Social wariness, preference for solitude, and peer difficulties in middle childhood: A longitudinal family-informed study

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Abstract

The present study examined, within a longitudinal family-informed design and across middle childhood, the predictive associations between preference for solitude and social wariness, two forms of social withdrawal, and peer difficulties. Specifically, preference for solitude, rather than social wariness, was expected to predict peer victimization and rejection, two aspects of peer difficulties. A total of 1041 children from the Quebec Newborn Twin Study were assessed by teachers and peers at ages 6, 7, and 10 years. Multi-level analyses conducted across three levels, between-family, within-family, and within-person, revealed that preference for solitude, rather than social wariness, increased the risk for peer difficulties in terms of both peer victimization and peer rejection. Specifically, preference for solitude was systematically associated with peer rejection starting at age 6 years and became progressively associated with peer victimization over time. This pattern was found both between and within families. In addition, the predictive association with peer rejection was found within genetically identical, monozygotic twin pairs, suggesting that this predictive association existed after taking into account genetic vulnerabilities. Social wariness was systematically unrelated to peer difficulties. These findings suggest that preference for solitude, rather than social wariness, is a risk factor for peer difficulties. They underscore the relevance of distinguishing these dimensions of social withdrawal and illustrate the usefulness of a family-informed design to document the processes underlying childhood social adjustment.

Keywords: Social wariness; preference for solitude; peer victimization; peer rejection; multi-level modeling; twin difference study

Positive peer interactions play a central role in children's socioemotional development (Dirks, Dunfield, & Recchia, 2018). Yet, some children miss out on these opportunities because they consistently withdraw from their peers or are hesitant to approach other children (Rubin, Coplan, & Bowker, 2009). Thus, it is not surprising that socially withdrawn children are concurrently and predictively at risk for chronic and recurring peer difficulties, especially in late childhood (Boivin, Petitclerc, Feng, & Barker, 2010). Given that peer difficulties play a significant role in the emergence of long-lasting health problems (Copeland, Wolke, Angold, & Costello, 2013), it becomes crucially important to document the extent to which social withdrawal leads to peer difficulties in childhood.

Social withdrawal is a multifaceted construct, and various forms of social withdrawal can be distinctively associated with social adjustment in childhood (Coplan, Prakash, O'Neil, & Armer, 2004). Social wariness and preference for solitude are two dimensions of social withdrawal that differ in various ways. Social wariness is a behavioral disposition characterized by hesitation in contexts of social novelty (Stevenson-Hinde & Shouldice, 1993). It presumably reflects an ambivalence between a desire to interact and an inclination to withdraw, or in motivational terms, a conflict between high approach and high avoidance tendencies (Asendorpf, 1990). In contrast, preference for solitude typically refers to a non-fearful disinterest in social affiliations and an inclination for solitary activities resulting from low approach and avoidance motivations in social contexts (Coplan et al., 2004). Unlike most socially wary children, children who prefer to be alone do not necessarily experience discomfort during social interactions, and can demonstrate consequent levels of social competencies when interacting with peers (Coplan et al., 2004). While childhood social wariness is a risk factor for internalizing problems, a preference for solitude does not appear to play a direct role in the emergence of internalizing

difficulties (Coplan et al., 2004; Degnan, Almas, & Fox, 2010). Social wariness and preference for solitude also tend to be expressed in different contexts; whereas social wariness is more often manifested in the context of social novelty, preference for solitude may be displayed across social situations (Coplan & Weeks, 2010a; Stevenson-Hinde & Shouldice, 1993).

As social wariness and preference for solitude differ in their respective underlying social motivations and contextual expressions, they may also differently contribute to peer difficulties (Coplan et al., 2004). For instance, dimensions of social withdrawal with opposite social motivations have been shown to independently increase the risk for peer difficulties in middle and late childhood (Chen & Santo, 2016; Liu et al., 2014). Another study also found that chronically victimized children reported stable levels of social wariness, but an increasing preference for solitude across that period (Ladd, Ettekal, & Kochenderfer-Ladd, 2018). Together, these studies suggest that peer victimization is differently associated with various withdrawal behaviors over time. However, previous studies did not document whether and how social wariness and preference for solitude *predict* peer difficulties.

There is some evidence suggesting that social wariness and preference for solitude could differently predict peer difficulties with age. As social withdrawal tends to be progressively more noticed and negatively perceived by the peer group during childhood, children displaying social withdrawal will tend to be more disliked and increasingly victimized by peers (Boivin et al., 2010; Younger & Boyko, 1987). To the extent that children perceive preference for solitude as deviant from group norms, preference for solitude could become increasingly related to peer difficulties at a time when children particularly value peer affiliations (Larson, 1990). This predictive association could increase as children displaying preference for solitude may also lack a supportive and positive social network (Coplan, Ooi, & Baldwin, 2019). In contrast, social

wariness may not follow the same pattern. Socially wary children may perceive the transition to school as unpredictable and stressful, and consequently be more likely to initially display reticent behaviors (Nelson, Rubin, & Fox, 2005). Alternatively, socially wary children could go unnoticed by peers early in childhood, and thus be less exposed to negative peer treatment. Indeed, wariness in the presence of unfamiliar peers was not found to be related to negative peer treatment in toddlerhood (Gazelle & Faldowski, 2014; Tarullo, Mliner, & Gunnar, 2011). About a third of children who display wariness among unfamiliar peers eventually show discontinuity in this initial tendency (Degnan & Fox, 2007; Fox, Henderson, Rubin, Calkins, & Schmidt, 2001). Accordingly, as they become acquainted with their peers over time, socially wary children may face unfamiliar social situations less frequently, follow a path toward greater sociability, and thus escape peer difficulties (Degnan & Fox, 2007). Therefore, unlike preference for solitude, social wariness may not be a risk factor for peer difficulties during the schooling years.

The goal of the present study was to document the extent to which preference for solitude, rather than social wariness, predicts later peer difficulties across childhood, that is over an extended period of time from at ages 6 (kindergarten) to 10 years (Grade 4). One key challenge for research testing the environmental nature of the predictive associations between child behaviors and their presumed social outcomes is to take into account the various, often unmeasured factors that could otherwise account for these predictions. That is to say, to examine how social wariness and preference for solitude uniquely contribute to peer difficulties, studies need to consider factors that may underlie these associations. For instance, a variety of putative family-wide factors (i.e., factors that are shared to a significant extent by children of the same family), such as lack of parental support, parental overprotection and intrusiveness, and low socioeconomic status have been associated with both social withdrawal and peer difficulties

(Rubin, Burgess, & Hastings, 2002; Volbrecht & Goldsmith, 2010; Wolke, Woods, Stanford, & Schulz, 2001). If not controlled for, these factors could therefore spuriously account for the association between social withdrawal and peer difficulties. The same could be said of genetic factors, which have been found to partly account for individual differences in both social withdrawal and peer difficulties. Indeed, twin studies indicate that genetic factors typically account for 40% to 70% of individual differences in both social withdrawal and exposure to peer difficulties (Ball et al., 2008; Boivin, Brendgen, Vitaro, Dionne, et al., 2013; Hoekstra, Bartels, Hudziak, Van Beijsterveldt, & Boomsma, 2008; Morneau-Vaillancourt et al., 2019). The same set of genetic vulnerabilities could confer an increased risk for both social withdrawal and peer difficulties.

However, most previous studies did not provide information on, and control for shared environmental features and genetic factors that could play a role in the association between social withdrawal and peer difficulties. By failing to account for these genetic and environmental confounding, studies cannot conclude that predictive associations reflect genuine environmental pathways from behavioral tendencies, here social withdrawal behaviors, to negative response by peers. One approach that provides a robust control for familial and genetic confounding factors is to use family informed designs, in this case twins, to disentangle between-family and within-family variance. Because twins grow up in the same family, examining differences within twin pairs controls for unmeasured features of the environment that are shared by twins of the same family. Examining twin differences also controls for genetic factors, in part for dizygotic (DZ) twins who share on average 50% of their genes, and fully for monozygotic (MZ) twins who are genetically identical. In the present study, we relied on a twin-based family informed design and multi-level analyses to more fully examine associations between dimensions of social

withdrawal and peer difficulties. Specifically, associations were estimated through multi-level analyses that considered three sources of variation: between-family and within-family variations, two sources of inter-individual differences, as well as within-person (i.e., time) variation. The crucial tests were whether the predictions would stand (1) within-family for all twin pairs (i.e., to control for environmental differences between families), and then (2) within-family, but for MZ pairs only (i.e., to additionally control for genetic differences). The within-person (intra-individual) level also provides information regarding developmental change in these patterns of associations. Disaggregating within- from between-person variations provides a finer understanding of the longitudinal associations at play (Curran & Bauer, 2011). The way in which social withdrawal changes *within* a given child over time and the way it changes *between* children are distinct levels of association which may operate independently and even in opposite directions. Therefore, disentangling within- and between-person associations over time provides a more complete overview of developmental processes at play.

In addition to refining the assessment of developmental processes, the present study also extends previous studies in three important ways. First, it provides a more comprehensive view of peer difficulties than previous studies by considering peer rejection (i.e., negative peer status) in addition to peer victimization. Whereas peer victimization refers to actual negative experiences, peer rejection reflects a negative attitude from the peer group, a perception that is not necessarily translated into negative behaviors from peers (Boivin, Hymel, & Hodges, 2001). Peer rejection plays a central role in the development of emotional problems, including low self-esteem, loneliness and depression, and has been associated with increased physical health, conduct, and school problems (Bukowski, Laursen, & Rubin, 2018). Assessing both victimization and rejection provides a more complete coverage, and thus a broader overview of

the peer difficulties associated with social wariness and preference for solitude. Second, the present study also documented children's aggression, another important correlate of peer victimization (Boivin et al., 2010; Ettekal & Ladd, 2019). Because some socially withdrawn children also display aggressive behaviors and tend to endure increased peer difficulties, it is important to consider this behavioral aspect to more precisely assess the contribution of social withdrawal to peer difficulties (Bowker, Markovic, Cogswell, & Raja, 2012). Third, previous longitudinal studies have often relied on the same informant, often parents or children themselves, to evaluate social withdrawal. These assessments are not only limited in their validity, but also can induce shared method variance across repeated assessments (Juvonen, Nishina, & Graham, 2001; Spangler & Gazelle, 2009). Parents do not directly witness how their child behaves at school, and self-reports reflect individuals' perceptions of themselves and their experiences, which vary among children, irrespective of their actual peer relationships. We addressed this limitation by using evaluations from different teachers and peers across assessment times. Finally, children's gender and whether twins attended the same classroom or not were taken into account since they appear to moderate the association between social withdrawal and peer difficulties (Bowker et al., 2012; Gazelle, 2006).

Method

Participants

Participants were from the Quebec Newborn Twin Study and were initially recruited at birth in the greater Montreal area, Canada, between April 1995 and December 1998 (Boivin et al., 2019). At recruitment, the Quebec Bureau of Statistics gave accessibility to birth records of families with newborn twins. The 662 families who agreed to participate initially were comparable to the population in the greater Montreal area in terms of sociodemographic

characteristics in the mid 1990s. Most parents had completed high school at recruitment; only 17% of mothers and 14% of fathers had not, and 28% of mothers and 27% of fathers held a university degree. Most parents (83%) had a job, and a minority of families (10%) were on welfare benefits.

The participants were assessed on various social, behavioral, and family characteristics in infancy and early childhood. The present study relied on the following waves once children formerly started school. Peer and teacher evaluations were collected prospectively at age 6 (kindergarten), 7 (Grade 1), and 10 years (Grade 4). The longitudinal models included a total of 1014 children, using a full information maximum likelihood estimator (FIML). There were 294 complete dizygotic (DZ) pairs, including 75 same-sex female, 77 same-sex male and 142 opposite-sex pairs. There were 206 complete monozygotic (MZ) pairs, including 108 female and 98 male pairs. There were also 10 incomplete DZ and 4 incomplete MZ pairs. The exact number of participants varied across measures (when some items were left unanswered by teachers), but there were at least 787 participants at age 6 years (51% girls), 811 at 7 (55% girls), and 732 at 10 (51% girls). The majority of participants in the present study was of European descent, 2% of children were of African descent, and 1% were of Asian descent.

Based on the 662 twin pairs initially recruited at birth, missing data percentage was 41% at age 6, 28% at age 7, and 34% at age 10 (see Boivin et al., 2019, for more details on sample attrition). Children who participated at the assessment at 6 years did not differ from those lost to attrition in terms of mother's and father's education level. However, families lost to attrition between 5 months and 6 years old had a lower income on average. There was a higher proportion of single parent families and minority families with respect to religion, ethnicity, and language spoken at home. In general, variation in yearly participation was not associated with

victimization. Missingness was associated with social wariness, preference for solitude, and rejection at certain times, but these missingness patterns were inconsistent. Missingness at age 7 was related to *lower* age-6 social wariness (t [800] = -2.28, p = .01) and preference for solitude (t [800] = -2.19, p = .03). In contrast, missingness at age 10 was related to *higher* age-7 social wariness (t [857] = 2.57, p = .01), preference for solitude (t [857] = 2.10, p = .04), and rejection (t [809] = 2.05, p = .04).

Procedure

Data collection took place in the spring of the school year so that peers and teachers had time to get familiar with the participants. Each year, most twins were in different classrooms (68% of the sample at 6 years; 76% at 7 years; 70% at 10 years), allowing different teachers and peers to assess the majority of participants. Teachers and peers' evaluations were also independent across assessment waves since children moved to a different classroom every year. We obtained parental consent from participating families at every stage of the study. All procedures were approved by ethics review boards at Université Laval (60-2000, *Les déterminants de l'adaptation sociale et scolaire lors de l'entrée en milieu scolaire: une étude de* jumeaux) and St-Justine Hospital (*Relations d'amitié et problèmes d'adaptation psychosociale à l'enfance*) in the Province of Quebec, Canada. Evaluation instruments were approved by the Institutional Review Board and by the School Board administrators.

Measures

Social wariness and preference for solitude. We assessed both social wariness and preference for solitude through a combination of teacher ratings and peer nominations. Teacher ratings and peer nominations provide the best convergent validity when measuring specific dimensions of social withdrawal (Spangler & Gazelle, 2009). Teachers had to rate the

participant's behavior over the past six months using a three-point scale (0 for *never,* 1 for *sometimes,* and 2 for *often*). Teacher scores were averaged over items. In addition, we asked children in the classroom to choose from a roster the photos of two classmates who best fitted a given description (see Boivin, Brendgen, Vitaro, Dionne, et al., 2013 for more details). The number of nominations received was calculated for all children in the classroom, and participants' scores were standardized within classroom.

For social wariness, questions to the teacher were adapted from Asendorpf's scale of situational shyness among unfamiliar peers (Asendorpf, 1987) and from Achenbach's Teacher Report Form (TRF; Achenbach, 1991), and selected on the basis of previous measures of social wariness which often relied on the social fear subscale of the Toddler Behavior Assessment Questionnaire (TBAQ; Goldsmith, 1996; e.g., Degnan et al., 2008; Jarcho et al., 2019; Natsuaki et al., 2013). These questions were: 1) *readily approached children that he or she didn't known* (inversed), 2) *was shy with children he or she didn't know,* 3) *took a lot of time to warm up to children he or she didn't know,* 4) *avoided the company of other children,* 5) *was too fearful or anxious,* 6) *was worried,* 7) *was nervous, high-strung or tense*. The following peer nomination item was from the Peer Nomination Inventory: …*children who are the most shy with other kids* (Perry, Kusel, & Perry, 1988).

For preference for solitude, questions to the teachers were adapted from the TRF (Achenbach, 1991) and from the Child Behavior Scale (CBS; Ladd & Profilet, 1996), and analog to items used in previous studies (e.g., Ladd, Ettekal, & Kochenderfer-Ladd, 2018; Wang, Rubin, Laursen, Booth-LaForce, & Rose-Krasnor, 2013). These questions were: 1) *preferred to play alone rather than with other children,* 2) *tended to do things on his/her own, was rather solitary,* 3) *sought the company of other children* (inversed), 4) *showed little interest in activities*

involving other children. The peer nomination item was … *children who rather prefer to play alone than with other children*, again from the PNI (Perry et al., 1988).

Teacher ratings of social wariness and preference for solitude both showed good internal consistency at all assessment waves (Cronbach's alpha varied between .73 and .78). Teacher reports and peer nominations of social wariness (r = .24 to .31) and preference for solitude (r = .08 to .39) were also moderately correlated at all assessment waves. Correlations within-dimensions were also higher than across dimensions, thus providing evidence for discriminant validity (see Supplementary material Table S4). Accordingly, we then computed composite social wariness and preference for solitude scores by averaging standardized teacher and peer ratings, as in previous studies relying on multiple informants (e.g., Degnan et al., 2008).

Peer victimization and rejection. Peer victimization and rejection were evaluated through peer nominations (see Boivin et al., 2013). To assess peer victimization, we asked children in the classroom to choose from a roster the photos of two classmates who *"... get called names most often by other children*," and "*... are often pushed and hit by other children, get the hits*." Both item scores were significantly correlated at all timepoints (r = .39 to .61), and the two item scores were thus averaged.

We assessed peer rejection by asking children in the classroom to identify the photos of three classmates with whom they most liked to play with, and of three classmates they least liked to play with. We calculated the number of positive and negative nominations received for each participant to create positive and negative scores. We standardized scores within classroom and created a Liked-Most score and Liked-Least score. Finally, we created a social preference score from subtracting the Liked-Least from the Liked-Most score, standardizing this score within classroom and inverting it to create a peer rejection score (Coie, Dodge, & Coppotelli, 1982).

Aggression. To measure aggression, here used as a control variable, teachers answered items adapted from the Child Behavior Checklist (Achenbach, 1991), the Ontario Child Health Study Scales (Boyle et al., 1993), and the Child Social Behavior Questionnaire (Tremblay et al., 1991). They had to indicate the extent to which the child "*got into fights*", "*physically attacked others*", and "*hit, bit, or kicked others*" during the past six months on the same previous three-point scale (0 for *never,* 1 for *sometimes,* and 2 for *often*). We averaged items scores to create the aggression score (Cronbach's alpha = .87 - .88).

Analytical approach

We conducted descriptive statistics and preliminary analyses in SPSS, version 24 (IMB Corporation, 2016) and Mplus version 7.4 (Muthen & Muthen, 2017). We calculated Pearson correlations to examine associations between aggression and the relevant variables at each age and across ages and tested for group differences across gender and across co-twins sharing the same classroom and those in separate classrooms. We tested group differences in Mplus by comparing a model in which means across gender or classroom membership were constrained to equality to a model in which means were freely estimated. Models accounted for familial clustering of the data.

Then, we conducted multi-level models in Mplus version 7.4 (Muthen & Muthen, 2017) to examine the longitudinal associations between social wariness, preference for solitude, and peer difficulties. Multi-level modeling offers several advantages for the analysis of longitudinal data (Hoffman, 2015). First, multi-level modeling accounts for dependency in the data such as when having twins from the same family. Second, multi-level models can include time-varying predictors (social wariness and preference for solitude measured repeatedly), and therefore allow distinguishing both within- and between-person variations in the predictors. Third, multi-level

models are more flexible than other longitudinal approaches in allowing non-normally distributed and unequally-spaced in time data, often problematic in structural equation modeling (Burchinal, Nelson, & Poe, 2006). Here, not all variables met normality standards (skewness: .36 to 1.93; kurtosis: -.28 to 3.17), and time intervals were not equivalent (from age 6 to 7 years, and then from age 7 to 10).

Multi-level models can be conceptualized as a series of regression equations, where the total variance of an outcome is partitioned into different levels of analysis (Hoffman, 2015). We examined three sources of variation: 1) between-family variation, where twin pairs were compared across families, 2) within-family variation, where all twins were compared to their co-twins first (to control for shared environment confounders), and then where only MZ twins were compared to their co-twins second (to control for genetic confounding), and 3) within-person variation, where repeated measures were considered within each participant. Models predicting victimization and rejection were tested separately. We tested all models by adding one parameter at a time and comparing nested models using the chi-square test for the difference in -2 log-likelihoods. We dropped parameters that did not significantly improve model fit.

As proposed by Hoffman (2015), we first tested two types of unconditional models sequentially: a *mean* model and a *growth* model. Unconditional *mean* models did not include the effect of time; they indicated how much of the variance in victimization or rejection was attributable to between-family, within-family, and within-person differences. Unconditional *growth* models identified the best-fitting growth curve for victimization and rejection. Starting from a simple unconditional growth model including a fixed linear time effect, we gradually added random parameters. Despite no significant average growth curve in victimization and rejection (because both variables were standardized at each assessment), we still tested linear

time effects so that we could model variations in the rate of change at the between- and within-family levels. Indeed, families or individuals within families could potentially show different slopes in victimization or rejection. To interpret time effects, we centered age so that initial status was age 6 and not age 0.

Then, we tested conditional models to include predictors. We first included parameters of the highest overarching level (between-family), followed by within-family parameters, and finally within-person parameters. To facilitate interpretation of effect sizes in the multi-level models, we standardized continuous predictors, that is social wariness, preference for solitude, and aggression. We tested 1) between-family associations by comparing family scores (in social wariness, preference for solitude, or aggression) at each timepoint, 2) within-family associations by comparing participants' scores to their co-twin's score at each timepoint, and 3) intra-individual associations by comparing each child's score at a given time to his or her own overall mean (across the three waves). Finally, we included the control variable of whether co-twins shared the same classroom at the between-family level. We considered this dichotomous variable (0 = co-twins were separated; 1 = co-twins were together) at each timepoint since children moved to a different classroom each year. Mathematical equations for the proposed final models are presented in the Supplementary materials.

Results

Descriptive results

At each wave and across waves, social withdrawal and peer difficulties dimensions were moderately correlated (r = -.12 to .35, see Supplementary materials for all correlations). Social wariness was negatively associated with victimization at age 6 years, but later became positively associated with victimization and rejection. In contrast, preference for solitude was positively

related to victimization and rejection at most assessment waves. Finally, aggression was positively correlated with preference for solitude, victimization, and rejection, confirming the need to control for aggression in the final models. Correlations are presented in Table S1 in the Supplementary materials.

Group difference tests revealed that girls differ from boys, as do co-twins sharing the same classrooms from co-twins in separate classrooms. Table 1 presents gender differences. Compared to girls, boys were more victimized and rejected by peers, and had a higher preference for solitude at all timepoints. Girls were more socially wary than boys at 6 years old. Otherwise, boys and girls did not differ in social wariness at 7 and 10 years old. Table S3 of the Supplementary materials presents differences across classrooms. Overall, co-twins sharing the same classroom were seen as less socially withdrawn, as well as less rejected and victimized by peers than co-twins in separate classrooms. Accordingly, we controlled for gender and for whether co-twins shared the same classroom or not in the main analyses.

Variance decomposition and patterns of growth in peer victimization and rejection

Unconditional mean models. Unconditional mean models (i.e., disregarding time) revealed that 19% and 5% of the total variance in victimization, as well as 30% and 10% of the variance in rejection reflected between- and within-family mean differences, respectively. The remaining variance in both peer victimization and rejection, 63% and 53% respectively, took the form of within-person variation around the person mean across years, which also included measurement error. For both victimization and rejection, each level of analysis accounted for a substantial proportion of total variance.

Unconditional growth models. Due to the nature of measurement, average levels of victimization and rejection at 6 years old were close to 0 (fixed intercept) and did not

significantly change over time: the slope was flat (fixed slope). For victimization and rejection, intercepts at age 6 years varied significantly both between-family and within-family. There were significant variations in the slopes between families, indicating that families varied in their rate of change in rejection and victimization. At the within-family level, adding a random slope did not improve models' fit for rejection and victimization, indicating that slopes did not vary between co-twins. All unconditional models are presented in Table 2.

Prospective associations between social wariness, preference for solitude, and peer difficulties

We then conducted a series of conditional models. We first included the control variables (whether co-twins shared the same classroom, aggression, and gender) and then the main predictors (social wariness and preference for solitude). The final best-fitting models are presented in Table 3 and the corresponding models for the variance are presented in Table 4.

The contributions of control variables were relatively similar for both outcome variables. First, twins who shared the same classroom experienced less peer rejection on average than siblings who were in different classrooms. Also, twin pairs who were more aggressive were more victimized and rejected at school entry. Twins who were on average more aggressive than their co-twins also experienced more peer difficulties, but this association progressively decreased for victimization, as indicated by the significant interaction between aggression and time at the within-family level. Finally, once between- and within-family associations were taken into account, children who were more aggressive at one time point than usual experienced *less* peer difficulties. Unexpectedly, female twin pairs experienced more peer rejection than male twin pairs at school entry. However, when looking within families, brothers (boys) were more victimized and rejected than their sisters (girls) in opposite-sex pairs.

Associations with peer victimization. Social wariness and preference for solitude differed in their associations with peer victimization. Whereas social wariness was systematically unrelated to peer victimization, preference for solitude showed significant interactions with time both between- and within-family. This indicates emerging associations between preference for solitude and victimization as children aged. Specifically, preference for solitude was not associated with victimization at age 6, but pairs of twins (i.e. between-family level) who had a high preference for solitude became progressively more victimized over time. Within-family, a similar pattern was found; twins who manifested more preference for solitude than their co-twin experienced gradually more victimization over time. However, this association was not replicated in the MZ-only model, suggesting that shared familial factors, including genetics, may account for the changing associations between preference for solitude and victimization. Finally, no association was found within person.

Associations with peer rejection. Social wariness and preference for solitude also differed in their association with peer rejection. At the between-family level, preference for solitude was positively related to peer rejection at school entry, and this association persisted over time. This association was confirmed within families. Twins who preferred solitude more than their co-twins were more rejected. Interestingly, this association was also found in the MZ-only model, suggesting that the predictive link between preference for solitude and rejection was robust to shared familial and genetic confounding factors. At the within-person level, the inverse association was found; children who preferred solitude more than usual at a given time were actually *less* rejected. In contrast to preference for solitude, social wariness was systematically unrelated to peer rejection.

Discussion

The aim of this study was to examine the extent to which preference for solitude, rather than social wariness, was associated with peer victimization and rejection, two aspects of peer difficulties, and to document how these associations evolved during middle childhood. Overall, the findings revealed that preference for solitude, rather than social wariness, increased the risk for peer difficulties in terms of both peer victimization and rejection. In fact, the only association not affected by shared familial and genetic factors was between preference for solitude and rejection. In contrast, social wariness was not related to peer difficulties.

The finding that preference for solitude was associated with increased peer difficulties across childhood is consistent with previous studies (Chen & Santo, 2016; Coplan et al., 2004; Liu et al., 2014), but also extends them in several ways. First, preference for solitude was related to both peer victimization and peer rejection, two related but distinct forms of peer difficulties. This indicates that this form of social disinterest, or solitary-passive behavior, was pervasively associated with peer difficulties. Second, the wide-ranging nature of the association between preference for solitude and peer difficulties was also revealed in the growing association between preference for solitude and peer victimization over time, found at both the between- and within-family level. This consistency in results across the between- and within-family levels suggests that change in environmental factors shared by co-twins, such as family status and socioeconomic status, harsh parenting behaviors or even school climate and norms regarding social behaviors (most co-twins attended the same schools) may not be responsible for the increasing association between preference for solitude and peer victimization. These results are consistent with, but also help specify previous findings showing a growing association between (general) withdrawal and peer victimization over time (Boivin et al., 2001, 2010). Incidentally, these previous findings had also documented a diminishing association between aggressive

behaviors and peer victimization with age, a result that was also corroborated in the present study. Our findings are in line with Younger and Boyko's (1987) initial proposition that children's aggressive and withdrawal behaviors are perceived differently depending on the developmental period. Peers' perceptions of preference for solitude may shift as children grow up. In early childhood, solitary behaviors are common and often go unnoticed by peers (Coplan et al., 2004). However, as children age, meaningful peer relationships and social reputation become increasingly valued and dimensions of social withdrawal may, as a result, become more salient (Younger & Boyko, 1987). Therefore, by late childhood, children who deliberately choose to isolate themselves from the peer group may be negatively perceived by peers and thus be more vulnerable to peer victimization. Most interestingly, when genetic sources of variance were further taken-into-account (in MZ twin within-family analyses), the increasing association between preference for solitude and victimization simply vanished. This suggests that genetic factors may account for this increasing association, thereby reflecting a gene-environment correlation that consolidates over time. Such a process has been previously documented for the association between aggressive behaviors and peer difficulties (Boivin, Brendgen, Vitaro, Forget-Dubois, et al., 2013; Johansson et al., 2020). Individual differences in social withdrawal and in the risk of being exposed to peer victimization are both significantly accounted for by genetic factors (Ball et al., 2008; Boivin, Brendgen, Vitaro, Forget-Dubois, et al., 2013; Hoekstra et al., 2008; Johansson et al., 2020; Morneau-Vaillancourt et al., 2019). Because we did not directly assess these genetic factors, our findings can only suggest that unmeasured genetic factors could play a role in the increased association between preference for solitude and victimization. Future genetically informed studies are necessary to further document this putative emerging gene-environment correlation.

In contrast to preference for solitude, social wariness was not associated with peer difficulties, and this was confirmed at multiple levels of analysis for both victimization and rejection. This is consistent with Buhs, Rudasill, Kalutskaya, and Griese (2015) who found that early social inhibition in the context of social novelty was negatively associated with peer rejection in middle childhood. Studies have shown that children who express inhibition to novelty are less likely to manifest negative behaviors (Buhs et al., 2015; Kochanska, Gross, Lin, & Nichols, 2002). Inhibited children tend to be more compliant with parental demands and to express more guilt after being led to believe that they had damaged valuable objects (Buhs et al., 2015; Kochanska et al., 2002). To the extent that social wariness is a developmental extension of these early behavioral tendencies (Kagan, 1997; Kagan, Reznick, & Snidman, 1988; Volbrecht & Goldsmith, 2010), socially wary children (if not perceived as they prefer solitude) may be more compliant and sensitive to others, thereby reducing their risk of being rejected and victimized. Given their interest in interacting with peers, wary children may overcome their initial hesitation and befriend a few children in the classroom, which may protect them from experiencing peer difficulties (Hodges, Boivin, Vitaro, & Bukowski, 1999; Ladd, Kochenderfer-Ladd, Eggum, Kochel, & McConnell, 2011). Moreover, in the present study, teachers' evaluations were collected toward the end of the school year. By that time, it is highly probable that children who were wary initially at the beginning of the year, when they were still unfamiliar with their peers, may have manifested typical social behaviors once they became acquainted with other children in the classroom. For this reason, socially wary children may have experienced less peer difficulties at the end of the school year, when they were evaluated.

The finding that social wariness was associated with less peer difficulties does not support previous evidence on related constructs (Hart et al., 2000; Sette, Zava, Baumgartner,

Baiocco, & Coplan, 2017; Shell, Gazelle, & Faldowski, 2014). This lack of convergence is likely explained by differences in the assessment of *anxious-solitary* or *shy* behavior, other forms of social withdrawal that are apparently related to social wariness (Coplan & Weeks, 2010b; Hart et al., 2000; Ladd et al., 2011). Whereas previous evidence was based on ratings of behavior in both familiar and unfamiliar situations, teachers in our study were asked to assess social wariness specifically in the context of unfamiliar peers. In fact, one study conducted with 2-year-olds showed that infants were only excluded when they were inhibited among familiar peers, and not when they were inhibited among unfamiliar peers (Gazelle & Faldowski, 2014). This contextual distinction is crucial because wary children, who may avoid social interactions initially, may eventually adapt well. Moreover, our conceptualization and definition of social wariness differed from other studies. For instance, in Hart et al. (2000), some items used to evaluate *reticence* could have reflected preference for solitude (e.g., "wanders aimlessly during free play"). Therefore, these evaluations most likely did not reflect the same underlying social withdrawal dimension, and this could explain why we did not find that social wariness was a problematic behavior.

Finally, two findings from multi-level models were somewhat unexpected. First, at the within-person level, there was a negative association between preference for solitude and peer rejection. This result may reflect children who generally manifested typical social behaviors, but who for some unknown reasons were sporadically seen as preferring to be alone (Oh et al., 2008). The reasons for preference for solitude being protective in this case are not clear. This momentary preference for being alone, perhaps self-initiated, could have been seen as adaptive and positive by the peer group. However that may be, it reflects intermittent within-person fluctuations, and may not bear long-term developmental implication. Second, also quite

unexpectedly, girls were more rejected than boys at the between-family level. It is not clear what features of opposite-sex pairs brings about this difference. Some evidence suggests that opposite-sex twins do not share friends to the same extent as same-sex twins (Thorpe & Gardner, 2006), but we know very little about the social dynamics of these unique pairs of twins, a task for future research. Finally, it is possible that these unanticipated results could simply be statistical artifact occurring as a result of the complex decomposition of variance and inclusion of multiple parameters in the model.

Strengths and limitations

This is the first longitudinal study to provide evidence that social wariness and preference for solitude are differently associated with peer difficulties throughout childhood. The present study was also the first to investigate these associations by capitalizing on a twin design to account for family-wide (e.g., familial stress; Volbrecht & Goldsmith, 2010) and genetic confounding variables. Relying on multi-level modeling allowed disaggregating inter- and intra-individual sources of variation, which allowed identifying, within a more informative approach, the different patterns of longitudinal associations found both within- and between-person. We filled a gap by documenting these associations prospectively and over a longer developmental period than what was previously considered. We evaluated two types of peer difficulties, providing a more complete overview of children's negative social experiences at school. Finally, we used assessments from multiple teachers and peers (participants moved to a different classroom each year), which diminishes the probability that rater bias has inflated correlations across assessments and between predictor and outcome variables (Little, 2013).

However, our study also had the following limitations. First, the fact that different teachers and peers provided ratings each year may have increased measurement error. Second,

sociometric measures consisted of either one or two items. This narrow distribution could have limited the sensitivity of scales, thus adding measurement error. Third, the measures for social wariness and preference for solitude were adaptations of previously validated scales (e.g., Revised Class Play; Masten et al., 1985). Shorter versions of these scales were used in the context of extensive evaluations of children's overall development, collected almost yearly throughout childhood (for more information on QNTS, see Boivin et al., 2019). Furthermore, the two-dimensional measurement structure for social wariness and preference for solitude did not perform optimally, which may have underestimated true associations especially in the early years (i.e., age 6 year). However, the evidence of discriminant validity and adequate internal consistency for social wariness and preference for solitude comforts the findings at ages 7 and 10. Finally, the vast majority of the sample was of European descent, and thus findings may not be generalized to other ethnic groups.

Conclusions

Our study sheds light on the complexity of social withdrawal by distinguishing two underlying dimensions, social wariness and preference for solitude. Their respective and independent prospective associations with peer difficulties during childhood were clarified. Our findings revealed that not all socially withdrawn children have equal risk of enduring negative peer experiences and that preference for solitude may be particularly problematic as children grow up. Considering that peer difficulties are frequent and common in middle childhood, and can have detrimental and long-lasting repercussions (Copeland et al., 2013), our study implies that encouraging children who prefer to be alone to make the effort to initiate social contacts with their peers is especially important. Preventive intervention should focus on creating

opportunities for these children to foster meaningful relationships with their peers early in childhood, possibly before difficulties associated with social withdrawal become crystalized.

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Table 1. Gender differences.

	Social wariness		Preference for solitude		Victimization		Rejection	
	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys
6 years old	**.07 (.89)**	**-.06 (.73)**	**-.05 (.71)**	**.06 (.78)**	**-.28 (.73)**	**.08 (.95)**	**-.24 (.67)**	**.08 (.96)**
7 years old	.04 (.85)	-.02 (.79)	**-.11 (.77)**	**.13 (.84)**	**-.24 (.83)**	**.21 (1.03)**	**-.26 (.88)**	**.11 (1.03)**
10 years old	.07 (.87)	-.04 (.80)	**-.10 (.83)**	**.15 (.92)**	**-.26 (.73)**	**.24 (1.07)**	**-.26 (.81)**	**.05 (1.06)**

Note. Estimates are group means with standard deviations in parentheses. Significant differences between girls and boys are in bold.

Table 2. Unconditional models for peer victimization and rejection

	Mean model		Growth model	
Outcomes	Victimization	Rejection	Victimization	Rejection
		Fixed effects		
Intercept	-.05 (.03)	-.06* (.03)	-.08* (.03)	-.07 (.04)
Time (linear)			.02 (.01)	-.00 (.01)
		Random effects		
Between-family				
Intercept	.19* (.03)	.30* (.03)	.15* (.03)	.36* (.04)
Time			.01* (.00)	.02* (.00)
Covariance			.00 (.01)	-.04* (.01)
Within-family				
Intercept	.05* (.02)	.10* (.02)	.07* (.02)	.13* (.02)
Time			-	-
Within-person				
	.63* (.03)	.53* (.02)	.58* (.03)	.46* (.02)
		Goodness-of-fit		
LL	-3043.63	-3000.67	-2909.71	-2872.28
AIC	6095.26	6009.36	5831.41	5758.55
BIC	6118.28	6032.36	5865.63	5798.55

* $p < .05$. In parentheses are standard errors of the estimates. Dashes indicate that parameters were tested but were dropped as they did not improve model fit.

Table 3. Multi-level models predicting peer victimization and rejection

	All twins (N = 1014)		MZ only (N = 416)	
	Victimization	Rejection	Victimization	Rejection
Predictors	Estimates (standard errors)			
Between-family				
Sharing classroom (0=no, 1=yes)	-.06 (.04)	-.15* (.02)		
Family gender	.14 (.08)	.18* (.09)		
Family gender by time	-	-		
Aggression	.42* (.03)	.40* (.03)		
Aggression by time	-	-		
Social wariness	-	-.01 (.03)		
Preference for solitude	-02 (.03)	.40* (.04)		
Preference for solitude by time	.07* (.01)	-		
Within-family				
Gender	-.28* (.07)	-.19* (.07)		
Gender by time	-	.02 (.02)		
Aggression	.38* (.05)	.28* (.04)	.05 (.08)	.18* (.06)
Aggression by time	-.06* (.02)	-	-.03 (.03)	-
Social wariness	-	.01 (.03)	-	.02 (.05)
Preference for solitude	.04 (.04)	.32* (.04)	.03 (.05)	.28* (.07)
Preference for solitude by time	.05* (.02)	-	.01 (.03)	-
Within-person				
Aggression	-.18* (.04)	-.28* (.04)		
Social wariness	-	-		

Preference for solitude	-	-.24* (.04)

* $p < .05$. Dashes indicate that parameters were tested but were dropped as they did not improve model fit.

Table 4. Models for the variance

	All-twins models (N = 1014)		MZ-only models (N = 416)	
Outcome	Victimization	Rejection	Victimization	Rejection
	Fixed effects			
Intercept	.00 (.04)	-.03 (.05)	.05 (.07)	-.20* (.06)
Time	.02* (.01)	.01* (.00)	.03 (.02)	.04* (.02)
	Random effects			
Between-family				
Intercept	.07* (.02)	.20* (.03)	.22* (.04)	.18* (.04)
Time	.01* (.00)	.01* (.00)	.01 (.00)	.01* (.01)
Intercept-time covariance	-	-.03* (.01)	-	-.02* (.01)
Within-family				
Intercept	.01 (.02)	.07* (.02)	.00 (.03)	.07* (.02)
Time	-	-	-	-
Intercept-time covariance	-	-	-	-
Within-person				
Residual variance	.56* (.02)	.45* (.02)	.45* (.03)	.32* (.03)

* $p < .05$. In parentheses are standard errors of the estimates. Dashes indicate that parameters were tested but were dropped as they did not improve model fit.