 (579) = 741.77, $p < .001$; RMSEA = .02; CFI = .996; SRMR = .05). All the factor loadings were statistically significant at $\alpha = .001$, and they loaded on their hypothesized latent variable (see Appendix F for factor loadings and z-values, and Appendix G for correlations among latent variables). The z-values associated with the standardized residual correlations ranged from -2.94 to 4.35, suggesting only a small amount of error between the predicted values and the data (Jöreskog & Moustaki, 2001). The only standardized residual value greater than 4.0 (i.e., 4.35) was observed in the correlation between the third and the fifth items in the direct aggression scale.

The boys' structural model suggested a good fit to the data (SBS χ^2 (583) = 758.11, $p < .001$; RMSEA = .02; CFI = .995; SRMR = .06). As can be seen in Figure 4.5., similar to girls' direct aggression model, a statistically significant negative association was observed between parental nurturance and direct aggression over time. Both parental nurturance and direct aggression showed moderate stability in the autoregressive paths over time. Parental nurturance at age 12 was negatively associated with direct aggression at age 14. None of the other crossed-lagged paths were statistically significant. The findings failed to confirm reciprocal relationships between parental nurturance and boys' direct aggression.

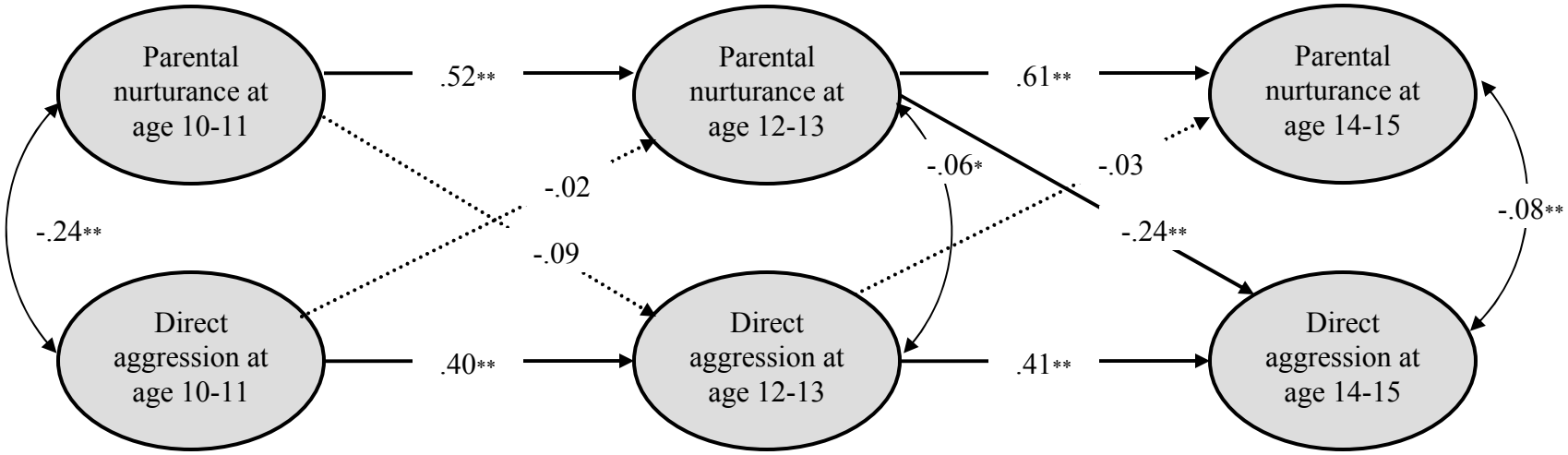

Figure 4.5. The results for the transactional model between parental nurturance and boys' direct aggression

Note. Completely standardized values are reported. The statistically significant crossed-lagged paths are shown in solid arrows. *$p < .05$. **$p < .01$. n = 681.

4.4. Discussion

The main objective of this study was to test a transactional model between parental nurturance and two different types of aggressive behavior during early to middle adolescence. Overall, the results favored parent effects rather than child effects. These findings are in line with the view that parents continue to influence their children's development throughout adolescence (Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000). More specifically, results indicated that adolescents who perceived their parents as nurturing were less likely to engage in aggressive behaviors. However, perceptions of parental nurturance were not influenced by adolescent reports' of aggressive behaviors. A difference in the timing of parental influence was observed between the models for boys and girls. For girls, parent effects were observed at younger ages, that is, between the ages of 10-11 and 12-13 for both direct and indirect aggression; whereas for boys, they were observed at older ages, between the ages of 12-13 and 14-15, for both outcome variables. Moreover, a higher stability was observed for parental nurturance than adolescent aggressive behaviors in each of the models.

Although the lack of child effects is somewhat inconsistent with most of the current findings in the literature, it is not without precedent. In a recent study based on six waves of data collected annually, researchers reported that adolescent girls' conduct disorder did not influence parental warmth, but low parental warmth predicted changes in girls' conduct disorder (Hipwell et al., 2008). In accordance with these findings, the results from this study showed that adolescents' aggressive behaviors did not influence parental nurturance, but increases in parental nurturance predicted decreases in adolescent aggressive behaviors.

There is consensus that parenting behaviors may not be equally influential on children/adolescent outcomes throughout childhood and adolescence. Maccoby (2002) argued that when children are young, parents have more influence on children than children have on parents. An alternative way of saying this is that parent effects may be differential depending on particular developmental transition period. For example, parent effects may be more influential during the transition from childhood to adolescence, but these effects may decrease as adolescents enter young adulthood.

Perceptions of parental nurturance at age 10 influenced girls' direct and indirect aggression at age 12. This age period marks the onset of pubertal development in girls (Fechner, 2003). In accordance with this statement, the findings from a recent NLSCY-based study indicated that 5% of the girls and 3% of the boys in the sample[18] reported having entered puberty by age 10 (Arim, Shapka, Dahinten, & Willms, 2007). Puberty represents a transition period with rapid developmental changes in adolescents, including physical, psychosocial, and cognitive changes (Susman & Rogol, 2004). It is possible that these rapid changes make adolescents a vulnerable population to diverse influences, including parental influences. From this perspective, positive parental influences, such as parental nurturance, may act as a protective factor to reduce the likelihood of engaging in problem behaviors because parents' nurturing behaviors may eliminate adolescents' feelings of insecurity, fear, and anger, which are known as risk factors for the occurrence of problem behaviors. In line with this assertion, a recent study indicated that early maturing girls (defined by having their first period before age 12) who reported low

[18] The sample in the Arim et al. (2007)'s study was a larger NLSCY sample, which included children from the sample of the present study.

parental nurturance were more likely to engage in both physical and relational aggression (Mrug et al., 2008).

In this study, for girls, parental effects seem to be stronger during the transition from 10-11 to 12-13 years (early adolescence) as opposed to the time period from 12-13 to 14-15 years (middle adolescence). It is possible that the later period (i.e., middle adolescence) may be marked by the formation and strengthening of other social influences, such as peer context, which may lead to a decrease in parental influences. For boys, given that they enter puberty approximately two years later than girls (Arim et al., 2007), the later influence of parental nurturance on boys' problem behaviors that was found in this study (at age 12 and at age 14) may indicate that boys like girls can benefit from positive parenting behaviors, such as parental nurturance, to reduce the maintenance of problem behaviors at the onset of puberty. It should be noted that although pubertal development may seem to be a plausible explanation, there can be other explanations (e.g., social factors) for the presence of parental nurturance effects at these age groups.

The developmental changes during adolescence occur at a time when most adolescents are making a transition from elementary to secondary school. According to a stage-environment fit perspective (Eccles et al., 1993), adolescents whose social environments are responsive to their needs are less likely to experience negative psychosocial outcomes, such as depression and delinquency. For example, Gutman and Eccles (2007) found that adolescents who reported more positive identification with their parents from Grade 7 through graduation from high school year were less likely to have depression. In accordance with these findings, the results from this study indicated that parental nurturance, which can be an indicator of a developmentally appropriate family

environment, is associated with a decrease in negative outcomes, such as aggressive behaviors.

Although the findings from this study failed to provide support for reciprocal effects between parental nurturance and adolescent aggression, they do not necessarily reject a bidirectional association between parenting and adolescent problem behaviors. Parent effects were observed in the presence of child effects in the model. For example, it is possible that the reciprocal relationships between parental nurturance and problem behavior were established in childhood, but remained stable during adolescence. Thus, statistically significant associations between parental nurturance and adolescent aggression could not be observed due to lack of transactions between parents and adolescents (or because of established stable interactions).

Levels of parental nurturance for both boys and girls were highly stable across three age groups, which is consistent with previous research showing that positive parenting interactions are also stable (Loeber, Drinkwater, Anderson, Schmidt, & Crawford, 2000). In contrast to boys, girls' indirect and direct aggression at age 12 showed relatively less stability. This may be a result of this age period being a developmental transition period for girls (but not for boys). It is possible that girls' scores during this time are showing less stability because they are more influenced by their environment, including the effects of their parents and peers, which may decrease or increase their likelihood of engaging in different problem behaviors. Alternatively, girls may be learning other types of problem behaviors during this period, including indirect aggression (Björkqvist et al., 1992).

The stability in parental nurturance and adolescent aggression may be a reason for not detecting statistically significant crossed-lagged effects because the latter is estimated after controlling for stability effects (Hoyle, 2007). Thus, in the presence of strong stability coefficients, it is difficult to observe statistically significant cross-lagged effects. There may be other reasons why reciprocal effects were not detected in this study. First, one might ask why adolescent problem behaviors influence other parenting behaviors, such as control or support (Stice & Barrera, 1995), but not parental nurturance. For example, researchers found that worrying, showing distrust, and monitoring can be reactions to adolescent problem behaviors (Kerr, Stattin, & Pakalniskiene, 2008); thus, these parenting behaviors are open to change in the face of adolescent problem behaviors. However, parental nurturance may be less susceptible to change even in the presence of adolescent problem behaviors compared to parenting behaviors such as worrying, showing distrust, and monitoring, because adolescents may have a working model (e.g., beliefs, attitudes, values, and experiences) of nurturance from the past, which may guide their perceptions' of their parents' behaviors potentially in a similar way over time (see Kuczynski et al., 1997 for a working model example).

Another conceptual reason for the lack of reciprocal effects could be that parents may not know about their children's problem behavior during adolescence, especially if these behaviors usually occur outside the home. For example, in this study, indirect aggression was assessed by adolescent reports' of their behaviors in manipulating their friendships. It is very likely that parents may not be aware of their adolescent's manipulation of friendships because such behaviors often take place away from parents, in particular, in older ages when parents have less opportunities to supervise their

adolescent children. In line with this argument, our findings, regardless of gender and age, indicated that the association between parental nurturance and indirect aggression was less strong in magnitude than that of parental nurturance and direct aggression.

The finding of parent effects suggests that parental nurturance is a determinant in the maintenance of adolescent problem behaviors. It appears that as adolescents go through puberty, parental nurturance may have a positive influence in reducing the likelihood of both girls' and boys' indirect and direct aggression. These findings highlight the need to promote positive parenting in adolescence, including the strengthening of nurturing behaviors to decrease the potential occurrence of problem behaviors. Moreover, although boys did not demonstrate much change in their levels of direct and indirect aggression, some change in girls' direct and indirect aggression was observed at age 12-13, indicating a transition period. These findings indicate that both changes within the adolescent and in the environment, such as high versus low nurturance result in changes in adolescent problem behaviors. Thus, another important implication for prevention and intervention is that both parents and adolescents should be supported during adolescents' developmental transition periods. This also highlights the importance of adopting a developmental-contextual framework in which both adolescents and their interactions with their family are considered in tailoring prevention and intervention programs. As an example, the results from the Earlscourt Girls Connection (EGC) intervention program for aggressive girls suggested that focus on girls' developmental changes as well as salient relationship contexts, such as family and peers resulted in decreases in problem behaviors, such as delinquency (Pepler, Walsh, & Levene, 2004).

4.4.1. Limitations, Strengths, and Future Directions

Several limitations of this study need to be noted as they provide directions for future research. First, only adolescent self-report data were used in this study. The use of adolescent self-report may have increased the likelihood of shared method invariance; however, the use of SEM minimizes this effect by allowing correlations among the error terms over time (Cole, 2006). In addition, although the use of multiple informants is highly encouraged in examining parent-child relationships (Smetana, Crean, & Daddis, 2002), researchers typically find similar results when they use both parent and adolescent reports (Kerr & Stattin, 2003; Laird et al., 2003). As well, arguably, it is adolescents' perceptions of their parents' behaviors rather than parents' perceptions of their own behaviors which are linked to adolescent problem behaviors (Smetana et al.). That said, we would have more confidence in the findings if both parents' and child reports had been used. It should also be noted that with the age range of the sample in this study, the use of parent-reports was not possible because parent-report data on adolescent outcomes are not collected after the age of 11 in the NLSCY dataset.

The reliance on adolescent self-report data may be a reason why child effects were not observed in this study. Specifically, adolescents may not perceive the changes in their parents' nurturing behaviors because of their working model of nurturance from the past. It is possible that parent reports may have revealed such changes if parent reports of adolescent problem behaviors were used. Future researchers may examine this possible explanation by replicating this study with parent reports of parental nurturance and comparing the results with adolescent self-report data.

The use of a global measure of parental nurturance may have weakened the ability to detect statistically significant associations between parental nurturance and adolescent aggression. More specifically, a domain-based assessment of parental nurturance with more sensitive items assessing nurturance in specific contexts may have revealed a more precise relationship between parental nurturance and adolescent aggression. In a similar vein, measures of perceived parenting did not differentiate between mothers' and fathers' parenting behaviors. It is possible that adolescent problem behaviors are differentially related to mothers' and fathers' nurturing behaviors. Future research should examine the differences in parent-adolescent reciprocal effects separately for mothers and fathers.

A second limitation of this study is related to the generalizability of the findings to other samples. More specifically, in addition to the sample reduction due to attrition, there was a large amount of missing data due to non-response. Although imputation was used to handle missing data, the scores on the parental nurturance and two aggression scale items could not be imputed for approximately half of the initial sample because their demographic characteristics could not be matched with other cases in the sample. As such, the final sample represents a fairly homogeneous group of adolescents. Therefore, the results may be unique to this sample and not generalizable to other samples. Given results from the attrition analyses pointing a pattern of attrition among adolescents living in low SES families and those who have high scores on problem behaviors. Replication is needed with samples that include adolescents with these characteristics, specifically given the possibility that child effects may be more commonly observed in samples of adolescents who have high levels of problem behaviors (Lytton, 1982).

A third limitation of this study is related to the timing of data collection. The two-year intervals may have been too long for us to detect statistically significant relationships between parental nurturance and adolescent aggression given the rapid developmental changes that may occur during this period. Gollob and Reichardt (1987) indicated that shorter or longer time-lags in longitudinal data collection may result in different effects. It would be worthwhile to replicate this study with one-year intervals.

Despite these limitations, the findings from this study contribute to the growing body of literature that recognizes both directions of influence in parent-adolescent relationships. A major strength of this study is that the ordinal nature of the observed variables (i.e., items in the parental nurturance and indirect and direct aggression scales) has been taken into account in both missing data imputation and SEM analyses. Previous research has shown that when the data is non-normal and categorical, the use of Pearson correlations and maximum likelihood estimation create high level of bias in parameter estimates, standard errors, and factor intercorrelations (DiStefano, 2002). Future studies should pay attention to such threats in order to produce accurate interpretations of the results based on categorical data. Another strength of this study is that three waves of data were used to examine the reciprocal effects between parental nurturance and adolescent problem behaviors. In addition, the models were tested separately for boys and girls in an attempt to recognize differences in the measurement of problem behaviors between boys and girls (i.e., lack of invariance of indirect and direct aggression scores across gender).

Previous researchers have noted that the style of the transaction and subsequent outcomes may be influenced by the interaction between parent and child characteristics

(Magnusson, 1988). In this study, both parental nurturance and adolescent aggression can be considered as parent and child characteristics, respectively. However, a strategy in future research with transactional models can be to account for multiple parent and child characteristics, such as parental nurturance in depressed mothers or aggressive behaviors in children with disabilities. From a developmental perspective, models that can capture the full emergence of a problem behavior and its stability or change over time will be invaluable for identifying the developmental period(s) in which the child (or the environment) is more influential.

In summary, there is still much to learn about the nature of the relationship between parenting and adolescent problem behaviors. Future research is needed to refine the application of transactional models with particular consideration of parent and child characteristics, as well as their combined effects on their reciprocal interactions within broader social contexts. Although this study moves us forward in our conceptualization and understanding of parent-adolescent relationships, there are clearly factors that warrant further examination before we can truly understand the reciprocal nature of the parent-adolescent relationships.

4.5. References

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5. CONCLUDING CHAPTER

The overall objectives of this research were twofold: (a) contribute to the area of measurement of parenting and problem behaviors during adolescence, and (b) contribute to a growing literature on reciprocal models which investigate the relationship between parenting behaviors and problem behaviors over time. Three studies were conducted to address these research objectives using data from the Canadian National Longitudinal Survey of Children and Youth (NLSCY). The selection of the NLSCY was purposeful because the dataset has been widely used to investigate Canadian children's health and development and the results have important implications for Canadian social policy. Overall, the findings provided limited support for the utility of the parenting and problem behavior scales in assessing the underlying behavior in each scale and suggested that the effect of parental nurturance on adolescent aggression was stronger than the effect of adolescent aggression on parental nurturance at transition periods. The purpose of this chapter is to provide a review of the findings from the three studies and discuss their overall implications, with suggestions for future research.

The first study evaluated the factor structure of the NLSCY parenting behavior scales and examined whether the observed scores on parenting behavior scales from a longitudinal sample of adolescents between the ages of 10 and 15 were invariant. Regarding the factor structure of the scales, none of the hypothesized NLSCY parenting behavior models showed a good fit to the data, indicating a psychometric inadequacy of these scales in this sample (Messick, 1980). From the perspective of Loevinger's (1957) three-component model of construct validity (i.e., substantive, structural, and external components), these results failed to provide support for the structural component of

construct validity of the specific inferences made from the NLSCY parenting behavior scales. Following Loevinger's recommendations, a possible explanation for these findings may be that the constitution of the pool of items for these scales was poor, suggesting a lack of support for the substantive component of validity. In other words, the items are not adequately representing each of the specific parenting behavior construct, and therefore, the measurement models fail to provide support for the structural component of construct validity.

Through a minor modification (based on conceptual and empirical reasons) in Parental Nurturance and Parental Monitoring scales, the factor structure showed a good fit to the data across all three age groups, thus providing support for the structural component of validity. This study was the first to evaluate and refine the scales of an adolescent self-report parenting questionnaire used in a national longitudinal dataset. Although the results indicated that the two revised models that were proposed appeared to be potentially useful in assessing parental nurturance and monitoring efforts in adolescents between the ages of 10 and 15, it was concluded that future research is needed to provide support for their ability to predict adolescent outcomes, emphasizing the need to provide support for the external component of construct validity (Loevinger, 1957). A note should be made here regarding why the external component of construct validity for the Parental Monitoring scale was not evaluated in this work. This was because previous research has shown that parental monitoring efforts were only weakly associated with adolescent problem behaviors (Kerr & Stattin, 2000; Stattin & Kerr, 2000).

Regarding the measurement equivalence in these scales, as expected, only configural invariance (i.e., equal factor structure) was obtained for the revised nurturance and monitoring scales, indicating that the items were functioning differently at different age groups representing a transition from late childhood/early adolescence to middle adolescence. From a measurement perspective, caution should be taken when making score comparisons between these three age groups because legitimate comparisons cannot be ensured due to lack of loading invariance (i.e., presence of item bias). From a developmental perspective, an important implication of these results is that developmental changes through adolescence may reflect developmental shifts in the relevance of these parenting behaviors at particular ages. Specifically, some parenting behaviors may change form or disappear across different developmental periods. An intriguing line of research would be studying which specific parenting behaviors are relevant as children go through adolescence.

In the second study, a similar analytical approach was taken to examine the measurement properties of three adolescent problem behaviors (i.e., Indirect Aggression, Direct Aggression, and Property Offence). The multi-group confirmatory factor analysis (MG-CFA) method that I used in this study is different than the longitudinal measurement invariance analysis that I conducted in the first study. Specifically, MG-CFA allows testing invariance across multiple samples (in this case across boys and girls and across three different age groups). The first study included a longitudinal sample of children, that is, I did not have multiple samples of children.

There were two motivations to conduct the second study: (a) no empirical work has previously confirmed the factor structure of the NLSCY problem behavior scales, and

(b) the differences in the expression of problem behaviors between boys and girls and across different ages have been a strong argument in research with little empirical support (see Dodge, Coie, & Lynam, 2006; Zahn-Waxler, Crick, Shirtcliff, & Woods, 2006 for a discussion). As hypothesized, the results supported the structure of these scales and indicated that the expression and the manifestation of these problem behaviors mostly varied between boys and girls and across the three adolescent age groups. All three scales achieved configural invariance across gender and age, indicating the presence of one single problem behavior that is being assessed across these groups. The Indirect Aggression scale achieved loading invariance across gender and for the 12 versus 14 year-olds; whereas the Direct Aggression scale achieved loading invariance for only the 10 versus 12 year-olds. These findings suggested that there is a structural equivalence in each problem behavior across all groups; however, similar expression of these problem behaviors cannot be assumed across all age groups in this sample.

A major research aim in the first and second manuscripts was to contribute to the area of measurement of parenting and adolescent problem behaviors, respectively, by not only examining the factor structure of the scales, but also evaluating a relatively less investigated aspect of measurement properties of scales, namely, measurement equivalence or invariance. The paucity of research examining measurement invariance in developmental research can be due to the confounding effects of developmental differences. In other words, it is difficult to disentangle the potential causes of lack of measurement invariance in developmental research.

The issue of assessing the same or commensurable constructs in longitudinal research is a fundamental validity question, but it has only recently become a major focus

in research (Lloyd, Zumbo, & Siegel, in press; Meade, Lautenschlager, & Hecht, 2005). To my knowledge, this fundamental issue has not been raised nor empirically studied using data from other national longitudinal datasets, such as National Longitudinal Survey of Youth (NLSY) in the United States, Avon Longitudinal Study of Parents and Children (ALSPAC) in the United Kingdom, and Dunedin Multidisciplinary Health and Development Study (DMHDS) in New Zealand despite great interest in examining developmental trajectories of problem behaviors and parenting and family processes (see Coley, Votruba-Drzal, & Schindler, 2008; Odgers et al., 2008).

There is no doubt that developmental changes add a level of complexity in research design and methodology. Qualitative changes within the individual, within the environment, and in the interaction between the two over time are viable in transactional models (Ollendick & Vasey, 1999; Sameroff & Mackenzie, 2003). Thus, building on the findings from the first two manuscripts, in the third study, four transactional models over a four-year period, which depicted the reciprocal relationships between parental nurturance and each of the two adolescent aggressive behaviors (i.e., indirect and direct aggression) were examined separately for boys and girls. The findings failed to demonstrate reciprocal effects, but confirmed parent effects at different ages for girls and boys. For girls, parental nurturance at age 10 was associated with both indirect and direct aggression at age 12. For boys, parental nurturance at age 12 was associated with both aggressive behaviors at age 14. These findings suggested that there may be different developmental periods when the observed effect of the parent may be stronger than the effect of the adolescent. Two alternative explanations, onset of puberty and stage-environment fit during school transition, were proposed. It is very likely that both of

these explanations played a role in the obtained results. An important contribution of this study was to show that parental nurturance, among many other positive parenting strategies, can have a protective role for adolescents, reducing their likelihood of engaging in aggressive behaviors during transition periods.

Sameroff and MacKenzie (2003) indicated that the broader goal of understanding transactional associations between parenting and adolescent problem behaviors is to help to improve the lives of youth at risk. From a practice perspective, observing stronger effects of parents or adolescents does not really matter because both adolescents and parents are influenced by the presence of problem behaviors. Thus, prevention and intervention programs should target both adolescents and their parents to prevent the occurrence of adolescent problem behaviors. The findings from the third study emphasize that intervention and prevention programs that are designed to promote positive parenting can focus on improving parental nurturance to prevent the development and maintenance of adolescent problem behaviors.

Although the investigation of the reciprocal effects between parenting behaviors and adolescent problem behaviors presents advancement in our conceptualization of parent-adolescent relations, one of the remaining caveats in parenting and problem behavior research is a lack of assessment of the quality of the existing measures. For example, Ramey (2002) indicated that there are virtually no definitions of parenting itself. Other researchers have emphasized the need to clarify parenting behavior constructs. For example, Kerr and colleagues argued that parental knowledge cannot be seen as a measure of parenting (Kerr, Stattin, & Engels, 2008). Similarly, the quality assessment of problem behaviors across gender and life-span remains a challenge in

developmental research (Achenbach & Rescorla, 2006). Despite these caveats, the scores on these measures often indicate important clues about potential consequences, such as implications for practice, policy, and research. In light of the measurement issues in parenting and problem behavior scales, it is important to evaluate the ethical component of construct validity (Messick, 1980). As Messick emphasized, psychometric evidence for a particular measure is not adequate to assume the appropriate use of the measure. This study provided limited psychometric evidence for the parenting and problem behavior scales; therefore, the results of this study should be taken into account in an evaluation of the potential consequences of the use of these measures.

5.1. Limitations, Strengths, and Future Directions

Several limitations of this work have already been discussed in detail at the end of each manuscript. However, there is one limitation relevant to all three manuscripts, the handling of missing data, which can also be described as an inevitable issue with latent variable analysis in longitudinal studies. Failure to account for the influence of missing data can create bias in the estimation of the parameters, and ultimately be a threat to validity (Schafer & Graham, 2002). To date, several different missing data techniques for structural equation modeling have been offered (see Allison, 2003 for a review). However, most of these techniques assume a normal distribution of the data. Ordinal variables by their nature have non-normal distributions; therefore, the use of missing data imputation techniques that assume normality may not be effective in handling missing data. Recently, several researchers have described different strategies for handling missing data in ordinal variables (Demirtas & Hedeker, 2008; Graham, 2009; Jöreskog,

2002; Yuan & Bentler, 2000), however, more research is needed to ensure the efficiency of these methods.

In this work, complete case analysis (i.e., listwise deletion) was used in the first two studies due to the evaluation of a measurement model and the large size of the initial sample. I believe that the bias in the estimates was minimal because the differences between the cases which had complete data versus those who did not indicated trivial to small differences in effect size. In the third study, following Jöreskog's (2002) recommendation, I used a matching technique to impute the missing values in the data by simply substituting them with a real value taken from a case with a similar pattern of responses. As mentioned before, the use of this method may have created a homogeneous sample of adolescents. However, given the known pattern of the missing data in the NLSCY dataset (e.g., children who come from low socioeconomic backgrounds are more likely to drop from the survey or have missing values) and the conclusions that were made cautiously in light of the known missing data pattern, confidence can be placed in the results from this study.

A challenge in analyzing transactional models with quantitative methods is the assessment of a dynamic system (Sameroff & MacKenzie, 2003). Specifically, a transactional model theorizes that the child is influenced and changed by the environment and the environment is changed by the child's restructured understanding of the environment. It is often difficult to determine whether the changes in both the child and the environment really occur as a result of continuous dynamic interactions. Sameroff and MacKenzie acknowledged this challenge as a theoretical barrier (i.e., empirical assessment of a dynamic system) in their recent work.

Despite this limitation, a strength of this research is the use of a transactional model for examining reciprocal relationships between parental nurturance and adolescent aggression. Specifically, the transactional model allowed examination of reciprocal effects between parental nurturance and adolescent aggression from a developmental perspective that focused not only on the growing adolescent, but also on his or her parenting context (i.e., equal emphasis on the individual and the environment). A unique contribution of this study is that the results from the transactional model suggested a developmental period where the lives of adolescents and their parents can be potentially improved by strengthening nurturing behaviors.

Another strength of this study is methodological. Specifically, the ordinal nature of the observed variables (i.e., items in scales) has been taken into account in both statistical analyses and missing data imputation. In addition, the use of confirmatory factor analysis (as opposed to correlations) and structural equation modeling (as opposed to multiple regression) allowed taking into account measurement error in the observed variables. Finally, the use of three waves of data to examine the reciprocal effects between parental nurturance and adolescent problem behaviors provided a more robust test of transactional models and a more complete coverage of the adolescent period in the life span.

There are many ways to extend this work in future research. First, potential moderators of parent-adolescent relationships, such as maternal depression should be added into the transactional model. In addition, the effects of a broader social context, such as neighborhood influences should be incorporated. Research has shown that neighborhood characteristics are associated with both parenting practices (Kotchick &

Forehand, 2002) and adolescent outcomes (see Leventhal & Brooks-Gunn, 2000 for a review). An important line of research would be examining how neighborhood factors play a role in reciprocal relations between parents and adolescents.

Several researchers have previously observed curvilinear relationships between some parenting behaviors, such as control and support, and adolescent problem behaviors (Stice, Barrera, & Chassin, 1993). Future research can account for these curvilinear relationships in transactional models by using latent growth curve modeling. The use of advanced statistical techniques is highly regarded in developmental research; however, most of these methods are limited for use with quantitative survey designs. Transactions in parent-adolescent relations should also be examined in interview studies, observational studies, and intervention studies. Findings from such studies would certainly enhance and enrich our understanding of parent-adolescent relationships.

5.2. Conclusion

This study aimed to address two current challenges in adolescent development research, namely, examining the quality of existing parenting and adolescent problem behavior measures, and recognizing bidirectionality in parent-adolescent relations. Two important findings emerged. First, the manifestation and expression of parenting and problem behaviors may change as adolescents mature. We need to ensure that our interpretation of their scores, regardless of gender, is appropriate at different ages. Second, parental nurturance appears to play a role in reducing the development and maintenance of problem behaviors at transition periods. Strengthening parents' nurturing behaviors could be a priority area in parenting and positive youth development intervention and prevention programs. The challenges in studying the relationship

between parenting behaviors and adolescent problem behaviors are tremendous given the complexity of the dynamic nature of this relationship. This work is far from providing a complete picture of parent-adolescent interactions; however, it uniquely contributes to our understanding of adolescent development within the family context.

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APPENDICES

Appendix A: Parenting Behavior Items

Name of the scale	Item code	Item Statement[a]
Parental nurturance	PN1	Smile at me.
	PN2	Praise me.
	PN3	Listen to my ideas and opinions.
	PN4[b]	And I solve a problem together whenever we disagree about something.
	PN5	Make sure I know I am appreciated.
	PN6	Speak of the good things I do.
	PN7	Seem proud of the things I do.
Parental rejection	PR1	Soon forget a rule they have made.
	PR2	Nag me about little things.
	PR3	Only keep rules when it suits them.
	PR4	Threaten punishment more often than they use it.
	PR5	Enforce a rule or do not enforce a rule depending upon their mood.
	PR6	Hit me or threaten to do so.
	PR7	Get angry and yell at me.
Parental monitoring	PM1	Want to know exactly where I am and what I am doing.
	PM2[c]	Let me go out any evening I want.
	PM3	Do tell me what time to be home when I go out.
	PM4	Find out about my misbehavior.
	PM5	Take an interest in where I am going and who I am with.

[a]All items are taken from the Parenting Questionnaire developed by Lempers et al. (1989).
[b]This item was excluded from the revised parental nurturance scale.
[c]This item was excluded from the revised parental monitoring scale.

Appendix B: Problem Behavior Items

Name of the scale	Item code	Item statement[a]	Item taken from
Indirect aggression[a]	IA1	I try to get others dislike him/her.	CBWA
	IA2	I become friends with another as revenge.	CBWA
	IA3	I say bad things behind his/her back.	CBWA
	IA4	I say to others: let's not be with him/her.	CBWA
	IA5	I tell that person's secrets to a third person.	CBWA
Direct aggression	DA1	I get into many fights.	OCHS
	DA2[b]	I react with anger and fighting.	MLES
	DA3	I physically attack people.	OCHS
	DA4	I threaten people.	OCHS
	DA5	I am cruel, bully, mean to others.	OCHS
	DA6	I kick, bite, hit other children.	OCHS
Property offence	PO1	I destroy my own things.	OCHS
	PO2	I steal at home.	OCHS
	PO3	I destroy things belonging to others.	OCHS
	PO4	I tell lies or cheat.	OCHS
	PO5	I vandalize.	OCHS
	PO6	I steal outside the home.	OCHS

Note. CBWA = Child Behavior When Angry. OCHS = Ontario Child Health Study. MLES = Montreal Longitudinal and Experimental Study.
[a]All the items taken from the Child Behavior When Angry scale (Lagerspetz et al., 1988) began with the following phrase: "when I am mad at someone, …"
[b]The complete statement of this item is "when another child accidentally hurts me (such as bumping into me), I assume that the other child meant to do it, and then react with anger and fighting".

Appendix C: Factor Loadings and *z*-values from the Indirect Aggression Measurement Model for Girls

Latent Variable	Item	Factor loading[a]	*z*-value[b]
Parental nurturance at age 10-11	PN1	.77	24.55
	PN2	.63	17.30
	PN3	.74	21.16
	PN5	.77	26.28
	PN6	.80	26.90
	PN7	.78	21.08
Parental nurturance at age 12-13	PN1	.79	32.73
	PN2	.78	30.74
	PN3	.79	34.10
	PN5	.84	39.00
	PN6	.87	47.39
	PN7	.90	39.70
Parental nurturance at age 14-15	PN1	.82	35.79
	PN2	.91	72.69
	PN3	.79	36.56
	PN5	.90	69.10
	PN6	.90	62.93
	PN7	.91	64.18
Indirect aggression at age 10-11	IA1	.70	13.14
	IA2	.64	11.23
	IA3	.80	16.19
	IA4	.74	14.97
	IA5	.59	9.45
Indirect aggression at age 12-13	IA1	.83	19.36
	IA2	.77	13.67
	IA3	.80	20.39
	IA4	.75	16.78
	IA5	.57	9.94
Indirect aggression at age 14-15	IA1	.88	21.91
	IA2	.68	11.28
	IA3	.69	14.02
	IA4	.79	16.49
	IA5	.67	10.97

Note. PN = parental nurturance. IA = indirect aggression. [a]Completely standardized solution is reported. [b]All *z*-values are significant at $p < .001$.

Appendix D: Factor Loadings and *z*-values from the Indirect Aggression Measurement Model for Boys

Latent Variable	Item	Factor loading[a]	*z*-value[b]
Parental nurturance at age 10-11	PN1	.74	22.63
	PN2	.66	18.79
	PN3	.72	20.58
	PN5	.70	19.72
	PN6	.77	22.09
	PN7	.79	21.93
Parental nurturance at age 12-13	PN1	.71	20.45
	PN2	.68	19.41
	PN3	.79	30.90
	PN5	.79	26.63
	PN6	.83	30.65
	PN7	.82	24.34
Parental nurturance at age 14-15	PN1	.76	27.96
	PN2	.85	39.62
	PN3	.78	31.26
	PN5	.87	46.85
	PN6	.88	36.73
	PN7	.88	47.10
Indirect aggression at age 10-11	IA1	.76	14.83
	IA2	.60	9.93
	IA3	.71	15.94
	IA4	.70	14.14
	IA5	.73	14.01
Indirect aggression at age 12-13	IA1	.63	11.04
	IA2	.50	7.41
	IA3	.73	12.66
	IA4	.70	13.78
	IA5	.71	12.01
Indirect aggression at age 14-15	IA1	.77	14.34
	IA2	.69	11.89
	IA3	.74	17.21
	IA4	.75	16.02
	IA5	.79	13.69

Note. PN = parental nurturance. IA = indirect aggression. [a]Completely standardized solution is reported. [b]All *z*-values are significant at $p < .001$.

Appendix E: Factor Loadings and *z*-values from the Direct Aggression Measurement Model for Girls

Latent Variable	Item	Factor loading[a]	*z*-value[b]
Parental nurturance at age 10-11	PN1	.76	24.50
	PN2	.64	17.51
	PN3	.74	21.29
	PN5	.76	26.17
	PN6	.80	30.17
	PN7	.79	21.86
Parental nurturance at age 12-13	PN1	.79	29.62
	PN2	.78	30.45
	PN3	.80	32.60
	PN5	.84	37.93
	PN6	.86	44.44
	PN7	.90	40.15
Parental nurturance at age 14-15	PN1	.82	33.75
	PN2	.91	68.89
	PN3	.79	35.26
	PN5	.90	66.49
	PN6	.90	62.74
	PN7	.91	61.33
Direct aggression at age 10-11	DA1	.66	9.72
	DA2	.66	10.52
	DA3	.70	9.38
	DA4	.76	10.97
	DA5	.72	9.87
	DA6	.77	12.78
Direct aggression at age 12-13	DA1	.80	16.95
	DA2	.57	8.46
	DA3	.86	15.54
	DA4	.95	24.64
	DA5	.72	14.61
	DA6	.91	21.04
Direct aggression at age 14-15	DA1	.82	17.24
	DA2	.62	11.48
	DA3	.84	18.33
	DA4	.89	24.06
	DA5	.76	16.49
	DA6	.86	20.80

Note. PN = parental nurturance. IA = indirect aggression. [a]Completely standardized solution is reported. [b]All *z*-values are significant at $p < .001$.

Appendix F: Factor Loadings and *z*-values from the Direct Aggression Measurement Model for Boys

Latent Variable	Item	Factor loading[a]	*z*-value[b]
Parental nurturance at age 10-11	PN1	.73	21.34
	PN2	.69	20.14
	PN3	.71	19.01
	PN5	.70	19.19
	PN6	.77	21.27
	PN7	.78	20.24
Parental nurturance at age 12-13	PN1	.71	20.37
	PN2	.68	18.89
	PN3	.80	30.14
	PN5	.77	24.66
	PN6	.84	31.01
	PN7	.82	23.86
Parental nurturance at age 14-15	PN1	.76	27.67
	PN2	.84	38.88
	PN3	.79	31.05
	PN5	.87	45.25
	PN6	.87	35.81
	PN7	.88	46.58
Direct aggression at age 10-11	DA1	.71	13.82
	DA2	.74	15.49
	DA3	.77	16.40
	DA4	.72	12.28
	DA5	.71	12.68
	DA6	.81	17.82
Direct aggression at age 12-13	DA1	.72	14.41
	DA2	.54	8.02
	DA3	.70	11.85
	DA4	.69	11.27
	DA5	.67	11.24
	DA6	.89	19.78
Direct aggression at age 14-15	DA1	.75	16.54
	DA2	.65	13.13
	DA3	.83	20.67
	DA4	.80	18.54
	DA5	.70	13.89
	DA6	.90	28.00

Note. PN = parental nurturance. IA = indirect aggression. [a]Completely standardized solution is reported. [b]All *z*-values are significant at $p < .001$.

Appendix G: Correlations among the Latent Variables in Measurement Models

Indirect Aggression Measurement Models						
Latent variable[a]	1	2	3	4	5	6
PN at age 10-11	-	.49	.38	-.39	-.21	-.21
PN at age 12-13	.57	-	.59	-.23	-.26	-.21
PN at age 14-15	.40	.60	-	-.11	-.16	-.20
IA at age 10-11	-.42	-.21	-.15	-	.36	.33
IA at age 12-13	-.30	-.31	-.24	.29	-	.43
IA at age 14-15	-.19	-.13	-.21	.35	.35	-
Direct Aggression Measurement Models						
Latent variable[a]	1	2	3	4	5	6
PN at age 10-11	-	.49	.38	-.46	-.26	-.25
PN at age 12-13	.57	-	.59	-.23	-.30	-.33
PN at age 14-15	.40	.60	-	-.18	-.18	-.36
DA at age 10-11	-.47	-.20	-.18	-	.36	.38
DA at age 12-13	-.30	-.44	-.23	.32	-	.40
DA at age 14-15	-.23	-.28	-.40	.34	.55	-

Note. The correlations below the diagonal are for girls and the correlations above the diagonal are for boys. PN = parental nurturance. IA = indirect aggression. DA = direct aggression. [a]Completely standardized solution is reported.

Appendix H: Certificate of Approval

The University of British Columbia
Office of Research Services
Behavioural Research Ethics Board
Suite 102, 6190 Agronomy Road, Vancouver, B.C. V6T 1Z3

CERTIFICATE OF APPROVAL - MINIMAL RISK

PRINCIPAL INVESTIGATOR:	INSTITUTION / DEPARTMENT:	UBC BREB NUMBER:
Jennifer Shapka	UBC/Education/Educational & Counselling Psychology, and Special Education	H07-01049

INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT:

Institution	Site
UBC	Point Grey Site

Other locations where the research will be conducted:
The British Columbia Inter-university Research Data Centre (BCIRDC)

CO-INVESTIGATOR(S):
Rubab Arim

SPONSORING AGENCIES:
Social Sciences and Humanities Research Council of Canada (SSHRC)

PROJECT TITLE:
The Reciprocal Nature of the Relationship between Parenting and Adolescent Problem Behaviours

CERTIFICATE EXPIRY DATE: May 25, 2008

DOCUMENTS INCLUDED IN THIS APPROVAL:	DATE APPROVED:
N/A	May 25, 2007

The application for ethical review and the document(s) listed above have been reviewed and the procedures were found to be acceptable on ethical grounds for research involving human subjects.

Approval is issued on behalf of the Behavioural Research Ethics Board and signed electronically by one of the following:

Dr. Peter Suedfeld, Chair
Dr. Jim Rupert, Associate Chair
Dr. Arminee Kazanjian, Associate Chair
Dr. M. Judith Lynam, Associate Chair
Dr. Laurie Ford, Associate Chair

Appendix I: CISS-Access to the RDC Program

Social Sciences and Humanities Research Council of Canada
Conseil de recherches en sciences humaines du Canada

March 22, 2007
File: CISS-RDC-Arim/314347

Rubab G. ARIM
Educational and Counselling Psychology, and Special Education Faculty of Education
2125 Main Mall
Vancouver, B.C.
CANADA V6T 1Z4

Dear Rubab Arim:

Thank you for submitting an application to the *CISS-Access to the RDC Program*, a joint initiative between Statistics Canada, the Social Sciences and Humanities Research Council and the Canadian Institutes of Health Research. The RDC-Access Granting Committee has now completed the review of your proposal and has approved it. We will now notify Statistics Canada so that it can do the required security check. We also ask that you get in touch with the RDC analyst to begin the administrative processes to gain access to the centre.

Each proposal was evaluated on the basis of four main criteria: scientific merit and viability of the proposed research; the viability of the methods to be applied given the data on which the analysis will be performed; a demonstrated need for access to detailed micro data; and, the expertise and ability of the researchers to carry out the work.

You will find enclosed an evaluation submitted to SSHRC by the RDC-Access Granting Committee. Should you have further questions, please feel free to contact the officer responsible for the administration of the *CISS-Access to the RDC Program*, Mika Oehling, at (613) 992-4227 or by email at rdc@sshrc.ca.

Yours sincerely,

Marc Fonda, Ph.D.
Acting Director
Strategic Programs and Joint Initiatives

c. c. Beverley Hunt
Operations Coordinator

encl.

350 ALBERT STREET
PO BOX 1610 STN B
OTTAWA ON K1P 6G4
www.sshrc.ca

350, RUE ALBERT
CP 1610 SUCC B
OTTAWA ON K1P 6G4
www.crsh.ca

Canada