## Transitions in Subtypes of Withdrawn Behavior from Childhood to Adolescence: The Role of Sports Participation

# TRANSITIONS IN SUBTYPES OF WITHDRAWN BEHAVIOR FROM CHILDHOOD TO ADOLESCENCE: THE ROLE OF SPORTS PARTICIPATION

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## ABSTRACT

Withdrawn behavior broadly describes individuals who are isolated from their peer group. Though not a clinical disorder, withdrawn behavior is a construct involved in many psychological problems, and it is likely the behavioral manifestation of distinct motivations and developmental processes. Additionally, withdrawn behavior is often used interchangeably with other psychological constructs, including shyness, social disinterest, and peer exclusion, making accurate classification difficult. In an effort to better understand the classification and developmental course of withdrawn behavior in youth, the current study used latent class analysis (LCA) and latent transition analysis (LTA) to identify distinct subclasses of withdrawn youth and to examine how these youth transition between classes over child and adolescent development. Furthermore, the current study investigated one potential predictor of class transition, sports participation. Results yielded the same two withdrawn classes across time and gender. The majority of youth fell within Class 1, which represented a low symptom class. Class 2 represented a shy/secretive class. For girls, the interpretation of Class 2 changed at Time 3 (e.g., ages 14-17 years), such that the majority of girls in the shy/secretive class also exhibited depressed mood. The majority of youth remained in the same class across time points. Although sports participation did not predict transitions between withdrawn classes, class membership at Time 2 (e.g., ages 10-13 years) predicted sports participation at Time 3, for boys. Taken together, these findings further clarify the nosology and developmental course of withdrawn behavior and the relation between withdrawn behavior and sports participation. It is recommended that future studies identify predictors of class transition and investigate whether withdrawn classes predict diagnostic trajectories.

## DEDICATION

*For Mom, Dad, Pete, and Jeff.*

*Play like a champion today.*

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# CHAPTER 1: INTRODUCTION

Withdrawn behavior, though not itself a clinical disorder, is a construct involved in many psychological problems, including anxiety, depression, autism spectrum disorders, schizophrenia, and personality disorders (Eggum et al., 2009; Goodwin, Fergusson, & Horwood, 2004; Miller, Byrne, Hodges, Lawrie, & Johnstone, 2002; Ooi, Rescorla, Ang, Woo, & Fung, 2011). Often used interchangeably with other constructs, including shyness, anxious-solitude, social reticence, behavioral inhibition, and peer exclusion, rejection, and victimization, withdrawn behavior broadly describes individuals who are isolated from their peer group (K. H. Rubin, Coplan, & Bowker, 2009). Although withdrawn behavior may appear phenotypically similar across individuals, it is likely the behavioral manifestation of distinct underpinnings and subtypes (K. H. Rubin et al., 2009). In this way, withdrawn behavior represents the construct of equifinality, which proposes that the same psychopathological phenotype may result from different developmental processes (Cicchetti & Rogosch, 1996).

Extant literature has shown that many factors influence the development of withdrawn behavior, including both dispositional factors, such as genetic influences and temperament, as well as environmental factors, including, parent-child attachment and parenting beliefs and behaviors (Burgess, Rubin, Cheah, & Nelson, 2001; Hoekstra, Bartels, Hudziak, Van Beijsterveldt, & Boomsma, 2008). Although the course of withdrawn behavior has been shown to be relatively stable across development, more recent research has demonstrated that environmental factors can amplify or buffer the long-term course of withdrawn behavior (Booth-LaForce & Oxford, 2008; Oh et al., 2008; K. H. Rubin, Chen, McDougall, Bowker, & McKinnon, 1995; Schneider, Younger, Smith, & Freeman, 1998). Given that one's withdrawn behavior is a function of time spent with others, external factors related to social interaction are particularly important when considering the etiology and trajectory of withdrawn behavior. For example, to date, the effects of peer relations (namely peer exclusion) and parenting behaviors have been given much attention in how they contribute to the development and maintenance of withdrawn behavior (Coplan, Arbeau, & Armer, 2008; Gazelle & Ladd, 2003; Mills & Rubin, 1998). One variable that has received little attention, but may be relevant to the course of withdrawn behavior, is sports participation. Although a large body of research has shown an inverse relation between physical activity and withdrawn-related constructs, namely anxiety and depression, little research has investigated the association between sports participation, specifically, and withdrawn behavior (Biddle & Asare, 2011).

Therefore, in an effort to better understand the development and maintenance of withdrawn behavior in youth over time, this dissertation proposed to explore distinct classes of internally motivated withdrawn behavior in youth and investigate how these individuals transition from one status to another over time. Furthermore, given the importance of investigating external factors that may influence the longitudinal trajectory of withdrawn behavior, the current study sought to explore the role sports participation played in the course of withdrawn behavior in youth. To better describe the importance of trajectories of withdrawn behavior and the importance of sports participation, in this introduction, I first present a comprehensive review of the withdrawn behavior nomenclature. I go on to describe research exploring distinct subtypes of withdrawn behavior and its longitudinal course. This is followed by a discussion of origins of withdrawn behavior. Finally, the current literature on the relation between withdrawn behavior and sports participation is presented.

**Withdrawn Nomenclature**

Much of the research on withdrawn behavior has focused on constructs related to fear and anxiety. For a review of these constructs, please see K. H. Rubin & Asendorpf (1993) and K. H. Rubin & Coplan (2004). In general, withdrawn related constructs can be organized into three categories: "conflicted shyness," "active isolation," and "social disinterest (Coplan, Prakash, O'Neil, & Armer, 2004). Both "conflicted shyness" and "social disinterest" are considered internally motivated withdrawn behaviors (Coplan et al., 2004). "Conflicted shyness" describes individuals who are too fearful to initiate social interactions and includes terms such as shyness, anxious solitude, and social reticence (Coplan et al., 2004). Shyness is defined as wariness or self-consciousness in novel or evaluative social situations (Buss, 1980; Cheek & Buss, 1981). Anxious-solitude is a term that stems from approach-avoidance theory and describes individuals with competing motivations, such that their desire for social approach is attenuated by fear and, therefore, elicits a desire for avoidance (Gazelle & Ladd, 2003). Social reticence is a similar construct to anxious-solitude in that it describes individuals who "watch from a far" and "hover," but do not engage (Coplan, Rubin, Fox, Calking, & Stewart, 1994). The "social disinterest" category of withdrawn behavior is far less studied, and describes individuals who are unsociable, socially disinterested, or have a preference for solitude (PFS) (Asendorpf, 1993; Coplan et al.,1994; K. H. Rubin & Asendorpf).

The "active isolation" domain describes withdrawn behavior that is externally determined, such as peer exclusion, which is defined as an overt action to exclude an individual(s) (Boivin & Hymel, 1997). In addition, peer rejection is related to peer exclusion, but represents an attitude of negative peer appraisals, which is not directly observable to the recipient of said appraisals, and peer victimization is defined by overt mistreatment (Boivin & Hymel, 1997).

For the purposes of this dissertation, *withdrawn behavior* will serve as the term used to describe behavioral solitude from one's peer group. The face validity of the items making up the Withdrawn/Depressed syndrome scale of the Child Behavior Checklist, the instrument used to measure withdrawn behavior in the current study, appears to measure internally motivated withdrawn behavior (e.g., "Too shy or timid" and "Would rather be alone than with others") (Achenbach & Rescorla, 2001). Therefore, this dissertation primarily focuses on internally motivated withdrawn behavior, but also reviews relevant research on the relation between internally motivated and externally determined withdrawn behavior.

**Subtypes of Withdrawn Behavior**

K. H. Rubin (1982) proposed two distinct developmental processes of withdrawn behavior: active isolation and social withdrawal. Active isolation refers to social seclusion as a result of peer rejection, whereas social withdrawal denotes individuals who isolate themselves from their peer group due to internal motivations, such as anxiety, negative self-esteem, and/or perceived deficits in interpersonal skills (K. H. Rubin, 1982). Few studies have psychometrically explored subtypes of withdrawn behavior. K. H. Rubin and Mills (1988) proposed creating two distinct factors reflecting active isolation and social withdrawal, respectively, from the items that loaded onto the Sensitivity/Isolation factor of the Revised Class Play, an assessment tool used to measure social competence through peer nomination (Masten, Morison, & Pellegrini, 1985). This hypothesis was examined with confirmatory factor analysis, which demonstrated that a two-factor model did not significantly deteriorate model fit compared to a one-factor model (Bowker, Bukowski, Zargarpour, & Hoza, 1998). Each factor was differentially related to outcome, such that social withdrawal was more strongly related to internalizing problems, whereas active isolation was more strongly related to externalizing problems.

Along a similar vein, Gazelle and Rudolph (2004) conducted a confirmatory factor analysis of anxious-solitude and peer exclusion, which provided an adequate two-factor fit. Furthermore, Thijs, Koomen, de Jong, van der Leij, and van Leeuwen (2004) conducted an exploratory factor analysis of withdrawn behavior using items based on face validity from three separate measures. Results showed that a three-factor solution fit the data best. Two factors were classified as withdrawn factors. The first factor represented a socially anxious subtype, such as "conflicted shyness" or "anxious solitude." The second factor mirrored a "preference for solitude" or "social disinterest" subtype and the third factor was characterized as emotion dysregulation. These investigators then conducted a confirmatory factor analysis using a separate sample of kindergarteners. The same three factors emerged, suggesting two distinct withdrawn subtypes as well as an internalizing factor of emotion dysregulation. These results further contribute to the growing body of work supporting distinct types of withdrawn behavior and offer a method for assessing multiple subtypes using one assessment tool (Thijs et al., 2004).

The studies of Bowker and colleagues (1998), Gazelle and Rudolph (2004), and Thijs and colleagues (2004) examined the characteristics of withdrawn behavior using a variable centered approach, which explores associations between variables. An alternative approach is to use a person-centered approach such as Latent Class Analysis (LCA), which attempts to place individuals into distinct categories of withdrawn behavior. D. Rubin, Althoff, Walkup, and Hudziak (2013) conducted separate LCAs of the 8-item Withdrawn/Depressed syndrome subscale of the Child Behavior Checklist (CBCL), Youth Self Report (YSR), and Teacher Report Form (TRF). Four classes emerged from the CBCL including an all symptoms class, a moderate-shy class, a moderate-secretive class, and a few/no symptoms class. Only three classes emerged from both the YSR and TRF. The moderate-shy class did not emerge from the YSR and the moderate-secretive class did not emerge from the TRF.

Results from this study support the existence of distinct classes of withdrawn individuals in childhood, and highlight the importance of perspective, such that different informants may offer unique insights into withdrawn behavior in youth. Although the secretive and shy class did not each emerge across informants, classes varied by type and not simply by severity. Whether shyness and secretive behavior represent one phenotype viewed through different lenses vs. two distinct types of withdrawn behavior is unknown. Taken together, both variable-oriented and person-oriented data analytic approaches have shown that separate constructs or distinct classes best represent withdrawn behavior. However, further research is warranted exploring predictors of withdrawn subtypes as well as the long-term course of different types of withdrawn behavior.

**Co-occurrence of Internally Motivated and Externally Determined Withdrawn Behavior**

Although internally motivated withdrawn behavior (e.g., "conflicted shyness" and "social disinterest") and externally motivated withdrawn behavior (e.g., "active isolation") may represent two distinct subgroups of withdrawn behavior, they can also co-occur and may act in a transactional manner (K. H. Rubin et al., 2009). Research exploring the direction of effects between anxious-solitude and peer exclusion in middle childhood supported the "early-onset hypothesis," which suggests that children who exhibit anxious-solitude tend to experience higher levels of peer exclusion earlier in childhood (i.e., kindergarten) as opposed to later in development (Gazelle & Ladd, 2003). Children who displayed higher levels of anxious-solitude exhibited higher mean levels of peer exclusion at school entry and increasing levels of peer exclusion over time, controlling for externalizing symptoms (Gazelle & Ladd, 2003). Similarly, children who displayed high levels of peer exclusion at school entry exhibited higher mean levels of anxious-solitude and stable levels of anxious-solitude over time compared to decreasing levels of anxious-solitude in children who experienced little peer exclusion at school entry (Gazelle & Ladd, 2003). Because the relation between anxious-solitude and peer exclusion was bidirectional at kindergarten, the initial direction of effect in this sample could not be determined (Gazelle & Ladd, 2003).

In addition, the relation between anxious-solitude and peer exclusion has been viewed through the lens of diathesis-stress, such that anxious-solitude is conceptualized as a disposition, whereas peer exclusion is conceptualized as an environmental context or interpersonal stressor, which then may influence the trajectory of anxious-solitude and associated outcomes (Gazelle & Ladd, 2003; Gazelle & Rudolph, 2004). Gazelle and Ladd (2003) explored the interaction between anxious-solitude and peer exclusion on future anxious-solitary behavior and found that children who exhibited anxious-solitude and high peer exclusion at school entry showed stable levels of anxious-solitude over time, whereas children who exhibited anxious-solitude and low peer exclusion at school entry demonstrated decreasing levels of anxious-solitude over time. In addition, high anxious-solitary children who were high on peer exclusion exhibited higher depressive symptoms at school entry, whereas high anxious-solitary children with low peer exclusion exhibited lower depressive symptoms at school entry. Anxious-solitary children who were excluded demonstrated high stable levels of depressive symptoms over time, whereas anxious-solitary children who were not excluded exhibited decreasing levels of depressive symptoms over time. In addition, Gazelle and Rudolph (2004) explored the relation between anxious-solitude and prosocial behavior, social helplessness, and depressive symptoms in the context of peer exclusion. Results showed that children high on anxious-solitude, compared to children with average levels of anxious-solitude, regardless of exclusion status, exhibited lower levels of prosocial behavior. Children high on anxious-solitude with high exclusion demonstrated a relative maintenance of low prosocial behavior overtime, whereas children high on anxious-solitude with low exclusion displayed an increase in prosocial behavior overtime. A similar pattern of results emerged for boys-only when exploring the relation between anxious-solitude and social helplessness and depressive symptoms, respectively, in the context of high and low exclusion, such that high anxious-solitary boys with high peer exclusion displayed increasing levels of social helplessness and depressive symptoms overtime, whereas high anxious-solitary boys with low levels of peer exclusion displayed decreasing levels of social helplessness and depressive symptoms overtime.

Findings from these studies demonstrate that anxious-solitude and peer exclusion act in a transactional manner and point to the important role peer exclusion plays in influencing the trajectory of anxious-solitude in youth overtime. One possible mechanism by which peer exclusion leads to continued solitude in anxious youth is that that exclusion early on in childhood may confirm social fears, maintain avoidant behavior, and contribute to feelings of anxiety and depression; whereas the absence of exclusion may allow for social approach, disconfirm fears, and facilitate new learning through observing a mismatch between prediction and outcome (Barlow, 2002; Bouton, 1993).

**Longitudinal Course of Withdrawn Behavior**

Historically, research has shown withdrawn behavior to be relatively stable (Hofstra, Van der Ende, & Verhulst, 2000; K. H. Rubin et al., 1995; Schneider et al., 1998). However, more recently, research has shown that withdrawn behavior can change over time, which has led to work exploring predictors of differential trajectories of withdrawn behavior across development (Booth-LaForce & Oxford, 2008; Eggum et al., 2009; Oh et al., 2008).

Two studies investigating the differential trajectories of withdrawn behavior identified the same three distinct courses, including *increasing*, *decreasing,* and *low-stable/normative* classes (Booth-LaForce & Oxford, 2008; Oh et al., 2008). Oh and colleagues explored trajectories of social withdrawal during youths' "senior" year of elementary school (i.e., 5$^{th}$ grade), across "freshman" year of middle school (i.e., 6$^{th}$ grade), and into "senior" year of middle school (i.e., 8$^{th}$ grade). The majority of youth fell within the low-stable class, whereas 7% and 8% of the sample fell within the increasing and decreasing classes, respectively. Peer exclusion/victimization was a predictor of class membership and class transition. High initial peer exclusion/victimization predicted *increasing* class membership, and lower levels of peer exclusion/victimization between 5$^{th}$ and 6$^{th}$ grade predicted a decrease in social withdrawal for youth in the *decreasing* class. In addition, high peer exclusion predicted an increase in social withdrawal for individuals in the *increasing* class, whereas a decrease in peer exclusion predicted a decrease in social withdrawal for children in the *decreasing* class. Furthermore, for the *increasing* class, an unstable best friendship in the 5$^{th}$ grade and the absence of a mutual friend in the 6$^{th}$ grade predicted an increase in social withdrawal over time. These authors concluded that social adversity, or lack thereof, appeared to be important in the trajectory of withdrawn behavior in youth. Unexpected results showed a mutual friend predicted *increasing* class membership and higher levels of prosocial behavior predicted an increase in social withdrawal over time for the *increasing* class. These findings may be explained by the fact that friends share similar characteristics (Oh et al., 2008). When these characteristics are maladaptive, such as withdrawn behavior, they may serve as a risk factor. Additionally, prosocial behavior may be related to less assertive, more submissive behavior, which may be viewed as less desirable among the peer group (Oh et al., 2008).

Booth-LaForce and Oxford (2008) also identified an *increasing*, *decreasing*, and *normative* withdrawal class in children from 1$^{st}$ through 6$^{th}$ grade. Overall, individuals in the *increasing* class were lonelier, more asocial, and excluded by peers. Shy temperament predicted *decreasing* group membership relative to the *normative* class; however, it did not predict *increasing* group membership. In addition, the *decreasing* group did not differ from the *normative* group on peer exclusion. As such, these results are consistent with prior work suggesting that withdrawn behavior in the absence of exclusion fosters approach and leads to a decrease in withdrawal over time. Lower scores of inhibitory control predicted *increasing* group membership compared to the *normative* group, but it did not predict membership in the *decreasing* group. Although youth in the *increasing* group exhibited lower scores of inhibitory control, they were neither more aggressive nor more hyperactive/impulsive than individuals in the *decreasing* and *normative* groups. Therefore, lower inhibitory control in these children may have manifested in poor interpersonal skills, as opposed to behavior problems or anxiety, though anxiety cannot be rule out, resulting in peer exclusion (Booth-LaForce & Oxford, 2008).

## Development and Maintenance of Withdrawn Behavior

As mentioned above, withdrawn behavior is a broad term that encompasses many different, but related, constructs, some of which may represent distinct underpinnings or subtypes of withdrawn behavior. As such, the etiology and course of withdrawn behavior is vast and complex. The literature examining the origins of withdrawn behavior points to both dispositional and environmental factors including temperament, genetic influences, parent-child attachment, and parenting behavior. The developmental considerations of internally motivated withdrawn behavior are reviewed.

**Temperament**. Behavioral inhibition (BI), a temperament defined by fearfulness, hyper-vigilance, and/or wariness, particularly in novel social situations (Kagan, Reznick, & Snidman, 1988), has been consistently linked to withdrawn behavior and withdrawn-related constructs, namely anxiety disorders (Biederman et al., 2001; Muris, van Brakel, Arntz, & Schouten, 2011; Rosenbaum et al., 1991; Svihra & Katzman, 2004; Vreeke, Muris, Mayer, Huijding, & Rapee, 2013). Walker, Henderson, Degnan, Penela, and Fox (2013) investigated the relation between BI and social problem solving in children during a social exclusion task and found that BI was positively related to social withdrawal. van Brakel, Muris, and Bogels (2004) explored the relation between behavioral inhibition and behavioral observations of BI. Results showed that BI was positively related to anxiety-withdrawal and negatively associated with social competence. Research exploring the relation between behavioral inhibition, attention biases to threat, and social withdrawal showed that early behavioral inhibition during toddlerhood is related to withdrawn behavior in early childhood and adolescence, respectively, but only among individuals with greater attention biases to threat (Perez-Edgar et al., 2010).

**Heritability.** Few studies have explored the heritability of withdrawn behavior. Results of these studies are mixed with some studies finding non-significant genetics effects and others showing modest to high heritability estimates up to 74% (Derks, Hudziak, Beijsterveldt, Dolan, & Boomsma, 2004; Eley et al., 2003; Kuo, Lin, Yang, Soong, & Chen, 2004; Polderman, Posthuma, De Sonneville, Verhulst, & Boomsma, 2006). Most recently, Hoekstra and colleagues (2008) conducted a study exploring the heritability of the stability of withdrawn behavior. Results showed moderate to high genetic contributions at each time point in childhood as well as high genetic contributions to the stability of withdrawn behavior. Modest to moderate contributions were observed for shared and unique environmental contributions within and across time points.

**Attachment**. Bowlby (1969) first posited that the attachment between mother and child plays an important role in child development. Specifically, Bowlby hypothesized that securely attached children defined by a parental figure that is available, responsive, and helpful, tend to have a positive sense of self, approach the world with confidence, and problem solve obstacles effectively (Bowlby, 1973, 1980). A secure attachment is important for developing social competencies, because it promotes positive social expectations, provides an understanding of reciprocity, and lays the foundations for developing a sense of self-worth and self-efficacy (Elicker, Englund, & Sroufe, 1992). As a result, securely attached children develop a sense of security in the world, which fosters a desire for social exploration (Elicker et al., 1992). On the other hand, insecurely attached children tend to have had a parental figure that did not consistently meet their emotional needs. These children are more likely to view the world as comfortless and unpredictable and respond by withdrawing or conflicting (Bowlby, 1973). Mary Ainsworth furthered this field by creating the Strange Situation task designed to observe a child's behavior both when separated from mother and upon the mother's return (Ainsworth, Blehar, Waters, & Wall, 1978). Based on coded observations, the mother-child pair is assigned one of three attachment styles: secure, insecure/avoidant, and insecure/resistant (Ainsworth et al., 1978). Numerous studies have explored the relation between attachment style in infancy and later interpersonal and behavioral outcomes. Much of the work in this domain has shown that a secure attachment is related to fewer problems and increased social competence; whereas an insecure attachment is related to later social withdrawal, peer difficulties, anxiety, and behavior problems (Chen, 2012; Erickson, Sroufe, & Egeland, 1985; Renken, Egeland, Marvinney, Mangelsdorf, & Sroufe, 1989; Shulman, Elicker, & Sroufe, 1999).

**Parenting**. In addition to dispositional and attachment factors, parenting beliefs, perceptions, and behaviors are also related to withdrawn behavior in children. Previous research has shown that parents, particularly mothers of withdrawn children, engage in over controlling, overprotective, and overly solicitous parenting behaviors compared to parents of non-withdrawn children. The direction of the association between parenting factors and withdrawn behavior appears to be bidirectional and transactional, such that parents' perceptions of withdrawn behavior may elicit parenting behaviors, such as a lack of encouragement for independence, over control, and over involvement, which may then elicit or further maintain withdrawal (Burgess et al., 2001; Hastings & Rubin, 1999; K. H. Rubin, Nelson, Hastings, & Asendorpf, 1999). Research has shown that children of mothers whose parenting beliefs included using highly controlling strategies to teach social skills were rated by their teachers as more withdrawn, anxious, and fearful, and used non-assertive social strategies to meet social goals (K. H. Rubin, Mills, & Rose-Krasnor, 1989). Additionally, in a study where mothers were given descriptions of hypothetical situations in which their child exhibited social withdrawal, mothers of anxious-withdrawn children compared to mothers of average children endorsed that they would be more likely to use directive statements and less likely to use indirect or no-response strategies in reaction to their child's withdrawn behavior (K. H. Rubin & Mills, 1990). Unfortunately, child dispositional factors can evoke maladaptive parenting behavior for withdrawn youth and serve to further elicit and maintain withdrawn behavior. In conjunction with or as an alternative to the evocative explanation, parents' interpretation of withdrawn behavior may also influence the parenting strategies they implement, which, in turn, influences child behavior.

Overly controlling parenting often takes the form of telling the child what to do in a directive and assertive manner and overly solicitous behavior consists of intervening and doing the task for the child (Burgess et al., 2001). Mills and Rubin (1998) found that mothers of withdrawn-internalizing children used more behavioral over control and threats towards self-esteem compared to mothers of children who were not withdrawn. Additionally, mothers of inhibited and reticent children have been shown to use more overly solicitous behaviors (i.e., intrusive control, unresponsiveness, physical affection, high positive affect, and engaged in more than one unsolicited intervention) during a free play task compared to mothers of average children (K. H. Rubin, Hastings, Stewart, Henderson, & Chen, 1997; K. H. Rubin, Cheah, & Fox, 2001). Similarly, overprotective parenting was over-represented in mothers of shy children and socially anxious adolescents compared to mothers of average youth (Coplan et al., 2004; Gar & Hudson, 2008).

Seemingly contrary to work showing a positive association between over control and over protectiveness and withdrawn behavior, Park, Belsky, Putnam, and Crnic, (1997) showed that mothers exhibiting parental behaviors high on sensitivity and positive affect and low on intrusiveness predicted inhibition in three-year-old boys compared to non-inhibited boys. Taken together, overly controlling, solicitous, or positive parenting may each serve to elicit and/or maintain withdrawn behavior by preventing the withdrawn child from utilizing his/her own coping mechanisms when presented with a challenging social situation, thereby interfering with the child's opportunity to learn adaptive associations in the social milieu, which then may serve to foster approach as opposed to withdrawal.

**Diathesis-Stress**. Although research has demonstrated that temperament, attachment, and parenting factors each uniquely predict withdrawn behavior in children, much of the research on the development and maintenance of withdrawn behavior points to the interactive effects of disposition and parenting factors on withdrawn behavior (Van Brakel, Muris, Bögels, & Thomassen, 2006). Degnan, Henderson, Fox, and Rubin (2008) found that preschool social reticence was significantly related to social wariness in children with mothers who were high, but not low, on overly solicitous parenting. In the same way, Coplan, Arbeau, and Armer (2008) showed that the positive relations between shyness and internalizing problems and social dissatisfaction, respectively, were stronger in children of mothers who were more overprotective. In addition, overprotective parenting itself did not predict negative outcomes, but rather only in the context of child shyness. Moreover, shy children of mothers who were less overprotective were not more likely to experience internalizing symptoms (Coplan et al., 2008). These results support the notion that overprotective parenting exacerbates the relation between shyness and maladjustment, and that overprotective parenting may be a particularly bad fit for shy children.

**Evocative Hypothesis**. Finally, it has also been shown that child temperament may cause, thereby evoking, maladaptive parenting styles, which then may predict withdrawn behavior and related outcomes. For example, Kiel and Buss (2011) explored the relation between fearful temperament, maternal parenting, and social withdrawal and found that toddler dysregulated fear predicted kindergarten social withdrawal through maternal overprotective parenting. Kiel and Maack (2012) investigated the relation between behavioral inhibition system (BIS) sensitivity, maternal protective parenting, and internalizing problems. Internalizing problems included symptoms specific to withdrawn behavior. These researchers found that maternal protective parenting partially mediated the relation between BIS sensitivity and internalizing symptoms (Kiel & Maack, 2012).

**Summary**

Withdrawn behavior is best described as an umbrella term for behavioral solitude from one's peer group, and represents the construct of equifinality whereby the same phenotype results from different underpinnings. For example, the origins of withdrawn behavior include an inhibited temperament, overly protective and overly solicitous parenting, and the interaction and transaction of temperament and parenting behavior. Moreover, similar behavioral manifestations of withdrawn behavior have been shown to have distinct subtypes, including internally motivated withdrawn behavior and externally determined peer exclusion. Additionally, these two types of withdrawn behavior are correlated and can act in a transactional manner. Once thought to have a stable course, withdrawn behavior is now known to change over time, and research has shown that environmental factors can influence the trajectory of withdrawn behavior. Most of the research in this area focuses on the influence of parenting behavior and peer exclusion on withdrawn behavior over time.

Despite a significant body of work investigating the effects of risk factors on withdrawn behavior over time, less is known about protective factors that may influence this phenotype. In a recent review of social withdrawal in childhood, K. H Rubin and colleagues (2009) call for additional research exploring protective factors of withdrawn behavior in childhood. This review only referenced one study looking at the protective role of organized sports on constructs related to internally motivated withdrawn behavior (i.e., shyness) (Findlay & Coplan, 2008). Since then, one study has explored the protective role of team sports on symptoms of social anxiety over time (Dimech & Seiler, 2011). Furthermore, only a handful of previous studies explored the association between sports participation and other symptoms related to internally motivated withdrawn behavior (i.e., depression, social isolation, self-esteem) (Barber, Eccles, & Stone, 2001; Bowker, Gadbois, & Cornock, 2003; Donaldson & Ronan, 2006; Gore, Farrell, & Gordon, 2001). Given that sports participation may allow for a type of *peer inclusion* as well as provide children and adolescents with a social environment to foster interpersonal skills and connections, sports may protect a child from persisting on a path of withdrawn behavior over time. In an effort to respond to this call of action, one goal of the current dissertation is to explore how sports participation influences the prevalence and the long-term course of withdrawn behavior in youth.

**Sports Participation and Withdrawn Behavior**

It is widely known that physical activity is related to fewer physical and mental health problems, including, but not limited to, anxiety and depression (Biddle & Asare, 2011). Although withdrawn behavior is involved in both anxiety and depression, few studies have looked specifically at how withdrawn behavior relates to physical activity. Sports participation is a subset of physical activity, which may be particularly relevant to withdrawn behavior, given the social context in which it takes place.

A sport is defined as "a human activity of achieving a result requiring physical exertion and/or physical activity, by its nature and organization, is competitive and is generally accepted as being a sport ("Australian Sports Commission: What is defined as a sport?," n.d.)." Sports participation is not only a common mode of physical activity for children, but it also provides a social arena in which children can build peer relationships, develop emotion regulation, and learn interpersonal skills (Eime & Young, 2013; Larson, 2000; Mahony, Larson, Eccles, & Lord, 2005; Smith, 2003). In this way, sports participation may act as a microcosm for social learning. Additionally, research also suggests that sports participation is related to psychological benefits via increased self-esteem, namely physical self-concept, and athletic competence (Dishman et al., 2006; Slutzky & Simpkins, 2009). Taken together, sports participation is an important activity and environmental context to study when considering children's physical, psychological, and social development.

Despite the benefits of sports participation in childhood, rates of participation dramatically decrease in adolescence; yet, children who play sports in their youth are more likely to engage in physical activity in adolescence and adulthood compared to children who do not participate in sports (Dodge & Lambert, 2009; Stubbe, Boomsma, & De Geus, 2005; Tammelin, Näyhä, Hills, & Järvelin, 2003; van der Aa, De Geus, van Beijsterveldt, Boomsma, & Bartels, 2010). Therefore, entry into sports participation early in development may set the stage for long-term engagement in physical activity, provide a foundation for future social interactions and peer relationships, and help to develop strong sense of self-worth. Furthermore, much of the research on the relation between sports participation and psychological problems is interpreted to assume that participation in sports *decreases* mental health problems; however, this research is largely cross sectional. Longitudinal studies examining the relation between sports and internalizing symptoms have shown significant effects in both directions. For example, some research has shown that individuals who play sports exhibit fewer psychological problems (Brunet et al., 2013), whereas other research has shown that individuals with greater psychological problems opt out of sports (Sabiston et al., 2013). The directionality of this relation may be particularly relevant for children exhibiting withdrawn behavior.

Most of the research exploring the relation between withdrawn-related constructs and sports participation involves symptoms of internally motivated withdrawn behavior, such as shyness, social anxiety, depression, and low self-esteem. Findlay and Coplan (2008) found that sport participation serves as a protective factor for shy children, such that individuals who exhibited high levels of shyness and participated in sports demonstrated a decrease in shyness overtime compared to their non-sport counterparts. Similarly, Dimech and Seiler (2011) explored the relation between sports participation and social anxiety in children over time. Results showed that social anxiety decreased over time in children who participated in team sports compared to children who engaged in individual sports or who did not play sports. These authors also assessed withdrawn behavior, specifically, using the Teacher Report Form, but did not find significant associations with sports participation. Additionally, research has shown that greater sports involvement is related to higher levels of self-esteem and fewer depressive symptoms, and team sports participation is associated with less social isolation (Barber et al., 2001; Bowker, 2006; Donaldson & Ronan, 2006; Gore et al., 2001).

Taken together, sports participation may buffer the long-term trajectory of withdrawn behavior over time. Whether an individual's withdrawn behavior is motivated by avoiding the experience of anxiety in social and/or performance situations or the result of social disinterest or peer exclusion, failure to participate in sports may prevent youth from 1) accessing protective effects of physical activity and social engagement, 2) experiencing a social milieu where they can develop interpersonal skills, and 3) learning new information that may disprove feared outcomes and allow for social approach.

**Current Study**

Although several reviews have attempted to clarify the definitions of different withdrawn-related constructs, few studies have psychometrically tested the presence of discrete subtypes of withdrawn behavior (Bowker et al., 1998; D. H. Rubin et al., 2013; K. H. Rubin et al., 2009; K. H. Rubin & Coplan, 2004; Thijs et al., 2004). Such analyses could contribute to the development of more refined evidence based assessments for different types of withdrawn behavior, and, consequently, inform more targeted early interventions for phenotypically similar, but differentially determined, withdrawn children. Furthermore, little is known about how these subtypes emerge at different stages in development. Towards better understanding the multifarious construct of withdrawn behavior across development, the first aim of this dissertation is to empirically derive classes of youth based on their withdrawn behavior at separate time points in childhood and adolescence.

Secondly, while existing research has explored the long-term course of withdrawn behavior in children and adolescence, few studies have investigated the trajectories of distinct subtypes of internally motivated withdrawn behavior, together, in the same analysis (Booth-LaForce & Oxford, 2008; Gazelle & Ladd, 2003; Gazelle & Rudolph, 2004; Hofstra et al., 2000; Oh et al., 2008; K. H. Rubin et al., 1995; Schneider et al., 1998). Additionally, little is known about how youth transition between subtypes of withdrawn over time. Therefore, in an effort to disentangle the stability and long-term course of withdrawn behavior, the second aim of this study is to explore how individuals move between distinct classes of internally motivated withdrawn behavior across child and adolescent development.

Finally, withdrawn behavior in youth is related to several long-term consequences, including greater academic problems, peer difficulties, and emotional maladjustment (Gazelle & Ladd, 2003; Hofstra, Van Der Ende, & Verhulst, 2001; Masten et al., 1985). Although several risk factors (e.g., peer exclusion and maladaptive parenting) of withdrawn behavior have been identified, much less is known about influences that may protect individuals from the development and/or persistent course of withdrawn behavior. To this end, and in the context of existing questions about the directionality of the relation between sports participation and withdrawn behavior, the third and final aim of this dissertation seeks to explore how sports participation influences the transition between withdrawn statuses over time.

# CHAPTER 2: METHODS

## Participants and Procedures

The current sample is based on data derived from a seven-wave longitudinal study of behavioral and emotional problems in children that started in 1983 (Verhulst, Akkerhuis, & Althaus, 1985). The original sample of 2,600 children from 13 birth cohorts aged 4 to 16 was drawn from municipal registers that list all residents in the Dutch province of Zuid-Holland. Of the 2,447 parents reached, 2,076 (i.e., 84.8%) provided usable data. The sample in 1983 consisted of 53% boys. This sample was approached every two years until 1991 (Waves 1-5), once in 1997 (Wave 6) and finally once in 2006 (Wave 7) creating a total follow-up period of 24 years. At Waves 1 through 7, children, their parents, and/or teachers filled in the appropriate version of the ASEBA checklists (Achenbach & Rescorla, 2001). Differences between participants who dropped out of the study and those who completed the study were minor (Althoff, Verhulst, Rettew, Hudziak, & van der Ende, 2010; Hofstra et al., 2001). Overall levels of psychopathology in children in the Netherlands are similar to United States populations, placing them at the omnicultural mean for overall problems on the CBCL, and allowing for the study of patterns of problem behavior separable from symptom severity (Ivanova et al., 2007). For the current study, only data from Waves 1, 3, and 5 was used. Children ages 6 to 9 years were selected from Wave 1 and followed every two years. Therefore, in the current study, Wave 1 was considered Time 1 and included children 6 to 9 years of age (N = 649). Wave 3 represented Time 2 and included the same children, now ages 10 to 13 years (N = 534). Wave 5 was considered Time 3 and included the same children at ages 14 to 17 years (N = 531). Retention rates over time were high with 82.3% of the sample retained from Time 1 to Time 2, 91.6% retained from Time 2 to Time 3, and 81.8% retained from Time 1 to Time 3.

## Measures

**Withdrawn Behavior**. Withdrawn behavior was measured using the Child Behavior Checklist (CBCL). The CBCL is a parent-report questionnaire that measures competencies and behavioral, emotional, and social problems in children ages 6 to 18 years. The CBCL consists of 118 problem items that parents answer on a 3-point scale of 0 (*Not true*), 1 (*Somewhat or Sometimes True*), or 2 (*Very True or Often True*). These items have been factor-analytically reduced to 8 syndrome scales that are consistent across age, informant, and culture (Achenbach & Rescorla, 2001). Seven items from the Withdrawn/Depressed (W/D) syndrome scale of the 1991 version of the CBCL were used in the current study and are displayed in Table 1 (Achenbach, 1991). These seven items overlap with seven of eight items from the current (2001) version of the CBCL W/D scale. From 1991 to 2001, two items were dropped from the W/D scale, including "sulks" and "stares," due to having higher factor loadings on the Aggressive Problems and Attention Problems scales, respectively. Additionally, the "There is very little that he/she enjoys" item from the 2001 W/D scale was not included in the 1991 CBCL. Therefore, this item was not available for use in the current study. The psychometrics of the W/D scale has been well characterized with a test-retest reliability of 0.89 and Cronbach's alpha of 0.80 (Achenbach & Rescorla). Good reliability and validity estimates of the Dutch version of the ASEBA checklists have been confirmed (Verhulst, van der Ende, & Koot, 1996). All items on the Withdrawn/Depressed syndrome scale are ordinal; however, responses were dichotomized for the purposes of the latent class analysis, such that 1 and 2 responses were collapsed to represent a positive response and 0 responses represented a negative response.

**Sports Participation**. Sports participation was measured using the CBCL, at each time point. On the CBCL, the reporter is asked to list up to three sports the child participates in. The sports participation variable is continuous where responses can include 0, 1, 2, or 3.

Table 1

| *Items from the Withdrawn/Depressed Syndrome Scale* |
|---|
| 42. Would rather be alone than with others |
| 65. Refuses to talk |
| 69. Secretive, keeps things to self |
| 75. Too shy or timid |
| 102. Underactive, slow moving or lacks energy |
| 103. Unhappy, sad or depressed |
| 111. Withdrawn, doesn't get involved with others |

## Data Analytic Plan

The following steps of data analysis were derived from Nylund's recommendations for conducting latent transition analysis (LTA) (Nylund & Muthén, 2007). Further guidance in the data analytic approach of latent class and latent transition analyses was obtained from Collins and Lanza (2010). From these sources, a three-step approach was designed.

**Step 0: Study Descriptive Statistics**. Analyses were conducted using Mplus, version 7.3 (Muthén & Muthén, 2012). Full-information maximum likelihood estimation with robust standard errors (MLR) was used to account for missing data and violations of distributional assumptions. The sample size at Times 1, 2, and 3 and the proportion of the sample that endorsed each item of the Withdrawn/Depressed syndrome scale are summarized in Table 3. Differences in the proportion of item endorsement between items and across time were explored. Additionally, means and standard deviations of the sports participation covariates at each time point (shown in Table 4) were examined and an initial exploration of their change over time was conducted.

**Step 1 (Specific Aim 1): Selecting the Best Fitting Latent Class Models**. Nylund (2007) recommends testing a series of latent variable models at each time point in order to choose the best type of model for the data. However, because two aims of the current dissertation were to 1) explore unobserved distinct categories of individuals based on their withdrawn behavior, and 2) examine the transition of classification over time, latent class analysis was selected, a priori, to fit the measurement model.

Latent class analysis (LCA) is a person-centered approach, which does not use cut off scores, as in a variable-centered approach, to classify individuals into groups. LCA is conceptually similar to factor analysis in that it assumes the presence of an underlying latent variable. Latent variables assumed to be continuous are usually described as factors, whereas latent variables assumed to be categorical are often described as classes. In LCA, the underlying variable and its observed indicators are categorical. For the purposes of the current study, all indicators were treated as categorical. Figure 1 illustrates the path diagram of the Withdrawn Behavior (WB) latent class model with seven observed indicators, $u1$-$u7$. A latent class variable has $K$ categories or classes.

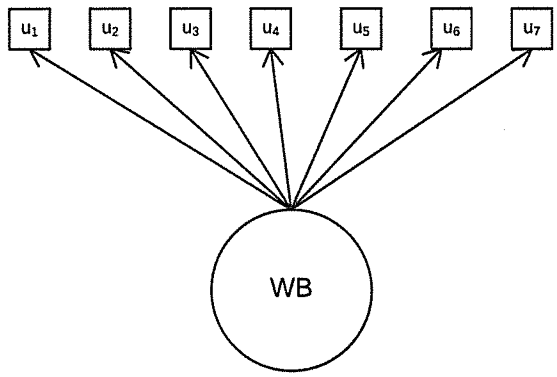



Figure 1. Path diagram of the Withdrawn Behavior (WB) latent class model.

Additionally, LCA is a type of mixture model, which assumes that the overall heterogeneity of a population is made up of a "mixing" of different groups that can be categorized into subpopulations, which are not directly observable (Nylund & Muthén, 2007). In order to derive the number of subpopulations (i.e., classes) that adequately describe the heterogeneity of item responses, a series of nested models (e.g., 2-class, 3-class, 4-class, etc.) was fit and compared to one another. The best fitting LCA model, at Time 1, Time 2, and Time 3 was determined based on fit statistics and the consideration of theory and substantive meaning. Figure 2 illustrates the LCA model at each time point. The seven indicators, $u_{tj}$, ($j$= 1,2,3,...7) were measured at each of the three time points, $t$=3.

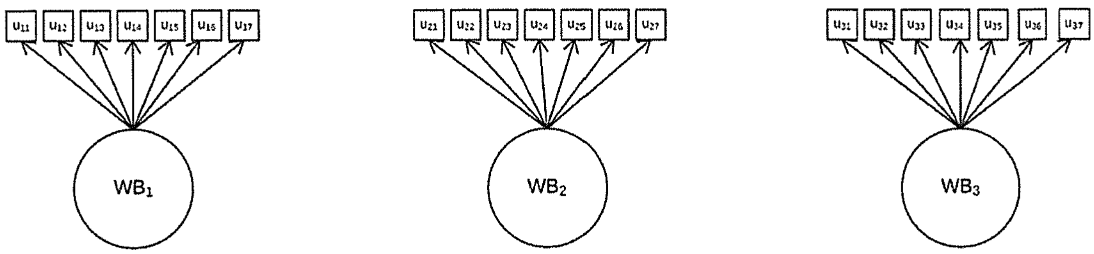



Figure 2. Path diagram of the WB latent class models at Times 1, 2, and 3.

***Using fit indices for model selection.*** Generally, nested models can be compared using likelihood ratio ($\chi^2$) tests (LRT); however, it is invalid to conduct an LRT when comparing the number of classes in an LCA model. The reason for this is when comparing a larger LCA model to a smaller LCA model with identical dimensions, but where one latent class prevalence parameter is fixed to zero, there is not enough information to estimate the item-response probabilities of the empty latent class (Collins & Lanza, 2010). Instead, the statistical indices used to evaluate LCA model fit were the bootstrap likelihood ratio test (BLRT), Bayesian Information Criterion (BIC), Vuong-Lo-Mendell-Rubin (VLMR) test, and entropy (McLachlan & Peel, 2000; Schwarz, 1978). When specifying an LCA model with *K* classes, the BLRT uses a bootstrapped sample to test the difference in log likelihood distributions between a latent class variable with *K* classes and *K*-1 classes. In this way, the BLRT compares the fit of two LCA nested models. A significant BLRT *p*-value signifies an improvement in fit with the inclusion of an additional class. A nonsignificant BLRT-value would suggest that the inclusion of an additional class did not significantly improve model fit. In the same way, a significant value of the VLMR test signifies that a model with *K* classes fits significantly better than a model with *K*-1 classes. The BIC is an information criterion fit statistic that compares log likelihood values of nested models and imposes a penalty for a small sample size and large number of parameters. In other words, for two models that are otherwise equal, the model with the fewest parameters and largest sample size is better, reflected in a smaller BIC value. Entropy is a measure of classification accuracy. Entropy values close to 1 indicate high classification accuracy. A study by Nylund, Asparouhov, and Muthén (2007) indicated that the BLRT and BIC are the best and most consistent fit statistics for determining the number of latent classes. Therefore, the BIC and BLRT statistics were prioritized when selecting the best fitting models. In addition to using fit statistics to determine the appropriate number of classes, it is imperative to also consider the interpretability of the solution based on practical and theoretical information.

***Interpreting the latent classes.*** Upon determining the best fitting latent class solution, with *K* classes, for each time point, the following LCA parameters were interpreted: item response probability parameters, class probability parameters, and posterior probability parameters. Item-response probability parameters are conditional on class membership, such that the parameter reflects the probability of endorsing an item given membership in a specific class. Class probability parameters define the frequency of each class. Posterior probabilities are a function of both item-response probabilities and class probabilities. These values indicate the individual's probabilities of being assigned to each class based on the individual's response pattern on items. An individual's highest posterior probability demarcates the class to which they are assigned; this process is called modal class assignment. Therefore, the highest posterior probability for each individual reflects the latent class assignment probability. The average latent class assignment probabilities for individuals in each class were also used to assess the quality of the LCA solution. Values greater than 0.80 indicate high accuracy in classification (Rost, 2006).

The item-response probabilities were used to interpret and assign meaning to the different withdrawn classes by examining their pattern within and across classes. These values were depicted in two forms: 1) a line graph displaying items on the x-axis and probabilities on the y-axis; each line represented a separate class and 2) a table displaying item probabilities, much like factor analysis. In this display, each column represented a class and each row represented an item. In this way, an item probability is specified in each cell of the table by item and class.

In general, there are two types of latent class solutions. An ordered solution consists of similar patterns between items within each class. In this case, classes mainly differ by the level or frequency of item endorsement, but the pattern between items is relatively equal across classes. An unordered solution is often signified by lines crossing and represents distinct patterns between items within each class. In other words, in ordered solutions, classes differ by level or frequency, whereas, in unordered solutions, classes differ by type.

***Measurement invariance across gender.*** To determine whether the same latent classes of withdrawn behavior emerged for boys and girls at each time point, measurement invariance across gender was tested at Times 1, 2, and 3. Measurement invariance tests both qualitative and quantitative differences in groups. If item response probabilities are identical across groups, any gender differences observed are merely quantitative (i.e., differences in class prevalences). On the other hand, differences in item response probabilities indicate qualitative differences between groups (i.e., differences in latent class type).

In order to establish whether the number of classes were identical in boys and girls, a series of nested models were run on each group individually (Collins and Lanza, 2010). In addition to evaluating fit statistics, there are additional criteria to consider when selecting the best fitting models for multiple groups. First, within a multiple group context, parsimony does not necessarily reflect the models with the fewest classes in each group. Rather, preference is given to models with the same number of classes across groups and measurement invariance of item response probabilities across groups (Collins and Lanza, 2010). Second, the sample size of the groups may influence statistical power, and, as a result, impact the ability to detect a significant difference between models or prohibit model identification. Similarly, differences in latent class prevalences across groups can also lead to group differences in statistical power. For example, there will be less power to detect a class with a smaller prevalence in Group A compared to the same class with a larger prevalence in Group B (Collins and Lanza, 2010).

Once the number of classes was determined for boys and girls, equality of parameters across gender in the measurement model was tested. In a cross sectional LCA, full measurement invariance assumes that item response probabilities and class prevalence probabilities are equal across conditions. Partial measurement invariance assumes that some parameters are equal across groups, while other parameters are best estimated freely across conditions. Treating gender as a grouping variable as opposed to a covariate has advantages, including being able to explore measurement invariance (Collins & Lanza, 2010).

A series of measurement invariance tests were conducted for the LCA models at each time point. First, a model (Model 1) where all parameters were freely estimated across gender was tested against a second model (Model 2) where all item-response probabilities and class prevalence probabilities were constrained to be equal across boys and girls. Based on these results, additional measurement invariance tests were conducted, where item-response probabilities were constrained to be equal across gender, but class prevalence probabilities were freely estimated (Model 3), and where partial measurement invariance of item-response probabilities was estimated and class prevalence probabilities were freely estimated (Model 4). To test for partial measurement invariance, individual Wald parameter tests were conducted for each item within each class to test whether item response probabilities were significantly different in boys and girls. Based on these results, Model 4 freely estimated significantly different item response probabilities and constrained all other items to be equal across gender. Model comparisons were done with an LRT, such that two times the difference in log likelihood values $-2(\ell_1 - \ell_2)$ was distributed as a chi square with degrees of freedom (*df*) equaling the difference in the number of estimated parameters, $df = p_2 - p_1$. In this case, an LRT does not violate assumptions, because the number of classes is not being compared between models. Rather, only constraints imposed on parameters are being tested between models. The best fitting model, based on model comparison tests, fit statistics, and substantive meaning, was retained for future analyses.

***Include sports participation as a covariate.*** When adding a covariate to an LCA model, although the covariate may influence the overall latent class structure, measurement invariance of the item-response probabilities are assumed to be invariant across all levels of the covariate. Therefore, in the current study, the addition of sports participation as a covariate may influence the latent class structure of withdrawn behavior, but the varied structure of the LCA model would remain the same at different levels of the covariate. However, because the current study is not interested in how sports participation influences the latent class structure of withdrawn behavior, the item response probabilities were fixed when adding sports participation as a covariate.

When adding a covariate to an LCA model, class prevalence probabilities are expressed as a function of intercepts and regression coefficients. For ease of interpretation, intercepts ($B_0$) were converted to odds and regression coefficients ($B_1$) were converted to odds ratios. Furthermore, one latent class must be designated as the reference class. In this way, when interpreting the results of the effect of the covariate on class membership, the intercept or odds reflects the change in the probability of membership in a given latent class, *c*, in relation to the reference latent class, *C*, when the covariate equals 0. The regression coefficient or the odds ratio reflects the change in the probability of membership in a given latent class, *c*, in relation to the reference latent class, *C*, for a one-unit increase in the covariate. In order to establish if a relation existed between withdrawn behavior and sports participation, sports participation was added to the LCA model at each time point to explore how the prevalence in withdrawn class membership changed as a function of sports participation. An LRT was conducted at each time point comparing a baseline LCA model without sports participation (i.e., sports participation fixed to equal 0) to an LCA model with sports participation freely estimated as a covariate. Figure 3 depicts the WB latent class path model, at each time point, with sports participation added as a covariate.

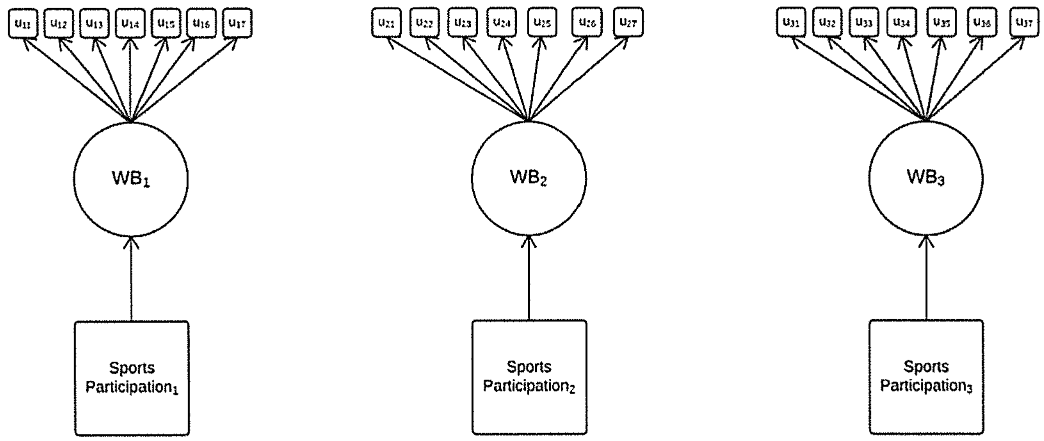



Figure 3. The Path diagram of the WB latent class model with sports participation added as a covariate at each time point.

**Step 2 (Specific Aim 2): The Unconditional Latent Transition Analysis (LTA) Model.** Latent Transition Analysis (LTA) builds off of the measurement model fitted in LCA and uses conditional probabilities to estimate the relation between latent class variables over time. LTA is an autoregressive model, in that it measures change in adjacent time points and often assumes a discontinuous (i.e., unsteady) rate of change between variables. In LTA, the same items are repeatedly measured at multiple time points, $t$. These observed items are indicators for the latent variable at each time point, $C_t$. Each latent variable has $K$ classes, which are determined in the LCA. There are $t$-1 transitions, and therefore $t$-1 regressions, in an LTA model whereby the latent variable at time point $t$ is regressed on the latent variable at time point $t$-1. In addition to item probabilities and class probabilities for LCA, LTA also uses transition probability parameters. These values describe the probability of transitioning to a class at time $t$

given an individual's class membership at time *t*-1. Transition probabilities are often depicted in a transition matrix.

***Measurement invariance across time.*** Measurement invariance of item-response probabilities across time points in LTA makes interpreting transition models much easier. When item-response probabilities are not significantly different across time points, the interpretation of change over time is merely quantitative, whereas when item response probabilities significantly differ across time points, change over time must be interpreted quantitatively (transition probabilities) and qualitatively (i.e., number and type of classes). If the cross-sectional LCAs at each time point yield the same number and types of classes, measurement invariance can likely be imposed. While full measurement invariance reduces the number of parameters thereby improving model identification and makes interpreting the model straightforward, latent classes may emerge differently overtime and reflect developmentally meaningful changes in the latent variable.

In the current study, full measurement invariance across time points was tested using an LRT by comparing a more restrictive model where item-response probabilities are constrained to be equal across time points to a model where item-response probabilities are freely estimated across time. If the LRT test was significant, full measurement invariance could still be imposed if the number and type of classes appeared similar across time in order to ensure that the meaning of the latent classes was held constant (Collins & Lanza, 2010). Figure 4 illustrates the WB latent transition model across Times 1, 2, and 3.

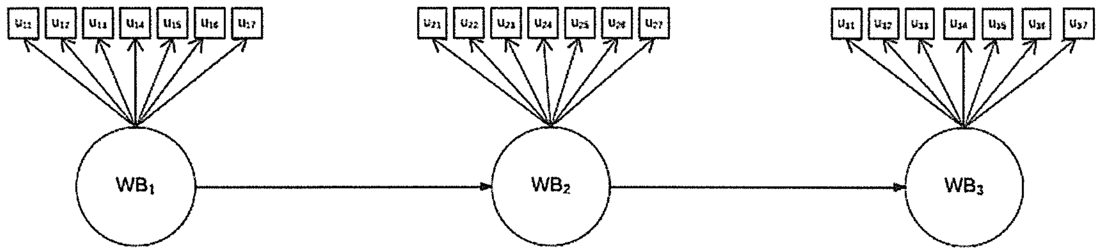


Figure 4. Path diagram of WB latent transition model across Times 1, 2, and 3.

***Gender differences in transition probabilities.*** Similar to the LCA test of measurement invariance, gender was used as a grouping variable. Testing gender equivalence of transition probabilities makes the most sense to interpret when measurement invariance of latent class structure has been established or reasonably assumed across gender and time. Therefore, gender differences in transition probabilities were only explored if measurement invariance could be imposed.

***Interpreting the LTA model.*** Transition probabilities are displayed in $t$-1 matrices, the number of transition periods in the model. In the current study, there are three time points; therefore, there are two transition probability matrices, one displaying the probabilities of transitioning from Time 1 latent statuses to Time 2 latent statuses and the second showing the latent status transition from Time 2 to Time 3. If gender equivalence of transition probabilities could not be assumed, these values were reported for boys and girls, separately. Table 2 illustrates two transition matrices. The cells of each matrix are populated with conditional probabilities of transitioning from one latent status to another. In this example, the WB latent variable, at each time point, has two categories or statuses. The matrix on the left shows the probabilities of transitioning latent statuses from Time 1 to Time 2, whereas the matrix on the right shows the transition probabilities from Time 2 to Time 3.

Table 2

*Transition Matrices Displaying Conditional Probabilities for Each Transition Period*

| | $WB_2$ | | | $WB_3$ | |
|---|---|---|---|---|---|
| $WB_1$ | 1 | 2 | $WB_2$ | 1 | 2 |
| 1 | $P(WB_2=1 \mid WB_1=1)$ | $P(WB_2=2 \mid WB_1=1)$ | 1 | $P(WB_3=1 \mid WB_2=1)$ | $P(WB_3=2 \mid WB_2=1)$ |
| 2 | $P(WB_2=1 \mid WB_1=2)$ | $P(WB_2=2 \mid WB_1=2)$ | 2 | $P(WB_3=1 \mid WB_2=2)$ | $P(WB_3=2 \mid WB_2=2)$ |

**Step 3 (Specific Aim 3): Include Sports Participation as a Covariate in the LTA Model.** The purpose of adding a covariate to an LTA model is to investigate predictors of latent status membership and/or transitions between latent statuses. When a covariate is added to an LTA model, it will likely change parameters, including item-response probabilities, class prevalence probabilities, and transition probabilities, if the covariate is related to the latent class variable. Covariates can be continuous or categorical, observed or latent, and time-varying or time-invariant.

An observed covariate is measured directly whereas a latent covariate is unobservable. There are two types of observed covariates: time-varying and time-invariant covariates. Time-varying covariates are variables whose values may change over time. Time-invariant covariates are usually constant over time even if measured repeatedly (e.g., gender). In addition, observed covariates can be estimated to have time-invariant or time-varying effects. For example, a covariate specified to have a time-varying effect is allowed to differentially influence the latent class variable or transition at each time point, whereas a covariate estimated to have a time-invariant effect would have the same effect on the latent class variable or transition at each time point. The current study will use sports participation as a categorical, observed, time-varying covariate with time-varying effects.

Although covariates can be added to an LTA model to investigate characteristics that influence latent status membership, the current study aimed to explore characteristics that influence transition between latent status memberships over time. When estimating the effect a covariate has on the transition between latent statues, an intercept and regression coefficient is estimated, similar to when adding a covariate to an LCA model. However, when estimating the effect of a covariate on the transition between latent status membership, an intercept and regression coefficient are both estimated for each row of the transition matrix with the exception of the row representing the status designated as the reference category. Again, these coefficients are converted into odds and odd ratios. Here, the regression coefficient reflects the odds of transitioning to a given class at Time 2 in relation to the reference status at Time 2, conditional on class membership at Time 1, when there is a one-unit increase in the covariate. In order to test the significance of the respective effects of sports participation at Time 1 and Time 2 on the latent status transitions between Time 1 and Time 2 and between Time 2 and Time 3, an LRT was conducted comparing a model that did not include the sports participation covariates (sports participation at Time 1 and Time 2 were each fixed to zero) to a model where the sports participation covariates were freely estimated.

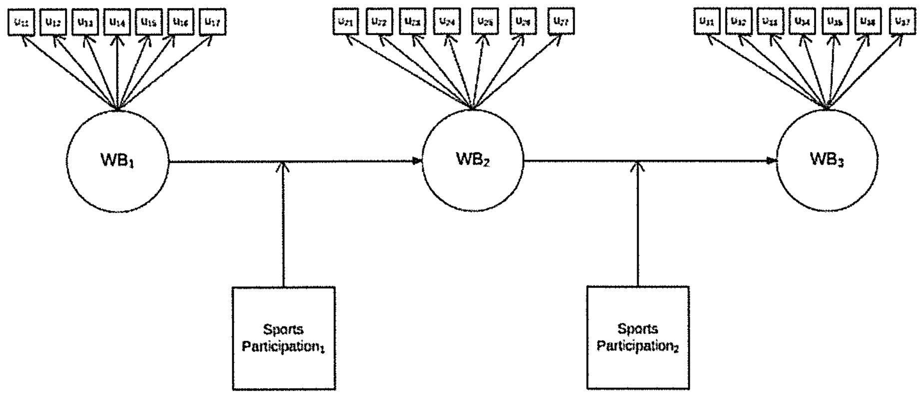



Figure 5. Path diagram of the WB latent transition model with sports participation covariates predicting transitions of latent status membership across time points

# CHAPTER 3: RESULTS

## Step 0: Study Descriptive Statistics

The sample size and the proportion of the sample that endorsed each item at Times 1, 2, and 3 are shown in Table 3. All participants responded to all items. Given that the items are binary (i.e., 0/1), the endorsement proportions represent the item means, which describe the proportion of the sample that endorsed each item. For example, 36% of the sample endorsed the “Would rather be alone than with others” item at Time 1. Within and across time points, the three items with the highest item endorsements were the “Would rather be alone than with others,” “Secretive, keeps things to self,” and “Too shy or timid” items. All other items within and across time points ranged from 0.04 to 0.12. Item means for the “Would rather be alone than with others” and Secretive, keeps things to self” items increased over time; however, the “Too shy or timid” item remained relatively stable over time. The overall pattern between items appeared consistent across time. The average item endorsement was 17.6%, 18.6%, and 24.3% at Times 1, 2, and 3, respectively. This increase in observed mean item endorsement was expected given that past studies have shown that withdrawn behavior increases from childhood to adolescence (Hoekstra et al., 2008; Hofstra et al., 2000; Schneider et al., 1998).

The means and standard deviations of the covariate, sports participation, at Times 1, 2, and 3, are presented in Table 4. The sports participation means significantly decreased over time. This result supports existing findings from studies demonstrating that sports participation decreases from childhood to adolescence (Stubbe et al., 2005; van der Aa et al., 2010).

Table 3

*Sample Size and Proportion of Item Endorsement at Times 1, 2, and 3*

| Withdrawn Items | Time 1 (N = 649) | Time 2 (N = 534) | Time 3 (N = 531) |
|---|---|---|---|
| | Prop. | Prop. | Prop. |
| Would rather be alone than with others | 0.36 | 0.41 | 0.57 |
| Refuses to talk | 0.08 | 0.06 | 0.09 |
| Secretive, keeps things to self | 0.24 | 0.27 | 0.37 |
| Too shy or timid | 0.34 | 0.30 | 0.33 |
| Underactive, slow moving or lacks energy | 0.12 | 0.11 | 0.12 |
| Unhappy, sad or depressed | 0.05 | 0.08 | 0.12 |
| Withdrawn, doesn't get involved with others | 0.04 | 0.07 | 0.10 |

Table 4

*Means and Standard Deviations of Sports Participation at Times 1, 2, and 3*

| Covariate | Time 1 M (SD) | Time 2 M (SD) | Time 1 M (SD) |
|---|---|---|---|
| Sports Participation | 2.22* (0.85) | 1.95* (0.87) | 1.44* (0.91) |

* Sports participation means significantly decreased over time, $p < .05$

## Step 1: Selecting the Best Fitting Latent Class Models at Times 1, 2, and 3

A series of nested models were run to determine the best fitting latent class model at each time point. For each time point, a 2-class model was selected as the best fitting model. Model comparisons for each time point are shown in Table 5. Item response probabilities for each class and time point are shown in Table 6 and Figure 6. The average latent class assignment probabilities for members assigned to each class ranged from 0.86 to 0.96 across time points, indicating high precision of class assignment for the 2-class models.

Table 5

*Selecting Number of Latent Classes of Withdrawn Behavior at Times 1, 2, and 3*

| Model | Numbers of Parameters Estimated | Log L | BIC | Entropy | Vuong-Lo-Mendell Rubin *p*-value | BLRT *p*-value |
|---|---|---|---|---|---|---|
| Time 1 | | | | | | |
| 1 class | 7 | -1889.28 | 3823.90 | | 0 | 0 |
| **2 class** | **15** | **-1780.26** | **3657.65** | **0.74** | **0.33** | **0.09** |
| 3 class | 23 | -1770.93 | 3690.80 | 0.86 | 0.46 | 0.67 |
| 4 class | 31 | -1764.53 | 3729.80 | 0.71 | 0.47 | 0.6 |
| Time 2 | | | | | | |
| 1 class | 7 | -1582.43 | 3208.83 | | 0 | 0 |
| **2 class** | **15** | **-1478.42** | **3051.04** | **0.77** | **0.46** | **0.67** |
| 3 class | 23 | -1471.63 | 3087.71 | 0.86 | 0.01 | 0.12 |
| 4 class | 31 | -1463.06 | 3120.82 | 0.91 | 0.04 | 0.43 |
| Time 3 | | | | | | |
| 1 class | 7 | -1774.78 | 3593.48 | | 0 | 0 |
| **2 class** | **15** | **-1619.29** | **3332.69** | **0.73** | **0.05** | **0** |
| 3 class | 23 | -1600.64 | 3345.59 | 0.83 | 0.02 | 0 |
| 4 class | 31 | -1586.22 | 3366.96 | 0.94 | 0.16 | 0.15 |

Table 6

*Item Response Probabilities for the 2-class LCA Solution at Times 1, 2, and 3*

| | Time 1 | | Time 2 | | Time 3 | |
|---|---|---|---|---|---|---|
| Withdrawn Items | Class 1 | Class 2 | Class 1 | Class 2 | Class 1 | Class 2 |
| Would rather be alone than with others | 0.31 | 0.57 | 0.37 | 0.56 | 0.49 | 0.74 |
| Refuses to talk | 0.02 | 0.30 | 0.01 | 0.25 | 0.004 | 0.29 |
| Secretive, keeps things to self | 0.09 | 0.82 | 0.11 | 0.89 | 0.14 | 0.89 |
| Too shy or timid | 0.24 | 0.71 | 0.21 | 0.63 | 0.20 | 0.61 |
| Underactive, slow moving or lacks energy | 0.08 | 0.28 | 0.07 | 0.28 | 0.05 | 0.28 |
| Unhappy, sad or depressed | 0.03 | 0.14 | 0.04 | 0.21 | 0.03 | 0.31 |
| Withdrawn, doesn't get involved with others | 0.01 | 0.26 | 0.004 | 0.33 | 0.001 | 0.30 |

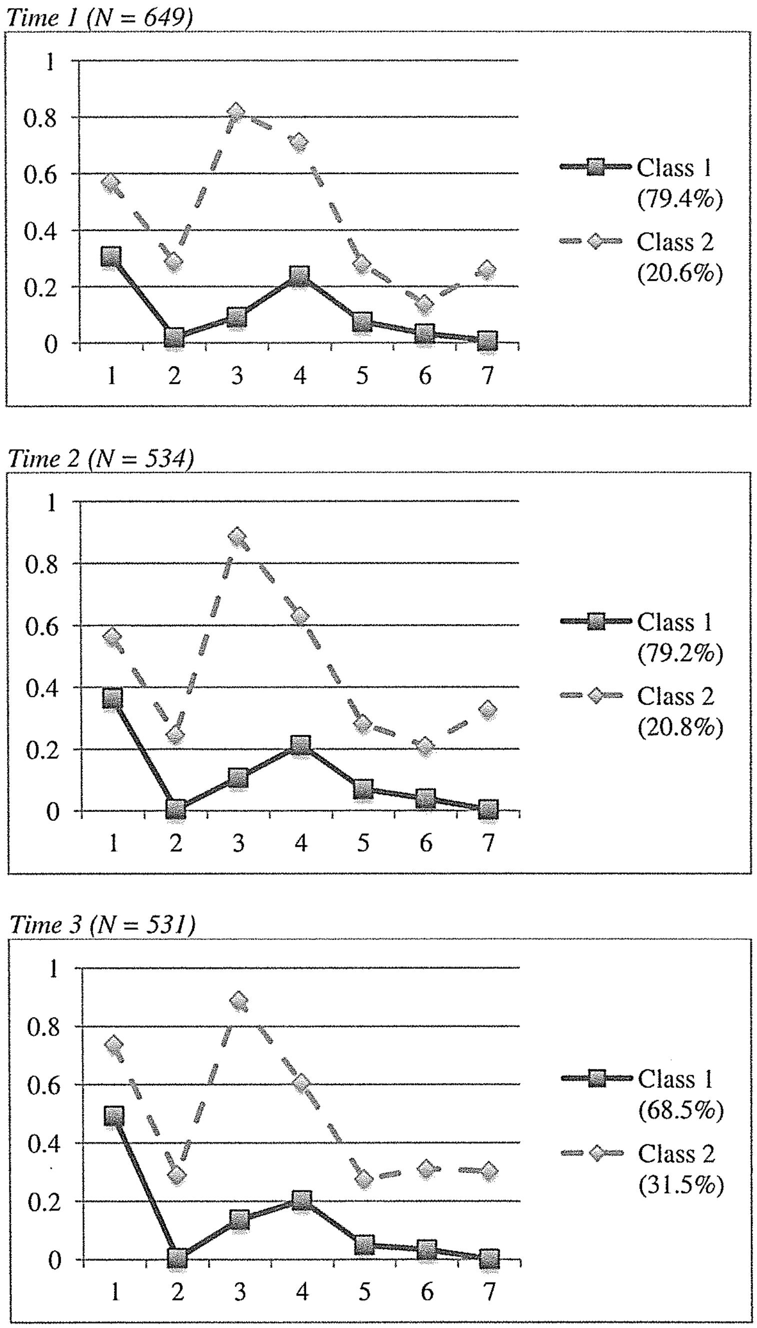



Figure 6. Item response probability plots for the 2-class solution at Times 1, 2, and 3. Class size information is in the legend. Class 1 = low symptom class, Class 2 = shy/secretive class. On the x-axis, 1 = Would rather be alone than with others, 2 = Refuses to talk, 3 = Secretive, keeps things to self, 4 = Too shy or timid, 5 = Underactive, slow moving or lacks energy, 6 = Unhappy, sad, or depressed, 7 = Withdrawn, doesn't get involved with others.

**Interpreting the Latent Classes**. The same two latent classes emerged at Times 1, 2, and 3. One latent class (Class 1) represented a low symptom endorsement across all items with the exception of a moderate endorsement on the "Would rather be alone than with others." The second class (Class 2) represented moderate symptom severity with peaks on the "Would rather be alone than with others," "Secretive, keeps things to self," and "Too shy or timid" items.

**Measurement Invariance Across Gender**. In selecting the best latent class model for each gender, few models provided fit statistics that unanimously pointed towards the same number of classes for boys and girls at each time point. As such, in addition to evaluating fit statistics, parsimony within the context of multiple groups (e.g., same number of classes across groups) and substantive meaning of classes were considered when determining the best fitting model for each gender.

For both boys and girls, a 2-class solution was selected for Times 1, 2, and 3. Similar to the LCA solutions collapsed across gender, one latent class (Class 1) that emerged at all three time points, for boys and girls, represented a low symptom endorsement across all items with the exception of a moderate endorsement on the "Would rather be alone than with others" item.

A second class (Class 2) that emerged at all three time points, for boys and girls, represented moderate symptom severity with elevations on the "Would rather be alone than with others," "Secretive, keeps things to self," and "Too shy or timid" items. Although the same general pattern was observed in boys and girls at Time 3, a few qualitative differences emerged. For girls, the "Unhappy, sad or depressed" item was also elevated. All other items fell within the low endorsement range for boys and in the moderate endorsement range for girls. Model comparisons for boys and girls, separately, at each time point are shown in Table 7. Item response probabilities and class prevalences for each gender and class are shown in Table 8 and Figure 7. Model comparisons of full and partial measurement invariance across gender for Times 1, 2, and 3 are shown in Table 9.

Table 7

*Selecting Number of Latent Classes for Boys and Girls at Times 1, 2, and 3*

| Model | Numbers of Parameters Estimated | Log L | BIC | Entropy | Vuong-Lo-Mendell Rubin *p*-value | BLRT *p*-value |
|---|---|---|---|---|---|---|
| | | | Time 1 | | | |
| Boys | | | | | | |
| 1 class | 7 | -918.75 | 1877.87 | | 0 | 0 |
| **2 class** | **15** | **-868.20** | **1822.92** | **0.70** | **0.01** | **0.31** |
| 3 class | 23 | -861.98 | 1856.62 | 0.84 | 0.15 | 0.67 |
| 4 class | 31 | -857.24 | 1893.30 | 0.88 | 0.45 | **1** |
| Girls | | | | | | |
| 1 class | 7 | -960.41 | 1961.40 | | 0 | 0 |
| **2 class** | **15** | **-896.65** | **1880.24** | **0.77** | **0.24** | **0.6** |
| 3 class | 23 | -889.76 | 1912.83 | 0.89 | 0.29 | 0.27 |
| 4 class | 31 | -883.41 | 1946.50 | 0.84 | 0.047 | 0.43 |
| | | | Time 2 | | | |
| Boys | | | | | | |
| 1 class | 7 | -758.79 | 1556.54 | | 0 | 0 |
| **2 class** | **15** | **-701.74** | **1486.95** | **0.85** | **0.01** | **0.19** |
| 3 class | 23 | -694.48 | 1516.94 | 0.92 | 0.45 | 1 |
| 4 class | 31 | -688.83 | 1550.16 | 0.89 | | |
| Girls | | | | | | |
| 1 class | 7 | -814.83 | 1668.93 | | 0 | 0 |
| **2 class** | **15** | **-759.66** | **1603.46** | **0.74** | **0.25** | **1** |
| 3 class | 23 | -754.50 | 1638.01 | 0.87 | 0.43 | 1 |
| 4 class | 31 | -750.42 | 1674.72 | 0.89 | 0.042 | 1 |
| | | | Time 3 | | | |
| Boys | | | | | | |
| 1 class | 7 | -853.37 | 1745.61 | | 0 | 0 |
| **2 class** | **15** | **-783.95** | **1651.20** | **0.73** | **0.06** | **0.08** |
| 3 class | 23 | -774.35 | 1676.41 | 0.87 | 0.19 | 0.12 |
| 4 class | 31 | -766.20 | 1704.53 | 0.90 | 0.78 | 1 |
| Girls | | | | | | |
| 1 class | 7 | -911.77 | 1862.81 | | 0 | 0 |
| **2 class** | **15** | **-816.39** | **1716.92** | **0.80** | **0.26** | **0** |
| 3 class | 23 | -802.91 | 1734.84 | 0.86 | 0.16 | 0.11 |
| 4 class | 31 | -794.35 | 1762.60 | 0.92 | 0.41 | 1 |

Table 8

*Item Response Probabilities for Boys and Girls at Times 1, 2, and 3*

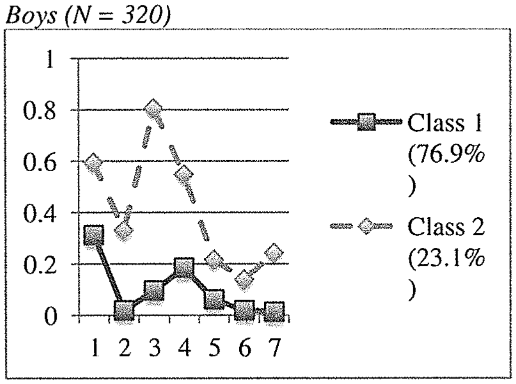
| | Time 1 | | | | Time 2 | | | | Time 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Boys | | Girls | | Boys | | Girls | | Boys | | Girls | |
| | Class 1 | Class 2 | Class 1 | Class 2 | Class 1 | Class 2 | Class 1 | Class 2 | Class 1 | Class 2 | Class 1 | Class 2 |
| Items | 37.9% | 11.4% | 40.8% | 9.9% | 40.7% | 8.1% | 38.4% | 12.7% | 31.0% | 17.6% | 38.9% | 12.5% |
| Rather be alone | 0.31 | 0.60 | 0.30 | 0.52 | 0.39 | 0.67 | 0.35 | 0.48 | 0.46 | 0.75 | 0.52 | 0.75 |
| Refuses to talk | 0.02 | 0.33 | 0.02 | 0.25 | 0.01* | 0.36 | 0.00* | 0.18 | 0.01* | 0.31 | 0.00* | 0.29 |
| Secretive | 0.10 | 0.81 | 0.08 | 0.81 | 0.15 | 1.00* | 0.07 | 0.78* | 0.13 | 0.96 | 0.15 | 0.85 |
| Too shy | 0.19 | 0.55* | 0.28 | 0.89* | 0.17 | 0.54 | 0.24 | 0.73 | 0.17 | 0.56 | 0.25 | 0.66 |
| Underactive | 0.06 | 0.22 | 0.09 | 0.34 | 0.08 | 0.20 | 0.06 | 0.33 | 0.04 | 0.22 | 0.06 | 0.37 |
| Unhappy | 0.02 | 0.14 | 0.04 | 0.14 | 0.04 | 0.16 | 0.04 | 0.25 | 0.04 | 0.17* | 0.03 | 0.53* |
| Withdrawn | 0.01 | 0.24 | 0.004 | 0.26 | 0.01 | 0.43 | 0.003 | 0.26 | 0.01* | 0.26 | 0.00* | 0.38 |

Note. Item labels were shortened

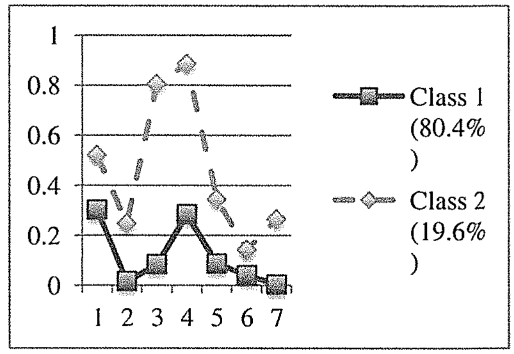
*Item response probabilities are significantly different in boys and girls, $p < .05$

*Time 1*

*Boys (N = 320)*

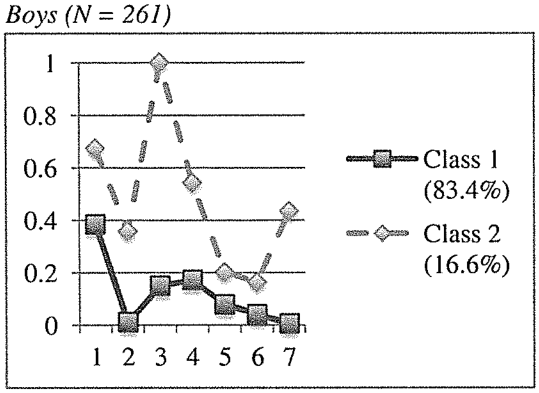



*Girls (N = 329)*

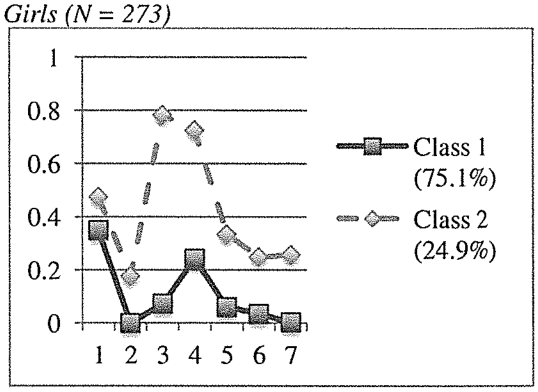



*Time 2*

*Boys (N = 261)*

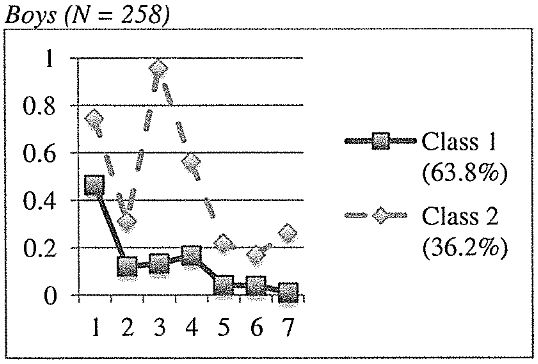



*Girls (N = 273)*




*Time 3*

*Boys (N = 258)*




*Girls (N = 273)*

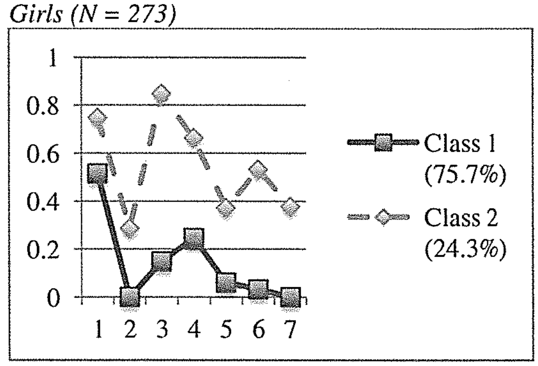



Figure 7. Item response probability plots for 2-class solution for boys and girls at Times 1, 2, and 3. Class size information is in the legend. Class 1 = low symptom class, Class 2 = shy/secretive class. On the x-axis, 1 = Would rather be alone than with others, 2 = Refuses to talk, 3 = Secretive, keeps things to self, 4 = Too shy or timid, 5 = Underactive, slow moving or lacks energy, 6 = Unhappy, sad, or depressed, 7 = Withdrawn, doesn't get involved with others.

Table 9

*Tests of Measurement Invariance Across Gender at Times 1, 2, and 3*

| Model | Number of Parameters Estimated | BIC | Log L | Model Comparison | 2(diff Log L) | $\Delta df$ | $p$ |
|---|---|---|---|---|---|---|---|
| | | | Time 1 | | | | |
| 1 | 31 | 4630.02 | -2214.64 | | | | |
| 2 | 16 | 4563.70 | -2230.05 | 1v2 | 30.82 | 15 | 0.01 |
| 3 | 17 | 4570.16 | -2230.04 | 1v3 | 30.80 | 14 | 0.01 |
| **4** | **18** | **4559.96** | **-2221.70** | **1v4** | **14.12** | **13** | **0.37** |
| | | | Time 2 | | | | |
| 1 | 31 | 3857.51 | -1831.41 | | | | |
| 2 | 16 | 3797.33 | -1848.42 | 1v2 | 34.03 | 15 | 0.003 |
| 3 | 17 | 3803.50 | -1848.37 | 1v3 | 33.92 | 14 | 0.002 |
| 4 | 19 | 3807.10 | -1843.89 | 1v4 | 24.96 | 12 | 0.02 |
| **5** | **20** | **3806.49** | **-1840.44** | **1v5** | **18.07** | **11** | **0.08** |
| | | | Time 3 | | | | |
| 1 | 31 | 4130.90 | -1968.19 | | | | |
| 2 | 16 | 4074.67 | -1987.13 | 1v2 | 37.89 | 15 | 0.001 |
| 3 | 17 | 4077.79 | -1985.56 | 1v3 | 34.75 | 14 | 0.002 |
| **4** | **20** | **4076.74** | **-1975.62** | **1v4** | **14.87** | **11** | **0.19** |

At Time 1, partial measurement invariance provided the best fit to the data. The "Too shy or timid" item was significantly lower in boys compared to girls; therefore, the best fitting model, Model 4, allowed for this item to be freely estimated. At Time 2, Models 2 through 4 provided a significantly worse fit to the data compared to Model 1. Of note, all significantly different item response probabilities occurred when the value of one of the parameters, either in boys or girls, was equal to 0 or 1. Therefore, it is possible that the Wald test $p$-value may represent a Type 1 error, such that a significant difference was detected when in fact the item response parameters were not significantly different from one another. Additionally, although not significantly different at Time 2, the "Too shy or timid" item was greater in girls than boys by 0.19. Given that this item was freely estimated at Time 1, a fifth model, which freely estimated the "Too shy or timid" item and the other significantly different item response probabilities was tested. Compared to Model 1, the parameter constraints in Model 5 did not significantly deteriorate model fit and suggested partial invariance at Time 2.

At Time 3, Model 4 provided the best fit to the data, suggesting partial measurement invariance of the latent structure. The "Refuses to talk" and "Withdrawn, doesn't get involved with others" item response probabilities were significantly greater in boys compared to girls. However, these significant differences occurred when the parameters equaled zero in girls and 0.01 and 0.12 in boys, respectively. Significant differences were not detected between boys and girls for other items, despite equal or greater differences between response probabilities. Additionally, the "Unhappy, sad, or depressed" item response probability was significantly greater in girls compared to boys, and, therefore, freely estimated in the model.

Although Wald parameter tests yielded significant differences in a subset of item response probabilities, the number, type, and overall interpretation of classes was similar in boys and girls across time points. Therefore, full measurement invariance across gender, at Times 1, 2, and 3, was imposed. Gender invariant item response probabilities are shown in Table 6. Furthermore, because measurement invariance of the item response probabilities across gender was imposed, measurement invariance of the latent class prevalences across gender was tested. A comparison between Models 2 and 3 using an LRT provided a test of gender differences in class prevalences. At each time point, Model 2 (i.e., item response probabilities and class prevalences were constrained to be equal across gender) did not provide a significantly worse fit to the data, indicating that latent class prevalences were not significantly different in boys and girls at Time 1 ($\chi^2$ (1, 649)

= 0.02, $p = 0.89$), Time 2 ($\chi^2$ (1, 534) = 0.10, $p = 0.75$), and Time 3 ($\chi^2$ (1, 531) = 3.14, $p = 0.08$).

**Include Sports Participation as a Covariate**. To determine whether it was necessary to account for gender when testing the effect of sports participation on class membership, two models were compared by means of an LRT at Times 1, 2, and 3. Model 1 included sports participation as a covariate when class prevalences were freely estimated across gender. Model 2 included sports participation as a covariate when class prevalences were constrained to be equal across gender. Sports participation was assessed separately at each time point. Results indicated that Model 2 did not significantly deteriorate model fit at Time 1 ($\chi^2$ (1, 648) = 0.002, $p = 0.96$), Time 2 ($\chi^2$ (1, 534) = 0.13, $p = 0.71$), and Time 3 ($\chi^2$ (1, 530) = 3.53, $p = 0.06$), suggesting that class membership did not significantly vary by gender, when accounting for sports participation. Therefore, Model 2 was retained for future analyses.

In order to test whether sports participation was a significant predictor of class membership, Model 2 was compared to Model 3 where class prevalences were constrained to be equal across gender, but the effect of sports participation on class membership was fixed to equal zero. Results of model comparisons indicated that Model 3 did not significantly deteriorate model fit at Time 1 ($\chi^2$ (1, 648) = 1.45, $p = 0.23$) and Time 2 ($\chi^2$ (1, 534) = 2.28, $p = 0.13$). These results indicated that sports participation at Time 1 did not significantly predict class membership at Time 1 and sports participation at Time 2 did not significantly predict class membership at Time 2. However, Model 3 provided a significantly worse fit to the data at Time 3 ($\chi^2$ (1, 535) = 5.73, $p < 0.05$), indicating that sports participation at Time 3 significantly predicted class membership at

Time 3. When sports participation equaled zero, individuals were less likely to be in the shy/secretive class relative to the low symptom class; however, this relation was not significant ($B_0$= -0.37, $p = 0.10$; Odds = 0.69). For a one-unit increase in sports participation at Time 3, the odds ratio of being in the shy/secretive class (Class 2) relative to the low symptom class (Class 1) changed by a factor of 0.74 ($B_1$= -0.30, $p < 0.05$, OR = 0.74). In other words, the odds decreased.

**Step 2: The Unconditional Latent Transition Analysis (LTA) Model**

Before measuring the transition probabilities between time points, tests of measurement invariance of the 1) latent structure across time and 2) transition probabilities across gender were conducted. Transition probabilities were computed from Time 1 to Time 2 and from Time 2 to Time 3, for the best fitting model.

**Measurement Invariance Across Time.** Full measurement invariance across time was tested by comparing Model 1 where item response probabilities were constrained to be equal across gender, but freely estimated across time points, to a more restrictive model, Model 2, where item response probabilities were constrained to be equal across both gender and time points. The more restrictive model, Model 2, significantly deteriorated model fit ($\chi^2$ (28, 649) = 71.84, $p < 0.001$). However, the BIC statistic was smaller in the more restrictive model. Given the BIC was smaller in Model 2 (*BIC* = 10860.06) compared to Model 1 (*BIC* = 10969.52) and the number and type of withdrawn classes appeared similar at Times 1, 2, and 3, full measurement invariance across time points could be reasonably assumed and was imposed for the latent transition analysis. The decision to impose measurement invariance across time points ensured that the meaning of the latent classes was held constant.

**Gender Differences in Transition Probabilities.** Because measurement invariance of the latent class structure was imposed across time and gender, gender differences in transition probabilities were explored. Model 1 with transition probabilities freely estimated across gender from Time 1 to Time 2 and from Time 2 to Time 3 was compared to Model 2 where transition probabilities across the two transition periods were constrained to be equal across gender. Models were compared by means of an LRT. Model 2 did not significantly differ from Model 1 ($\chi^2$ (2, 649) = 4.56, $p$ = 0.10); therefore, the more parsimonious model was retained and transition probabilities, at each transition period, were constrained to be equal across gender. Transition probabilities for the periods between Time 1 and Time 2 and between Time 2 and Time 3 are displayed in Table 10.

**Interpreting the LTA Model.** The diagonal elements of the transition probability matrices reflect the probability of remaining in the same latent class over time. Individuals were most likely to remain in their same class from Time 1 to Time 2 and from Time 2 to Time 3. Individuals in the low symptom class (Class 1) had a high probability (89%) of remaining in the same class at Time 2. Only 11% of low symptom individuals transitioned into the shy/secretive class (Class 2) at Time 2. Similarly, individuals in the shy/secretive class had a high probability (76%) of remaining in the same class at Time 2, whereas only 24% of individuals in the shy/secretive class transitioned into the low symptom class at Time 2. The same pattern of results was observed from Time 2 to Time 3. From Time 1 to Time 2, a greater percentage of individuals transitioned from the shy/secretive class to the low symptom class than from the low symptom class to the shy/secretive class. However, from Time 2 to Time 3, this pattern was reversed, such that a greater percentage of individuals transitioned from the low symptom class into the shy/secretive class compared to individuals who transitioned from the shy/secretive class to the low symptom class.

Table 10

*Transition Probabilities for the LTA Model*

| | $WB_2$ | |
|---|---|---|
| $WB_1$ | 1 | 2 |
| 1 | 0.89 | 0.11 |
| 2 | 0.24 | 0.76 |

| | $WB_3$ | |
|---|---|---|
| $WB_2$ | 1 | 2 |
| 1 | 0.79 | 0.20 |
| 2 | 0.13 | 0.87 |

Note. 1= low symptom class; 2= shy/secretive class

### Step 3: Include Sports Participation as a Covariate in the LTA Model

To determine whether it was necessary to account for gender when testing the effects of sports participation covariates on latent status transitions, two models were compared by means of an LRT. Model 1 retained the item response probability constraints across time and gender, but allowed transition probabilities to be freely estimated in boys and girls across transition periods. Model 2 differed from Model 1 in that transition probabilities were constrained to be equal across gender. Sports participation at Times 1 and 2 were each added to both models to test their respective effects on transition probabilities between Time 1 and Time 2 and between Time 2 and Time 3. Results indicated that Model 2 did not significantly deteriorate model fit ($\chi^2$ (2,

533) = 4.44, $p$ = 0.11), suggesting that transition probabilities did not significantly differ across gender, when accounting for sports participation at Times 1 and 2. Therefore, Model 2 was retained for future analyses.

In order to test the respective effects of sports participation at Times 1 and 2 on the latent status transitions between Time 1 and Time 2 and between Time 2 and Time 3, two models were compared by means of an LRT. Model 2 was compared to Model 3 where relations between sports participation variables and transition probabilities were fixed to equal zero. Results indicated that Model 3 did not significantly deteriorate model fit ($\chi^2$ (6, 533) = 7.63, $p$ = 0.27), suggesting that sports participation at Time 1 did not significantly predict transition probabilities between Time 1 and Time 2 and sports participation at Time 2 did not significantly predict transition probabilities between Time 2 and Time 3.

## Alternative Modeling Solutions

**Alternative #1: Selecting a 3-class Model at Time 3.** Because an argument could be made for a 3-class model at Time 3, this possibility was also explored. Item response probabilities and class prevalences for a 3-class model at Time 3 are depicted in Table 11 and Figure 8 for boys and girls, separately. The average latent class assignment probabilities for boys assigned to each class ranged from 0.91 to 0.94, indicating high precision of class assignment for the 3-class model. For girls, the average latent class assignment probabilities for Class 1 and Class 3 were 0.98 and 0.91, respectively. However, the average latent class assignment probability for Class 2 was 0.75, which was somewhat low and indicated uncertainty with regard to class assignment for Class 2 compared to Classes 1 and 3.

Table 11

*Item Response Probabilities for the 3-Class LCA Solution for Boys and Girls at Time 3*

| | Boys | | | Girls | | |
|---|---|---|---|---|---|---|
| | Class 1 | Class 2 | Class 3 | Class 1 | Class 2 | Class 3 |
| Withdrawn Items | 31.0% | 14.9% | 2.7% | 37.8% | 6.8% | 6.9% |
| Would rather be alone than with others | 0.46 | 0.78 | 0.62 | 0.52 | 0.74 | 0.70 |
| Refuses to talk | 0.02* | 0.34 | 0.11 | 0.00* | 0.09 | 0.44 |
| Secretive, keeps things to self | 0.14 | 1.00 | 0.58 | 0.12 | 1.00 | 0.73 |
| Too shy or timid | 0.18 | 0.64* | 0.00* | 0.22 | 1.00* | 0.42* |
| Underactive, slow moving or lacks energy | 0.04 | 0.20 | 0.33 | 0.06 | 0.19 | 0.48 |
| Unhappy, sad or depressed | 0.00* | 0.10 | 1.00* | 0.03* | 0.15 | 0.85* |
| Withdrawn, doesn't get involved with others | 0.01* | 0.29 | 0.08 | 0.00* | 0.33 | 0.36 |

*Item response probabilities are significantly different in boys and girls, $p < .05$

*Time 3*

*Boys (N = 258)* *Girls (N = 273)*

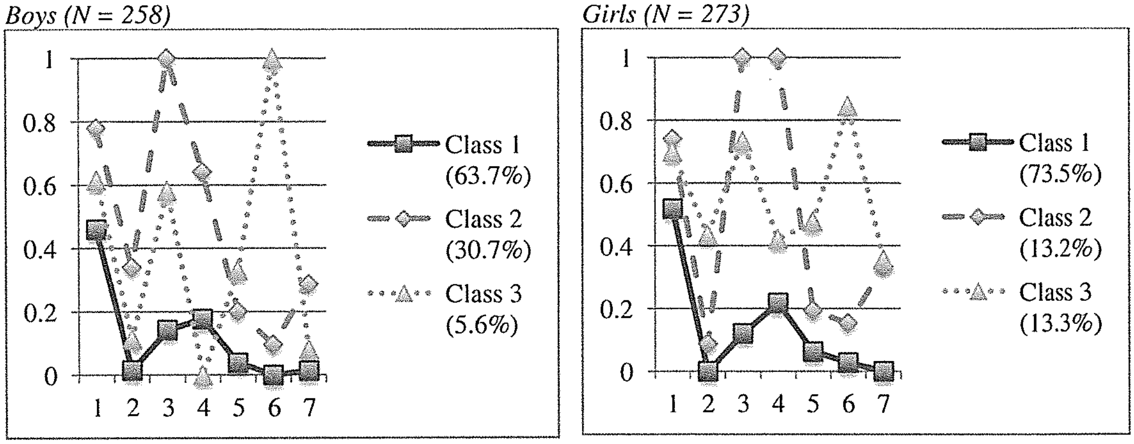



Figure 8. Item response probability plots for the 3-class solution for boys and girls at Time 3. Class size information is in the legend. Note. Class 1 = low symptom class, Class 2 = shy/secretive class, Class 3= depressed class. On the x-axis, 1 = Would rather be alone than with others, 2 = Refuses to talk, 3 = Secretive, keeps things to self, 4 = Too shy or timid, 5 = Underactive, slow moving or lacks energy, 6 = Unhappy, sad, or depressed, 7 = Withdrawn, doesn't get involved with others.

***Interpreting the latent classes.*** The same two classes from the 2-class model emerged. Class 1 represented a low symptom class and Class 2 represented a shy/secretive class. In addition, for both boys and girls, Class 3 represented a depressed class with a peak on the depressed item and moderate to high symptom severity on the "Would rather be alone than with others" and "Secretive, keeps things to self" items. For girls, all other item response probabilities were in the moderate to high range, whereas, for boys, all other item response probabilities were in the low to moderate range.

***Measurement invariance across gender.*** To test measurement invariance of item response probabilities across gender, a series of models were compared. In Model 1, all parameters (i.e., item response probabilities and class prevalences) were freely estimated across gender. In Model 2, all parameters were constrained to be equal in boys and girls.

If Model 2 provided a significantly worse fit to the observed data, Model 1 was compared to Model 3, a model where all item response probabilities were constrained to be equal across gender, but class prevalences were left freely estimated. If all item response probabilities could not be constrained to be equal across gender, partial measurement invariance was tested in Model 4. In Model 4, all item response probabilities were constrained to be equal across gender with the exception of any item response probabilities parameters that were significantly different across gender. Model comparisons are showed in Table 12. Model 3 provided the best fit to the data, such that all item response probabilities were constrained to be equal across gender and class prevalences were freely estimated. Since measurement invariance of item response probabilities was imposed, gender differences in class prevalences were tested. Model 2 was compared to Model 3 using an LRT. Model 2 significantly deteriorated model fit ($\chi^2$ (2, 531) = 14.8, $p$ = 0.001), indicating that latent class prevalences were significantly different in boys and girls at Time 3.

Table 12

*Tests of Measurement Invariance Across Gender for the 3-Class Model at Time 3*

| Model | Number of Parameters Estimated | BIC | Log L | Model Comparison | 2(diff Log L) | $\Delta df$ | $p$ |
|---|---|---|---|---|---|---|---|
| 1 | 47 | 4185.13 | -1945.11 | | | | |
| 2 | 24 | 4087.56 | -1968.48 | 1v2 | 46.76 | 23 | 0.002 |
| **3** | **26** | **4085.31** | **-1961.08** | **1v3** | **31.96** | **21** | **0.06** |

***Include sports participation as a covariate.*** To test the effect of sports participation on latent class membership, Model 1 was compared to Model 3 where latent class prevalences were freely estimated across gender, but the effect of sports participation on class membership was fixed to zero. Model 3 did not significantly deteriorate model fit ($\chi^2$ (2, 530) = 5.6, $p$ = 0.06), indicating that sports participation was not a significant predictor of latent class membership.

***Measurement invariance across time.*** Full measurement invariance across time was tested by comparing Model 1, where item response probabilities were constrained to be equal across gender and were freely estimated across time points, to Model 2 where item response probabilities were constrained to be equal across both gender and time. Item response probabilities for Class 1 and Class 2 were constrained to be equal across gender and time, but the item response probabilities for Class 3, which were only modeled at Time 3, were only constrained to be equal across gender. Model 2 significantly deteriorated model fit ($\chi^2$ (28, 649) = 79.55, $p$ < 0.001). Given the BIC was smaller in Model 2 (*BIC* = 10877.09) compared to Model 1 (*BIC* = 10978.85) and Class 1 and Class 2 were interpreted similarly at Times 1, 2, and 3, full measurement invariance across time points for Classes 1 and 2 could be reasonably assumed and was imposed for the latent transition analysis.

***Gender differences in transition probabilities.*** Model 1 with transition probabilities freely estimated across gender between Time 1 and Time 2 and between Time 2 and Time 3 was compared to Model 2 where transition probabilities across the two transition periods were constrained to be equal across gender. Model 2 did not significantly differ from Model 1 ($\chi^2$ (3, 649) = 6.64, $p$ = 0.08), indicating that transition probabilities were not significantly different in boys and girls. Transition probabilities for both transition periods are displayed in Table 13.

Transition probabilities from Time 1 to Time 2 followed the same pattern of results from the 2-class full measurement model, such that individuals had the highest probability of remaining in the same class over time. From Time 2 to Time 3, individuals also had the greatest probability of remaining in the same class over time. Individuals in the low symptom class (Class 1) who changed class membership were most likely to transition to the shy/secretive class (Class 2); whereas, individuals in the shy/secretive class were most likely to transition to the low symptom class. All individuals had the lowest probability of transitioning into the depressed class (Class 3).

Table 13

*Transition Probabilities for the LTA Model with a 3-Class Model at Time 3*

| | $WB_2$ | |
|---|---|---|
| $WB_1$ | 1 | 2 |
| 1 | 0.89 | 0.11 |
| 2 | 0.25 | 0.75 |

| | $WB_3$ | | |
|---|---|---|---|
| $WB_2$ | 1 | 2 | 3 |
| 1 | 0.81 | 0.14 | 0.05 |
| 2 | 0.14 | 0.77 | 0.09 |

Note. 1= low symptom class; 2= shy/secretive class; 3 = depressed class

***Sports participation predicting transition probabilities.*** To determine whether it was necessary to account for gender when testing the effects of sports participation covariates on latent status transitions, two models were compared by means of an LRT.

Model 1 retained the item response probability constraints across time and gender, but allowed transition probabilities to be freely estimated in boys and girls across time. Model 2 differed from Model 1 in that the transition probabilities were constrained to be equal across gender. Sports participation at Times 1 and 2 were each added to both models to test their respective effects on latent status transitions between Time 1 and Time 2 and between Time 2 and Time 3. Results indicated that Model 2 did not significantly deteriorate model fit ($\chi^2$ (3, 533) = 5.86, $p$ = 0.12), suggesting that transition probabilities did not significantly very across gender, when accounting for both sports participation covariates. Model 2 was retained for future analyses.

In order to test the respective effects of sports participation at Times 1 and 2 on the latent status transitions between Time 1 and Time 2 and between Time 2 and Time 3, two models were compared by means of an LRT. Model 2 was compared to Model 3 where relations between sports participation variables and transition probabilities were fixed to equal zero. Results indicated that Model 3 did not significantly deteriorate model fit ($\chi^2$ (8, 533) = 14.65, $p$ = 0.07), suggesting that sports participation at Time 1 did not significantly predict transition probabilities between Time 1 and Time 2 and sports participation at Time 2 did not significantly predict transition probabilities between Time 2 and Time 3.

**Alternative #2: Modeling Partial Measurement Invariance**. The LCA model comparisons at Times 1, 2, and 3 suggested that imposing partial measurement invariance did not significantly deteriorate model fit compared to the freely estimated model. In addition, at Time 3, the interpretation of Class 2 in girls appeared to change due to an elevated item response probability on the "Unhappy, sad, or depressed" item compared to

Times 1 and 2. Therefore, LCA models and an LTA model imposing partial measurement invariance as opposed to full measurement invariance were explored.

For each 2-class LCA model at Times 1, 2, and 3, significantly different item response probabilities between boys and girls were freely estimated. All other item response probabilities were constrained to be equal across gender. Additionally, at Time 2, although the "Too shy or timid" item was not significantly different in boys and girls in Class 2, freeing this item significantly improved model fit. Therefore, this item was freely estimated in Class 2, for boys and girls, at Time 2. Given that the interpretation of latent classes remained relatively similar across boys and girls under partial measurement invariance, gender differences in the latent class prevalences were tested. Model comparisons revealed that constraining latent class prevalences to be equal across gender did not deteriorate model fit at Time 1 ($\chi^2$ (1, 649) = 0.62, $p$ = 0.43) and Time 2 ($\chi^2$ (1, 534) = 0.46, $p$ = 0.50). At Time 3, the LRT yielded a p-value trending towards significance ($\chi^2$ (1, 531) = 3.73, $p$ = 0.054).

***Include sports participation as a covariate.*** To determine whether it was necessary to account for gender when testing the effect of sports participation on class membership, two models were compared by means of LRTs at Times 1, 2, and 3. Model 1 included sports participation as a covariate when class prevalences were freely estimated across gender. Model 2 included sports participation as a covariate when class prevalences were constrained to be equal across gender. Sports participation was assessed separately at each time point. Results indicated that Model 2 did not significantly deteriorate model fit at Time1 ($\chi^2$ (1, 648) = 0.48, $p$ = 0.49) and Time 2 ($\chi^2$ (1, 534) = 0.53, $p$ = 0.47), suggesting that class prevalences did not significantly vary by gender, when accounting for sports participation at both Time 1 and Time 2. However, at Time 3, the LRT between Model 1 and 2 yielded a significant difference ($\chi^2$ (1, 530) = 4.16, $p <$ 0.05), indicating that class prevalences significantly differed in boys and girls when accounting for sports participation at Time 3.

To test the effect of the sports participation at Time 1 on latent class membership at Time 1 and sports participation at Time 2 on latent class membership at Time 2, Model 2 was compared to Model 3 at each time point. In Model 3, class prevalences were constrained to be equal in boys and girls and the effect of sports participation on class membership was fixed to equal zero. Results indicated that Model 3 did not significantly deteriorate model fit at Time 1 ($\chi^2$ (1, 648) = 1.16, $p = 0.28$) and Time 2 ($\chi^2$ (1, 534) = 2.44, $p = 0.12$. These results indicated that sports participation at Time 1 was not a significant predictor of class membership at Time 1 and sports participation at Time 2 was not a significant predictor of class membership at Time 2.

At Time 3, Model 1 was compared to Model 4 where class prevalences were freely estimated in boys and girls and the effect of sports participation on class membership was fixed to equal zero. Results indicated that Model 4 significantly deteriorated model fit ($\chi^2$ (1, 530) = 6.25, $p < 0.05$), indicating that sports participation significantly predicted class membership when gender was freely estimated. In other words, when accounting for sports participation, class prevalences significantly varied by gender ($B_1$= 0.47, $p < 0.05$). Likewise, when accounting for gender, sports participation significantly predicted class membership ($B_1$= -0.30, $p < 0.05$, OR = 0.73). When sports participation equaled zero, individuals were less likely to be in the shy/secretive class relative to the low symptom class ($B_0$= -0.63, $p < 0.05$; Odds = 0.53). For a one-unit increase in sports participation at Time 3, the odds ratio of being in the shy/secretive class (Class 2) relative to the low symptom class (Class 1) changed by a factor of 0.73. In other words, the odds decreased.

In order to investigate whether there was a gender x sports participation interaction, a moderation analysis was run using SPSS version 22. Results showed that gender did not significantly moderate the relation between sports participation and class membership at Time 3 ($B_I = 0.14$, $p = 0.52$). The effect of sports participation on class membership was nonsignificant in boys ($B_I = 0.15$, $p = 0.29$) and marginally significant in girls ($B_I = 0.30$, $p = 0.07$).

***Partial measurement invariance across time.*** Model 1 allowed item response probabilities that were significantly different in boys and girls to be freely estimated within and across time points. All other item response probabilities were constrained to be equal across gender, but freely estimated across time. Model 1 was compared to a more restrictive model, Model 2, where item response probabilities that were significantly different in boys and girls were freely estimated within and across time points, but all other item response probabilities were constrained to be equal across gender *and* time points. The more restrictive model, Model 2, significantly deteriorated model fit ($\chi^2$ (21, 649) = 54.24, $p < 0.001$). However, the BIC statistic was smaller in Model 2 (*BIC* = 10880.71) compared to Model 1 (*BIC* = 10962.45). Given supporting evidence from the smaller BIC statistic in Model 2 and similarities in class type across time, partial measurement invariance across time points could be reasonably assumed and was imposed for future analyses. Furthermore, permitting gender differences in a select subset of item response probabilities across gender and time allowed for the LTA model to capture differences in withdrawn latent classes in boys and girls while also largely maintaining the meaning of latent classes over time.

***Gender differences in transition probabilities.*** To test gender differences in transition probabilities, Model 1 with freely estimated transition probabilities across gender between Time 1 and Time 2 and between Time 2 and Time 3 was compared to Model 2 where transition probabilities across the two transition periods were constrained to be equal across gender. Results of the LRT indicated that Model 2 did not significantly differ from Model 1 ($\chi^2$ (2, 649) = 4.25, $p$ = 0.12). Therefore, transition probabilities were constrained to be equal across gender. Transition probabilities for the periods between Time 1 and Time 2 and between Time 2 and Time 3 are displayed in Table 14. Transition probabilities followed the same pattern of results from the 2-class full measurement model.

Table 14

*Transition Probabilities for the LTA Model with Partial Measurement Invariance*

| | $WB_2$ | |
|---|---|---|
| $WB_1$ | 1 | 2 |
| 1 | 0.87 | 0.13 |
| 2 | 0.22 | 0.78 |

| | $WB_3$ | |
|---|---|---|
| $WB_2$ | 1 | 2 |
| 1 | 0.80 | 0.20 |
| 2 | 0.16 | 0.84 |

Note. 1= low symptom class; 2= shy/secretive class

***Sports participation predicting transition probabilities.*** To determine whether it was necessary to account for gender when testing the effects of sports participation covariates on latent status transitions, two models were compared by means of an LRT. Model 1 retained the partially invariant item response probability constraints across time and gender, but allowed transition probabilities to be freely estimated in boys and girls across transition periods. Model 2 differed from Model 1 in that transition probabilities were constrained to be equal across gender. Sports participation at Times 1 and 2 were each added to both models to test their respective effects on transition probabilities between Time 1 and Time 2 and between Time 2 and Time 3. Results indicated that Model 2 did not significantly deteriorate model fit ($\chi^2$ (2, 533) = 0.70, $p$ = 0.70), suggesting that transition probabilities did not significantly differ in boys and girls, when accounting for both sports participation covariates. Model 2 was retained for future analyses.

In order to test the respective effects of sports participation at Times 1 and 2 on the latent status transitions between Time 1 and Time 2 and between Time 2 and Time 3, two models were compared by means of an LRT. Model 2 was compared to Model 3 where the relations between sports participation variables and transition probabilities were fixed to equal zero. Results indicated that Model 3 did not significantly deteriorate model fit ($\chi^2$ (10, 533) = 10.43, $p$ = 0.40), suggesting that sports participation at Time 1 did not significantly predict transition probabilities between Time 1 and Time 2 and sports participation at Time 2 did not significantly predict transition probabilities between Time 2 and Time 3.

# CHAPTER 4: DISCUSSION

Withdrawn behavior is one of the first observable behaviors in the development of psychopathology. For this reason, better understanding the type and course of withdrawn behavior may improve the prevention, diagnostic classification, and treatment of psychological problems related to behavioral solitude. To this end, the present dissertation made several important contributions to the study of withdrawn behavior across child and adolescent development.

## Latent Structure of Withdrawn Behavior

First, the current study psychometrically tested the presence of distinct subtypes of withdrawn behavior using the items from the Withdrawn/Depressed (W/D) syndrome subscale of the Child Behavior Checklist (CBCL) (Achenbach, 1991). Two classes emerged that differed by type and level of item endorsement. Class 1 represented a low symptom endorsement class and Class 2 represented a moderate symptom endorsement class with isolated peaks on the "Secretive, keeps thing to self" and "Too shy or timid" items. The emergence of the shy/secretive class raised several important points.

To start, the emergence of the shy/secretive class supports an existing body of research that has identified and investigated a broad category of withdrawn behavior motivated by shyness and/or anxiety (Coplan et al., 2004; K. H. Rubin & Asendorpf, 1993; K. H. Rubin & Coplan, 2004). Several constructs within this domain have been studied, including "conflicted shyness," "anxious solitude," and social reticence" (Coplan et al., 2004; Gazelle & Ladd, 2003). Overall, these subtypes of withdrawn behavior are defined by a wariness to approach either familiar or unfamiliar peers. Children who belong to these subtypes often wish to engage in social interaction, but their fear of social approach outweighs their desire to engage with peers (Asendorpf, 1993; Coplan et al., 2004). Whereas many parents may be accurately capturing the motivation behind their child's shy withdrawn behavior, other parents may be misinterpreting it. For example, parents may label their child's withdrawn behavior as "shy," because it is a more socially acceptable description (and explanation) of solitude, compared to other items on the W/D scale (e.g., "Refuse to talk" and "Unhappy, sad, or depressed") (D. H. Rubin et al., 2013). Therefore, on one hand, the shy/secretive class may be capturing a subtype of withdrawn behavior that closely resembles "conflicted shyness." On the other hand, the shy/secretive subtype may also include children with more severe withdrawn behavior that is normalized (e.g., rated as "shy") by parents. Future research examining the structure of the W/D scale in a clinical population of anxious youth may elucidate subtle, but important, differences in withdrawn subtypes motivated by shyness and/or anxiety.

In addition, findings from the current study supported and extended the results from a separate LCA of the W/D scale conducted by D. H. Rubin and colleagues (2013). Results from this study of U.S. children, aged 6-18 yielded four latent classes, including a low and high symptom endorsement class that only varied by level, and two separate moderate endorsement classes, one with an isolated peak on the "Too shy or timid" item and the other with an isolated peak on the "Secretive, keeps things to self" item. Findings from the current dissertation also found these items to be central to the latent structure of withdrawn subclasses. Furthermore, Rubin and colleagues conducted separate LCAs of parent-, teacher-, and youth-reported withdrawn behavior. All informants identified the low and high symptom classes, but of the moderate symptoms classes, only teachers identified the shy-moderate class, and only youth identified the secretive-moderate class.

The authors suggested that this discrepancy may be based on informant type, and that the shy- and secretive-moderate classes may be capturing the same expression of withdrawn behavior. The current study supports this notion as it classifies high endorsement of both items into the same class.

Finally, in the current study both classes had moderate (i.e., > 0.30) endorsements of the "Would rather be alone than with others" item with a higher average endorsement of this item in Class 2, suggesting that, regardless of class type, youth (31-49% in Class 1 and 56-74% in Class 2) prefer to be alone. More recently, research has explored "preference for solitude" as a separate class of internally motivated withdrawn behavior. One study showed that a preference for solitude was related to greater maladjustment in early adolescence (Wang, Rubin, Laursen, Booth-LaForce, & Rose-Krasnor, 2013). However, in this study, youth with greater levels of preference for solitude also exhibited greater levels of shyness ($r = 0.51$). In the current study, a preference for solitude cut across subclasses of withdrawn behavior. Therefore, a preference for solitude may reflect a more common temperamental trait, which may only assert deleterious effects in the context of other withdrawn behaviors or symptoms (e.g., shyness). Towards clarifying whether a preference for solitude is developmentally maladaptive, an extension of the current research could examine how class membership in the shy/secretive class relative to the low symptom class earlier in childhood influences the likelihood of experiencing maladjustment in adolescence and adulthood.

## Gender Differences

Second, the current study investigated the structure and course of withdrawn behavior in boys and girls. Overall, the same two distinct classes emerged for boys and girls across time points; however, two important gender differences emerged within the shy/secretive class. First, within the shy/secretive class at each time point, the level of endorsement on the shy item was greater for girls than boys. For Times 1 and 2, allowing these items to be freely estimated in boys and girls significantly improved model fit. Similarly, the secretive item was greater in boys compared to girls at Times 2 and 3, and significantly greater at Time 2. Higher rates of endorsement of secrecy and shyness in boys and girls, respectively, may reflect societal gender norms reflected in parents' differential response to shyness in boys compared to girls. Research has shown that parents tend to reward and accept shyness in girls, whereas they discourage shyness in boys (Birnbaum & Croll, 1984; Coplan et al., 2004; Doey, Coplan, & Kingsbury, 2014; K. H. Rubin & Barstead, 2014). In addition, research also suggests that reporters (e.g., parents and teacher) may recall "gender-stereotypical" behavior more readily in girls compared to boys (Doey et al., 2014; Renn & Calvert, 1993). For example, in the current study, it may be the case that parents recall more shyness in girls compared to boys and/or that they interpret the same shy withdrawn behavior as a "choice" to keep things to one's self in boys versus shyness or timidity in girls. This explanation would support the idea that secrecy and shyness are labels given to the same withdrawn behavioral phenotype.

A second gender difference in the shy/secretive class emerged at Time 3 when youth were between the ages of 14 and 17 years old. Although the same general pattern was observed in boys and girls at Time 3, for girls, the "Unhappy, sad or depressed" item was also elevated. This finding is consistent with a large body of research showing that rates of depression (both symptoms and clinical diagnoses) dramatically increase during adolescence, and that this increase is much greater for girls than boys (Nolen-Hoeksema, 2001). Much evidence exists suggesting that gender difference in rates of depression during adolescence can be attributed to the preponderance of stressful life events in females compared to males. For example, Nolen-Hoeksema (2001) outlined that stressful life events occur more often in women as a result of systemic inequalities, higher rates of victimization, and an intensification of gender in adolescence (Cutler & Nolen-Hoeksema, 1991; Hill & Lynch, 1983). Additionally, compelling evidence suggests that hormones including estrogen and progesterone may moderate the hypothalamic-pituitary-adrenal (HPA) axis, such that rapid hormonal changes (e.g., pubertal development) may shift the regulation of the HPA axis for females, and in turn, increase their vulnerability to depression (Young & Korszun, 1999). Regulation of the HPA axis may also be impaired by traumatic experiences, which, as stated previously, occur more often in girls than boys (Weiss, Longhurst, & Mazure, 1999). Furthermore, girls become more interpersonally oriented than boys during adolescence, and therefore, may be at higher risk for depression when relational conflict arises (Cyranowski, Frank, Young, & Shear, 2000). Finally, during adolescence, compared to boys, girls are more likely to respond to stress with rumination, a maladaptive cognitive coping style and risk factor of depression (Nolen-Hoeksema, Larson, & Grayson, 1999).

Gender differences also emerged when modeling a 3-class solution at Time 3. Class prevalence in the depressed class was greater in girls compared to boys.

Furthermore, comparing the 2-class and 3-class solutions raised several conceptual considerations. For example, a 2-class solution across time suggests that the shy/secretive class evolved into a class where about 50% of female class members also exhibited sad or depressed mood at Time 3. In this way, the meaning of the shy/secretive changed over time. In the 3-class solution, the meaning of the shy/secretive class was preserved and the existence of a new, depressed class emerged, in both boys and girls, at Time 3. The small class prevalence for the depressed class in boys (2.7% of the entire sample) not only illustrates the gender difference in depressive symptoms during adolescence, but may also explain why the 3-class solution was not detected based on fit statistics. Additionally, the 3-class solution allowed for individuals in the shy/secretive class at previous time points to remain in the same class or transition into the low symptom or depressed classes, thereby allowing for the investigation of predictors of transition into the depressed class.

Modeling a 2-class or 3-class solution may have implications for how researchers conceptualize subtypes of withdrawn behavior at different stages of development. For example, a 2-class model across time points may suggest that a shy subtype exists earlier in childhood, but evolves into a subtype that includes depressed mood in adolescence, for girls. Alternatively, a 3-class solution may suggest that a shy subtype of withdrawn behavior exists at all stages of development; however, in later adolescence (e.g., ages 14-17 years) a depressed subtype emerges, which may be the result of persistent shyness and/or develop through separate mechanisms unique to this stage in development.

**Long-Term Course of Withdrawn Behavior**

Third, the current dissertation investigated the structure of withdrawn behavior over time, and investigated transitions between subtypes across eight years of youth development. Overall, the structure and course of withdrawn subtypes remained relatively stable over time. Individuals in each class were most likely to remain in the same class over time. In this way, membership in the shy/secretive class in childhood is a risk factor for persistent shy withdrawn behavior. Overall, withdrawn behavior increased with age, such that the prevalence of membership in the shy/secretive class increased over time.

Changes in the number and interpretation of classes at Time 3 support a plethora of research demonstrating increased rates of depressed mood during adolescence, the comorbidity of anxiety and depression, and that anxiety often precedes depression (Zahn-Waxler, Klimes-Dougan, & Slattery, 2000). Findings from the current study point to the existence of two or three separate classes of withdrawn behavior and provide information about their temporal order. First, the majority of youth exhibit no (or at least very low) symptoms of withdrawn behavior. Some of these individuals spend time by themselves without the presence of other behavioral or psychological symptoms associated with withdrawn behavior (e.g., shyness, refuses to talk, secretive, depressed). This low symptom subclass of withdrawn behavior emerges early in childhood and it is present throughout youth development. Children in this class rarely transition classes.

Second, findings also indicate that a much smaller group of children exhibit shy and secretive withdrawn behavior. These children are likely to remain shy and secretive across youth development. During adolescence, girls in this subclass are at risk for developing symptoms of depressed mood. This change over time suggests that the shy/secretive subtype of withdrawn behavior, in girls, may evolve into a subtype also defined by depression. On the other hand, it may be the case that individuals in the shy/secretive class are most likely to remain shy and secretive, with only a small portion transitioning into a third depressed subtype of withdrawn behavior during adolescence. A separate depressed subtype of withdrawn behavior may resemble the "socially disinterested" subtype of withdrawn behavior (Coplan et al., 2004). Some youth in this class may represent shy children whose shyness led to feelings of depression and disinterest over time. Other individuals in this group may represent a separate onset of depressed mood with underpinnings distinct from persistent shyness.

**The Role of Sports Participation**

Fourth, sports participation was tested as a predictor of class transitions. In the current study, sports participation significantly decreased over time, which supports existing research demonstrating that sports and exercise participation decreases in adolescence (Stubbe et al., 2005; van der Aa et al., 2010). While sports participation did not predict transitions in class membership across development, it is recommended that future studies investigate the effect of a sports intervention on transitions in withdrawn behavior, especially for individuals within the shy/secretive subtype.

At Time 3, sports participation was significantly related to class membership such that adolescents who played more sports were more likely to be in the low symptom withdrawn class compared to the shy/secretive class. However, this association was cross-sectional; therefore, directionality cannot be inferred. It may be the case that shy/secretive-withdrawn individuals are less likely to participate in sports, especially at a time when sports participation becomes more competitive and closely tied to self-esteem (Bowker, 2006; Dishman et al., 2006). Parents may also rate children who engage in fewer sports as more shy, secretive, and withdrawn. On the other hand, individuals who engaged in sports participation during adolescence may experience a decrease in their shyness, secrecy, and preference to be alone.

In order to further explore the directionality of the association between sports participation and withdrawn behavior, post hoc analyses were conducted examining whether class membership at Times 1 and 2 predicted sports participation at Times 2 and 3, respectively. Results revealed that class membership at Time 2 predicted sports participation at Time 3 in boys ($B_1 = 0.35$, $p < 0.05$), such that boys, ages 10 to 13 years old, in the low symptom class, relative to boys in the shy/secretive class, played significantly more sports when they were 14-17 years old.

It may be the case that shy-withdrawn boys perceive the possibility of failure in sports as "too risky," given higher societal and parental expectations of boys to participate and be successful in sports compared to girls (Bowker et al., 2003; Lantz & Schroeber, 1999). Although this relation is cross-sectional at Time 3, boys and girls in the shy/secretive class played fewer sports, on average, compared to boys and girls in the low symptom class. In high school, sports participation becomes more competitive for boys *and* girls; therefore, both shy-withdrawn girls and boys may tend to opt out of sports. However, shy-withdrawn boys' and girls' motivations for selecting out of sports may vary. For example, while shy boys may be withdrawing to avoid the fear of failure in sports, shy girls may be avoiding the fear of interpersonal conflict in the context of sports. These possibilities should be the focus of future research.

Taken together, the negative relation between sports participation and withdrawn behavior may be best explained by the idea that withdrawn individuals opt out of sports. Given that the current study did not explore time points after the age of 17 years, transactional analyses should be explored from childhood to adolescence and adolescence to adulthood. Furthermore, future research is needed to identify factors that predict transition to and from withdrawn classes, as well as factors that predict stability within subclasses. Finally, investigating distal outcomes of latent class membership will elucidate how these profiles predict psychopathology later in life.

**Limitations**

Despite the aforementioned contributions, this study is not without limitations. First, the current study only used parent-report of withdrawn behavior. Although D. H. Rubin and colleagues (2013) found high inter-rater reliability between parents, teachers, and youth, future research would benefit from including multiple informants, especially peers, in latent class and transition analyses of withdrawn behavior. Second, the current study only used one measure of withdrawn behavior, the W/D scale of the CBCL. Although findings from the current study provide important insights into the measurement of withdrawn behavior with this well-validated questionnaire, additional research using a variety of assessment measures and methods (e.g., observation) of withdrawn behavior could further strengthen the confidence in findings. Third, the current study used a parent-report measure of sports participation that is somewhat limited due to its lack of specificity. Future research would benefit from using a multifaceted measure of sports participation designed to assess the duration and frequency of sports participation, energy expenditure during sports participation, involvement in team and individual sports, and sport competence/ability.

## Conclusion

The current study identified distinct classes of withdrawn behavior at separate stages of youth development, and established their course over eight years. Furthermore, this is the first study to establish directionality in the longitudinal relation between withdrawn behavior and sports participation, indicating that shy-withdrawn boys opt out of sports. This dissertation contributed to the nosology and temporal precedence of withdrawn behavior subtypes, and set the stage for further research examining whether distinct withdrawn classes in youth predict psychological morbidity in adulthood.

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## APPENDIX A: Summary of Results

*Specific Aim 1: Conduct a latent class analysis of the W/D syndrome scale of the Child Behavior Checklist at Times 1, 2, and 3.*

Hypothesis 1a: Distinct classes of withdrawn behavior will emerge at Times 1, 2, and 3.

**Result 1a:** The same two latent classes emerged at Times 1, 2, and 3. One latent class (Class 1) represented a low symptom endorsement across all items with the exception of a moderate endorsement on the "Would rather be alone than with others" item. The second class (Class 2) represented moderate symptom severity with peaks on the "Would rather be alone than with others," "Secretive, keeps things to self," and "Too shy or timid" items. At Time 3, the "Unhappy, sad or depressed" item was also elevated in girls.

Hypothesis 1b: Latent class structure will be invariant across gender and sports participation.

**Result 1b:** Fit statistics indicated partial measurement invariance of the latent structure between boys and girls. However, since the number, type, and overall interpretation of classes was similar in boys and girls, full measurement invariance across gender was imposed at each time point. The latent class structure was fixed before adding sports participation.

Hypothesis 1c: Prevalence of latent class membership will significantly vary depending on sports participation.

**Result 1c:** Latent class prevelances did not significantly vary depending on sports participation when full measurement invariance was imposed for the 2-class model at Times 1 and 2. At Time 3, youth who played more sports were less likely to be assigned to the shy/secretive class relative to the low symptom class. When 3 classes were modeled at Time 3, the relation between sports participation and latent class membership trended towards significance. When partial measurement invariance was imposed for the 2-class model, youth who played more sports were less likely to be assigned to the shy/secretive class relative to the low symptom class at Time 3 only.

*Specific Aim 2: Conduct a latent transition analysis of the WB latent statuses between Time 1 and Time 2 and between Time 2 and Time 3.*

Hypothesis 2a: Latent class structure will be invariant across time points.

**Results 2a:** Fit statistics provided mixed evidence for measurement invariance of latent class structure over time. However, because the number and type of withdrawn classes appeared similar at Times 1, 2, and 3, measurement invariance could be reasonably assumed and was imposed over time.

Hypothesis 2b: Transition probabilities will be invariant across gender.

**Results 2b:** Regardless of modeling solution, transition probabilities were invariant across gender at each transition period.

*Specific Aim 3: Determine whether sports participation, at Times 1 and 2, will predict WB latent status transition probabilities*

Hypothesis 3: Sports participation at Time 1 will significantly predict latent status transition probabilities from Time 1 to Time 2. Sports participation at Time 2 will significantly predict latent status transition probabilities from Time 2 to Time 3.

**Results 3:** Sports participation at Times 1 and 2 were not significant predictors of transition probabilities between Time 1 and Time 2 and between Time 2 and Time 3, respectively.

# APPENDIX B: Supplemental Tables

Table 15

*Correlation Matrix of Withdrawn Items and Sports Participation Variables*

| | | Time 1 | | | | | | | | Time 2 | | | | | | | | Time 3 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | S | 1 | 2 | 3 | 4 | 5 | 6 | 7 | S | 1 | 2 | 3 | 4 | 5 | 6 | 7 | S |
| Time 1 | 1 | 1 | 0.05 | 0.15+ | 0.09* | 0.13* | 0.06 | 0.16+ | -0.04 | 0.21+ | 0.7 | 0.06 | 0.02 | 0.07 | 0.03 | 0.11+ | -0.09* | 0.15+ | 0.03 | 0.12+ | 0.01 | -0.02 | -0.02 | -0.03 | 0.02 |
| | 2 | | 1 | 0.32+ | 0.14+ | 0.11+ | 0.09* | 0.17+ | -0.05 | -0.02 | 0.18+ | 0.15+ | 0.09* | 0.05 | -0.03 | 0.12+ | 0.03 | -0.03 | 0.20+ | 0.07 | 0.08 | 0.09* | 0.001 | 0.10* | 0.04 |
| | 3 | | | 1 | 0.31+ | 0.12+ | 0.10+ | 0.31+ | -0.03 | 0.08 | 0.16+ | 0.39+ | 0.15+ | 0.09* | 0.08 | 0.23+ | 0.03 | 0.08 | 0.12+ | 0.27+ | 0.11* | 0.10* | 0.10* | 0.16+ | 0.08 |
| | 4 | | | | 1 | 0.14+ | 0.09* | 0.18+ | 0.03 | 0.04 | 0.03 | 0.21+ | 0.42+ | 0.12+ | 0.04 | 0.16+ | 0.04 | 0.05 | 0.08 | 0.18+ | 0.38+ | 0.10+ | 0.03 | 0.15+ | 0.03 |
| | 5 | | | | | 1 | 0.13+ | 0.15+ | -0.15+ | 0.02 | 0.11+ | 0.16+ | 0.08 | 0.45+ | 0.07 | 0.10* | -0.04 | 0.07 | 0.05 | 0.08 | 0.08 | 0.34+ | 0.14+ | 0.16+ | -0.04 |
| | 6 | | | | | | 1 | 0.17+ | 0.02 | -0.07 | 0.02 | 0.01 | 0.05 | 0.13+ | 0.29+ | 0.04 | -0.04 | 0.01 | 0.07 | 0.07 | 0.04 | 0.13+ | 0.15+ | 0.07 | -0.07 |
| | 7 | | | | | | | 1 | -0.10* | 0.05 | 0.08 | 0.18+ | 0.09* | 0.17+ | 0.05 | 0.15+ | -0.09* | 0.09* | 0.11* | 0.14+ | 0.07 | 0.06 | -0.02 | 0.11* | -0.04 |
| | S | | | | | | | | 1 | -0.06 | -0.06 | -0.04 | 0.02 | -0.08 | 0.05 | 0.03 | 0.26+ | -0.002 | -0.08 | -0.03 | -0.02 | -0.06 | 0.09* | -0.06 | 0.17+ |
| Time 2 | 1 | | | | | | | | | 1 | 0.11+ | 0.12+ | 0.08 | 0.05 | 0.01 | 0.13+ | -0.06 | 0.35+ | 0.09 | 0.13+ | 0.07 | 0.02 | 0.04 | 0.10* | -0.06 |
| | 2 | | | | | | | | | | 1 | 0.31+ | 0.09* | 0.07 | 0.21+ | 0.19+ | -0.01 | 0.05 | 0.26+ | 0.16+ | 0.04 | 0.12+ | 0.07 | 0.10* | 0.05 |
| | 3 | | | | | | | | | | | 1 | 0.26+ | 0.21+ | 0.16+ | 0.37+ | -0.04 | 0.14+ | 0.22+ | 0.36+ | 0.26+ | 0.19+ | 0.06 | 0.19+ | -0.03 |
| | 4 | | | | | | | | | | | | 1 | 0.10* | 0.14+ | 0.26+ | -0.05 | 0.13+ | 0.04 | 0.16+ | 0.47+ | 0.09 | 0.05 | 0.16+ | -0.08 |
| | 5 | | | | | | | | | | | | | 1 | 0.10* | 0.13+ | -11* | -0.01 | 0.001 | 0.07 | 0.07 | 0.38+ | 0.06 | 0.11* | -0.05 |
| | 6 | | | | | | | | | | | | | | 1 | 0.09* | 0.05 | -0.05 | 0.05 | -0.05 | 0.03 | 0.15+ | 0.32+ | 0.07 | -0.001 |
| | 7 | | | | | | | | | | | | | | | 1 | -0.09* | 0.16+ | 0.25+ | 0.23+ | 0.15+ | 0.11+ | 0.09* | 0.24+ | -0.12+ |
| | S | | | | | | | | | | | | | | | | 1 | -0.13+ | -0.003 | -0.08 | -0.05 | -0.07 | 0.05 | -0.03 | 0.34+ |
| Time 3 | 1 | | | | | | | | | | | | | | | | | 1 | 0.09* | 0.18+ | 0.14+ | 0.01 | 0.10* | 0.16* | -0.09* |
| | 2 | | | | | | | | | | | | | | | | | | 1 | 0.33+ | 0.10* | 0.26+ | 0.26+ | 0.31+ | -0.09* |
| | 3 | | | | | | | | | | | | | | | | | | | 1 | 0.37+ | 0.19+ | 0.24+ | 0.33+ | -0.04 |
| | 4 | | | | | | | | | | | | | | | | | | | | 1 | 0.12+ | 0.05 | 0.28+ | -0.12+ |
| | 5 | | | | | | | | | | | | | | | | | | | | | 1 | 0.29+ | 0.31+ | -0.13+ |
| | 6 | | | | | | | | | | | | | | | | | | | | | | 1 | 0.19+ | -0.07 |
| | 7 | | | | | | | | | | | | | | | | | | | | | | | 1 | -0.09* |
| | S | | | | | | | | | | | | | | | | | | | | | | | | 1 |

Note. 1 = Would rather be alone than with others, 2 = Refuses to talk, 3 = Secretive, keeps things to self, 4 = Too shy or timid, 5 = Underactive, slow moving or lacks energy, 6 = Unhappy, sad, or depressed, 7 = Withdrawn, doesn't get involved with others, S = Sports Participation

* $p < 0.05$

+ $p < 0.01$

Table 16

*Means (CI) of Sports Participation by Gender at Times 1, 2, and 3*

| | Sport | |
|---|---|---|
| | Boys | Girls |
| Time 1 | 2.11 (2.01 to 2.21) | 2.33 (2.24 to 2.41) |
| N = 648 | N = 320 | N = 328 |
| Time 2 | 1.97 (1.85 to 2.08) | 1.93 (1.84 to 2.03) |
| N = 534 | N = 261 | N = 273 |
| Time 3 | 1.52 (1.40 to 1.63) | 1.36 (1.25 to 1.47) |
| N = 530 | N = 258 | N = 272 |

Table 17

*Means (CI) of Sports Participation by Gender and Class at Times 1, 2, and 3 for the Full Measurement Invariance Model*

| | Boys | | Girls | |
|---|---|---|---|---|
| | Class 1 | Class 2 | Class 1 | Class 2 |
| Time 1 | 2.12 (2.01 to 2.23) | 2.08 (1.84 to 2.33) | 2.33 (2.23 to 2.42) | 2.32 (2.10 to 2.53) |
| N = 648 | N = 260 | N = 60 | N = 265 | N = 63 |
| Time 2 | 2.00 (1.88 to 2.12) | 1.82 (1.52 to 2.11) | 1.96 (1.85 to 2.07) | 1.83 (1.64 to 2.03) |
| N = 534 | N = 212 | N = 49 | N = 213 | N = 60 |
| Time 3 | 1.55 (1.42 to 1.68) | 1.45 (1.24 to 1.67) | 1.43 (1.30 to 1.56) | 1.19 (1.00 to 1.39) |
| N = 530 | N = 170 | N = 88 | N = 194 | N = 78 |

*Table 18*

*Means (CI) of Sports Participation by Gender and Class for the 3-Class Model at Time 3*

| | Boys | | | Girls | | |
|---|---|---|---|---|---|---|
| | Class 1 | Class 2 | Class 3 | Class 1 | Class 2 | Class 3 |
| Time 3 Sport<br>N = 530 | 1.54 (1.41 to 1.67)<br>N = 173 | 1.45 (1.20 to 1.70)<br>N = 67 | 1.50 (1.01 to 1.99)<br>N = 18 | 1.44 (1.31 to 1.56)<br>N = 193 | 1.14 (0.87 to 1.41)<br>N = 42 | 1.22 (0.92 to 1.51)<br>N = 37 |

Table 19

*Means (CI) of Sports Participation by Gender and Class at Times 1, 2, and 3 for the Partial Measurement Invariance Model*

| | Boys | | Girls | |
|---|---|---|---|---|
| | Class 1 | Class 2 | Class 1 | Class 2 |
| Time 1<br>N = 648 | 2.11 (2.00 to 2.22)<br>N = 246 | 2.12 (1.90 to 2.34)<br>N = 74 | 2.33 (2.24 to 2.43)<br>N = 263 | 2.29 (2.07 to 2.51)<br>N = 65 |
| Time 2<br>N = 534 | 2.00 (1.88 to 2.12)<br>N = 212 | 1.82 (1.52 to 2.11)<br>N = 49 | 1.96 (1.85 to 2.07)<br>N = 215 | 1.84 (1.64 to 2.05)<br>N = 58 |
| Time 3<br>N = 530 | 1.56 (1.43 to 1.69)<br>N = 172 | 1.43 (1.21 to 1.65)<br>N = 86 | 1.42 (1.29 to 1.54)<br>N = 206 | 1.18 (0.98 to 1.39)<br>N = 66 |