Children with persistent versus transient early language delay: language, academic and psychosocial outcomes in elementary school

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Abstract

Purpose: The objective of this study was to compare children with persistent versus transient preschool language delay (LD) on language, academic and psychosocial outcomes in elementary school. Method: Children with persistent LD (n=30), transient LD (n=29) and controls (children without LD; n=163) were identified from a population-based sample of twins. They were compared on language skills, academic achievement and psychosocial adjustment in Kindergarten and Grades 1, 3, 4 and 6. Results: Children with persistent LD continued to show language difficulties throughout elementary school. Further, they had academic difficulties, in numeracy, as well as psychosocial difficulties (ADHD behaviors, externalizing behaviors, peer difficulties) from Grade 1 to Grade 6. Children with transient LD did not differ from controls on language and academic performance. However, they showed more externalizing behaviors in Kindergarten and peer difficulties in Grade 1 than controls. Conclusions: Difficulties at school-age are wide-spread and enduring in those with persistent early LD, but appear specific to psychosocial adjustment in those with transient LD.

Introduction

Language skills are central to children's development in promoting school readiness and learning vital to school achievement (Bleses, et al., 2016; Dionne, et al., 2013; Hoff, 2014; Krajewski & Schneider, 2009; Lefevre, et al., 2010), as well as self-regulation of emotions (Kopp, 1989), behaviors (Dionne, 2005; Dionne, et al., 2003; Girard, et al., 2014) and social interactions (Rice, 1993). Therefore, children with language problems may be at risk of difficulties not only in language development, but also in academic achievement and psychosocial adjustment at school age. Previous studies on children with language problems included children with language delay (LD; when children acquire language more slowly than other children their age) and/or developmental language disorder (DLD; a profile of language problems that causes functional impairment in everyday life, that is associated with poor prognosis, with no known biomedical aetiology; Bishop, et al., 2017). In this paper, the term "language problems" is thus used when samples included both children with LD or DLD. The current study does not focus on children with DLD (nor on children whose LD was first identified by the end of the preschool years or the beginning of the school years, i.e. late-emerging LD) but rather on children with early LD in toddlerhood.

Toddlers with early LD may follow two distinct language trajectories (Dale, et al., 2003; Henrichs, et al., 2011; Law, et al., 2000; Rescorla & Dale, 2013; Zambrana, et al., 2014). Studies shows that roughly half of these children catches up to children with typical language development by the end of their preschool years (transient LD) whereas the other half have persistent LD – some of which may qualify as having DLD (Caglar-Ryeng, et al., 2020; Law, et al., 2000; Rescorla & Dale, 2013). Though many studies have shown that children with early LD may have difficulties at school age, it remains controversial as to whether they differ for

persistent versus transient LD. The objective of this study was to compare language, academic and psychosocial outcomes of children with early LD at 18 months as a function of early LD persistence at 5 years of age. Persistence of early LD is typically identified before children enter school (a period of transition in child and language development), by the end of the preschool years (i.e., 4-5 years; Rescorla & Dale, 2013), when children have accomplished the basics of language development (Hoff, 2014). Identification of early LD at 18 months is earlier than in most previous studies (Rescorla & Dale, 2013; Paul et al., 1996), nonetheless, it was shown that parents express worries about their child's language development even before the age of 2 (Rescorla & Dale, 2013; Shevell et al., 2005). In addition, early identification offers the opportunity to provide early interventions that improve prognosis (Dale & Patterson, 2010; Paul & Roth, 2011).

Language Development in Children with Early LD

Rescorla (2009) proposed a "language endowment spectrum", ranging from children with typical language development, to children with transient early LD, to those with persistent LD, and to children with DLD. According to this dimensional account of early LD, differences between children are quantitative rather than qualitative. This account was supported by numerous studies (Ellis Weismer, 2007; Rescorla & Dale, 2013). Indeed, children with persistent LD typically display a broad range of language difficulties at school age whereas children with transient LD have few or no residual language difficulties (Bishop & Adams, 1990; Dale et al., 2014; Paul, et al., 1996; Paul, et al., 1997; Stothard, et al., 1998). For instance, Bishop and Adams (1990) and Stothard and colleagues (1998) found that children with persistent expressive or receptive language problems between ages 4 and 5.5 had a range of language difficulties in vocabulary and morphosyntax at ages 8 and 15, respectively. Similarly, Paul et al. (1996; 1997)

identified various language difficulties in children with expressive LD at age 2 years and persistent language problems at ages 6, 7 and/or 8. In contrast, Dale and colleagues (2014) observed that children with transient expressive LD between 2 and 4 years of age had similar language scores than controls at 7 and 12 years. Indeed, difficulties were found in morphosyntax at age 8 in children referred for expressive or receptive language problems at age 4 (Bishop & Adams, 1990), and in narrative skills at ages 6 and 7 in children with expressive LD at age 2 (Paul, et al., 1996). Consequently, it still remains unclear if the recovery of children with transient LD is only illusory (Dale, et al., 2014).

Academic Outcomes in Children with Early LD

Studies have documented academic difficulties in literacy domains (reading, writing and spelling) in children with early LD (Hawa & Spanoudis, 2014; Larney, 2002; Paul & Roth, 2011; Preston, et al., 2010; Rescorla, 2002), as well early language problems in children who end up having dyslexia (Bishop & Snowling, 2004; Nash, et al., 2013). The role of language in mathematics may seem less obvious than in literacy domains, though language and mathematic skills share neurobiological and cognitive bases such as working memory and executive functions (Cragg & Gilmore, 2014). Further, recent studies have shown that early language skills predict later mathematics achievement (Bleses, et al., 2016; Krajewski & Schneider, 2009; Lefevre, et al., 2010; von Stumm, et al., 2020).

Although children with early LD show poorer overall reading, writing, spelling and mathematic skills than controls in elementary school (Beitchman, et al., 1996; Hawa & Spanoudis, 2014; Justice, et al., 2009; Larney, 2002; Paul & Roth, 2011; Preston, et al., 2010; Rescorla, 2002), it is unclear whether children with persistent delay have more difficulties than

those with transient delay. A few studies point to differing trajectories in academic achievement as a function of LD persistence. Indeed, the literacy and numeracy skills of children with transient LD do not appear to be affected during their elementary school years (Bishop & Adams, 1990; Dale, et al., 2014; Paul, et al., 1997). Dale and colleagues (2014) even found that children with transient expressive LD between the age of 2 and 4 had slightly better reading skills at age 7 and 12 than children without early LD, however, differences were not significant. Results are less clear for children with persistent LD. Bishop and Adams (1990) found that children with persistent expressive or receptive language problems between the ages of 4 and 5.5 years had weaker reading skills but similar spelling skills than controls at age 8. However, in another study of children with expressive LD at age 2 and persistent language problems at age 8, Paul et al. (1997) found that their reading and spelling skills at 8 years were similar to controls and children with transient LD, but that their mathematic skills were poorer (Paul, et al., 1997). Thus, literacy outcomes for children with persistent expressive LD may be better than those for children with persistent expressive/receptive LD. Paul and colleagues (1997) were the only ones who examined mathematical achievement in children with transient and persistent LD. No study has compared academic achievement in children with transient and persistent LD beyond the age of 8 years.

Psychosocial Adjustment Outcomes in Children with Early LD

Coping with and regulating emotions and behaviors during elementary school is necessary for children to develop healthy relationships with their classmates and to benefit from learning opportunities in school. However, LD may impact such self-regulations skills (Dionne, 2005; Dionne, et al., 2003; Kopp, 1989; Girard, et al., 2014; St-Clair, et al., 2019). Poor self-regulation skills are associated with internalizing symptoms such as anxiety and depression

(Aldao, et al., 2010), and externalizing behaviors such as aggression (Dionne, 2005; Dionne, et al., 2003; Girard, et al., 2014); these in turn can cause social difficulties (Rice, 1993). Moreover, language problems are often associated with attention deficit hyperactivity disorder (ADHD) behaviors (Craig, et al., 2016; Sciberras, et al., 2014; Webster & Shevell, 2004). Internalizing, externalizing and ADHD behaviors and social difficulties are common in children with early LD in elementary school (Benasich, et al., 1993; Curtis et al., 2018; Redmond & Rice, 1998, 2002; Shevell, Majnemer, Platt, et al., 2005; Shevell, Majnemer, Webster, et al., 2005; Toseeb & St Clair, 2020; Yew & O'Kearney, 2013) and during adolescence (Aram, et al., 1984; Beitchman et al., 1996; Curtis et al., 2018; Yew & O'Kearney, 2013). Conversely, Whitehouse et al. (2011) found no differences in internalizing and externalizing behaviors between 2-year-olds with expressive LD and controls at ages 5, 8, 10, 14 and 17.

It is unclear whether psychosocial difficulties vary according to LD persistence. Three different pictures emerged in three studies. Snowling and colleagues (2006) have shown that children with persistent expressive or receptive language problems at ages 4 and 5.5, but not those whose language problems resolved, had more parent-reported ADHD behaviors than controls at age 15-16. However, groups did not differ on rates of psychiatric disorders (e.g., ADHD, conduct disorder, general anxiety disorder, dysthymia, etc.) based on psychiatric interview conducted with the child at the same age (Snowling et al., 2006). Beitchman et al. (1996) found that 42%–43% of children with early persistent or transient expressive/receptive language problems between the age of 5 and 12, had at least one psychiatric disorder (e.g., ADHD, conduct disorder, anxiety disorder or depression) at age 12. By contrast, McGrath et al. (2008) reported that children with transient speech-sound disorder between the age of 4 and 7

had more parent-reported inattention behaviors at age 7 years than children with persistent disorder.

In sum, children with early LD appear to be at a higher risk of long-term difficulties in language, academic achievement and psychosocial adjustment. However, it is unclear whether these differ for persistent versus transient early LD. Difficulties in language seem to remain a problem especially in children with persistent early LD, but few studies have addressed differences in academic and psychosocial adjustment as a function of persistence. No unique study has documented all three type of outcomes. In light of the above, the objective of this study is to compare children with persistent or transient expressive/receptive LD between 18 months and 5 years of age on their language, academic and psychosocial outcomes in Kindergarten and Grades 1, 3, 4 and 6.

Method

Participants

The Quebec Newborn Twin Study

Data came from the Quebec Newborn Twin Study (QNTS) (Boivin, et al., 2012), a prospective longitudinal follow-up of a population-based birth cohort of twins born between November 1995 and July 1998 in the greater Montreal area, Quebec, Canada (662 families). The study conducted quasi-annual assessment of cognitive, behavioral and social-emotional development. To be included in the QNTS, children had to be born without any major medical conditions, have available birth data, and have one parent fluent in either French or English. Attrition averaged 3% per year (Boivin, et al., 2012). The family characteristics of the QNTS are very similar to those of a parallel representative sample of singletons (Boivin, et al., 2012). Twin

cohorts are typically used to quantify the genetic and environmental etiology of phenotypes; however, given the extent of the longitudinal data they typically collect, they are also used as convenience samples to address developmental issues (Dale, et al., 2014; Dale, et al., 2003; Oliver & Plomin, 2007), as is the case here.

The Current Study

The current study used a subsample of children from the QNTS. Before selecting the subsample, all dependent variable scores were Z-standardized within the QNTS sample. To be included in the current study, children had to have expressive and receptive vocabulary scores at 18 months, and to have expressive and receptive vocabulary scores at 5 years of age (see the description of the vocabulary measures below). Since French was the first language for 96.1% of children (3.2% were English-speakers and .7% were bilinguals), bilinguals and English-speakers were excluded. A total of 564 children (49.1% boys, 56.7% dizygotic twins) met inclusion criteria. Their mean birth weight was 2.5 kg and their mean 5-minute APGAR was 9. Average family income was 40K–50K/year CND. Mothers' mean age at birth was 30.2 years, 15.3% had no high school diploma and 6.3% were single mothers.

Measures

Identification of Early LD and Persistence

Among the 564 children included in the study, we first identified children with early LD at 18 months, and then divided them up into Persistent versus Transient LD groups, based on the presence or absence of LD at 5 years of age. To identify early LD at 18 months, expressive and receptive vocabularies were assessed with a French in-house checklist of 77 words drawn or

adapted from the MacArthur Communicative Development Inventories (MCDI; Fenson et al., 1994; Fenson et al., 1993) and lists used in clinical settings in French Canadian populations (the French Canadian adaptation of the MCDI was not yet available). Parents checked words the child could say (expressive vocabulary) and words the child could say or understand (receptive vocabulary). Expressive and receptive scores were corrected for age and gestational age and averaged ($r = .55$, $p < .01$) to yield a total vocabulary score at 18 months. Vocabulary checklists are extensively used to identify early LD in research and clinical settings (Dale, et al., 2014; Dionne, et al., 2011; Ghassabian, et al., 2014; Horwitz, et al., 2003). Moreover, vocabulary checklists completed by parents have high internal consistency and show good concurrent validity with other language measures (Feldman, et al., 2005; Fenson et al., 1994; Fenson et al., 1993).

To identify LD persistence at 5 years of age, the French Canadian version of the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1997; Dunn, et al., 1993) was used. The PPVT is a standardized language test that is widely used and displays good internal consistency (Dunn & Dunn, 1997; Dunn, et al., 1993). In this study, the administration of the test was adapted, based on the Developmental Indicators for the Assessment of Learning (Mardell-Csudnowski & Goldenberg, 1998) procedure, to assess both expressive and receptive vocabularies. In the expressive task, children were asked to name an illustrated noun, verb or adjective until they reached the stop criterion (six failed items within the last eight). In the receptive task, children were asked to choose from four illustrations the one best representing a word they had failed to name in the expressive task until the stop criterion was reached. This procedure had been used previously by Malenfant and colleagues (2012) and shown to provide reliable expressive and

receptive scores. Expressive and receptive scores were corrected for age and prematurity, and then averaged ($r = .72$, $p < .01$) to yield a total vocabulary score at age 5.

Early LD at age 18 months was defined as a total vocabulary score ≤15th percentile based on the whole QNTS sample (Dionne, et al., 2011; Ghassabian, et al., 2014; Henrichs, et al., 2013; Henrichs, et al., 2011; Rescorla & Achenbach, 2002). To maximize group sizes, LD at age 5 was defined as a total vocabulary score ≤25th percentile based on the whole QNTS sample. Figure 1 shows the sample's language distribution and the creation of subgroups. A total of 67 children had early LD at 18 months: 30 (18 girls) had a delay at age 5 (Persistent LD group), 29 (9 girls) did not (Transient LD group), and eight had scores ≥75th percentile and were excluded from the Transient LD group to avoid overamplifying between group differences. A total of 293 children had a vocabulary score within the population mean (i.e., 25th-75th percentiles) at age 18 months. Among them, 163 (77 girls) still had a score within the population mean at age 5 years and comprised the control group. Table 1 shows the three groups (Persistent LD, Transient LD, controls) language scores at 18 months and 5 years, as well as *p*-values of t-tests comparing groups.

The three groups were not different for family income, mother's mean age at birth, marital status, children's sex, zygosity, birth weight, 5-minute APGAR, and non-verbal IQ at age 5, assessed with the Block Design subtest of the Wechsler Intelligence Scale for Children (WISC-III; Wechsler, 1991). However, groups differed on the proportion of mothers not having a high school diploma (10% of mothers did not have a high school diploma for Persistent LD, 20.7% for Transient LD, and 12.7% for controls, $p = .012$), so mother's education was entered as a covariate (see statistical analyses).

School-age Outcomes

Language. Vocabulary was assessed in Grade 1 by a research assistant at school with the standard French Canadian version of the PPVT (the assistant asked the child to choose the illustration from a set of four that best represented a particular word given until the stop criterion was reached; Dunn & Dunn, 1997; Dunn et al., 1993) and the Vocabulary subtest of the WISC-III (Wechsler, 1991). For the Vocabulary subtest of the WISC-III, the assistant asked the child to define words (rated 0 to 2 based on the accuracy of the definition) from a list of 25 until the stop criterion was reached (four consecutive scores of 0). Both tests have well documented psychometric properties (Dunn & Dunn, 1997; Dunn et al., 1993; Wechsler, 1991) and are extensively used in clinical and research settings. PPVT and WISC-III Vocabulary subtest scores were averaged ($r = .54$, $p < .01$) to provide a total vocabulary score in Grade 1. Outliers <1st percentile (n = 5) were winsorized (i.e. replaced with the next lowest score).

Expressive morphosyntax was assessed in Grade 1 with mean length of utterances (MLU; total words/total utterances) and clause density (dependent and independent clauses/independent clauses) derived from child answers on the WISC-III Vocabulary subtest. Answers were recorded then transcribed to calculate MLU and clause density. This way of calculating MLU and clause density had been used previously and shown to be valid by Mimeau and colleagues (2015). MLU and clause density scores were averaged ($r = .69$, $p < .01$) to yield an expressive morphosyntax score in Grade 1. Outliers >99th percentile (n = 5) were winsorized.

Oral communication was assessed by teachers in Kindergarten and Grade 1 with 6 items (uses correct grammar, able to relate a factual event, communicates well with others, articulates clearly, able to tell a story, able to communicate his/her needs) from the Early Development

Instrument (EDI; Janus & Offord, 2007) on a five-point scale (1 = very poor to 5 = excellent). Oral communication was assessed by teachers in Grades 4 and 6 using one item ("How would you rate this child's current academic achievement in oral expression?") on a five-point scale (1 = greatly under average to 5 = greatly above average). Scores in Kindergarten and Grades 1, 4 and 6 were averaged to provide an oral communication score in elementary school (α = .94).

Academic Achievement. In Grades 1 and 3, teachers rated reading, writing and mathematical achievement on a five-point scale (1 = greatly under average to 5 = greatly above average) using one item ("How would you rate this child's current academic achievement in …"). In Grades 4 and 6, teachers rated oral reading, reading comprehension, writing, calculation and mathematical problem solving on the same five-point scale using the same item. Reading and writing scores in Grades 1, 3, 4 and 6 were averaged to yield a literacy score (α = .95). Mathematic scores in Grade 1 and 3 and calculation and mathematical problem solving scores in Grades 4 and 6 were averaged to yield a numeracy score (α = .92).

Psychosocial Adjustment. Teachers in Kindergarten and Grades 1, 3, 4 and 6 rated the occurrence of ADHD (8 items assessing hyperactivity and inattention), externalizing (13 items assessing aggression and opposition), and internalizing (6 items assessing anxiety and depression) behaviors in the last 12 months on a three-point scale (0 = never, 1 = sometimes, and 2 = often) using the Social Behavior Questionnaire (SBQ; Tremblay, et al., 1987). The SBQ is similar to the Child Behavior Checklist (Achenbach, 1991), and has been shown to be reliable (Tremblay et al., 1987). We averaged Kindergarten and Grade 1 scores for each scale (α = .93 for ADHD, α = .93 for externalizing and α = .80 for internalizing behaviors) and averaged Grade 3, 4 and 6 scores for each scale (α = .95 for ADHD, α = .96 for externalizing and α = .86 for

internalizing behaviors) to yield three psychosocial scores at the beginning of elementary school (Kindergarten and Grade 1) and three psychosocial scores at the middle/end of elementary school (Grades 3, 4 and 6).

Peer rejection and victimization were assessed in Kindergarten and Grades 1 and 4 using a within-class sociometric procedure described more thoroughly by Boivin et al. (2013). Booklets of photographs of all children in a given class were handed out to all participating children in the class. They were asked to circle photos of: a) three peers they most liked to play with (positive nominations), b) three peers they least liked to play with (negative nominations) and c) two peers who got "called names most often by other children" and were "often pushed and hit by other children" (victimization nominations). Nominations were summed and Z-standardized for each child within the different classrooms and grades. Peer rejection equaled negative nominations minus positive nominations. Victimization nominations were summed. We averaged Kindergarten and Grade 1 scores for peer rejection (r=.28, p<.000) and victimization (r=.24, p<.000) separately.

Statistical Analyses

To compare children with persistent LD, transient LD, and without early LD (controls) on school-age outcomes, we used a series of linear regressions in STATA (StataCorp, 2019), in which we entered group (Persistent LD, Transient LD, Controls) and covariates as predictors in separate models for each outcome. STATA allows to use clusters and Maximum Likelihood estimator to correct standard error estimates for the non-independence of twin data and to fit the model to all non-missing data. For all analyses, the alpha threshold was set at .05.

Covariates

To select covariates, we examined correlations between children's sex, zygosity, birth weight, 5-minute APGAR, family income, mother's mean age at birth, mother's education and marital status, and each outcome. The criterion to select covariates was a significant correlation ($p < .05$) with outcome. Sex was entered as covariate for each outcome; zygosity was entered as covariate for externalizing behaviors and peer rejection; birth weight was entered for each outcome except for oral communication and morphosyntax; APGAR was entered for numeracy and morphosyntax; income was entered for each outcome except for ADHD behaviors, externalizing behaviors and victimization; mother's age at birth was entered for oral communication, literacy, numeracy and vocabulary; marital status was entered for ADHD and externalizing behaviors. Mother's education was entered as a covariate in all models because, as mentioned above, groups were different.

Results

Language and Academic Outcomes

Table 2 shows group means and standard deviations for school-age outcomes. Table 3 presents group coefficients, *p*-values and confidence intervals, adjusted for covariates (covariates results not shown) from regression models. Because we used Z-scores, regression coefficients can be interpreted as mean differences (adjusted for covariates) and can be compared. Mean differences can be interpreted as Cohen's d: .2, small effect; .5, medium effect; and >.8, large effect (Cohen, 1988).

The results showed that children with persistent LD had poorer outcomes than children with transient LD in vocabulary and oral communication (medium-large effect sizes). Moreover, children with persistent LD had poorer vocabulary, morphosyntax, oral communication and

numeracy outcomes than controls (medium to large effect sizes), whereas children with transient LD did not differ from the controls on any language and academic outcomes.

Psychosocial Outcomes

Table 4 shows group coefficients, *p*-values and confidence intervals, adjusted for covariates (covariates results not shown) from regression models. Results indicated that children with persistent LD and children with transient LD were different on ADHD behaviors at the beginning of elementary school (medium effect size); children with persistent LD had higher scores than children with transient LD. Moreover, children with persistent LD had higher scores than controls at the beginning of elementary school for ADHD behaviors (large effect size). Throughout elementary school, they had higher scores than controls for externalizing behaviors, peer rejection and victimization (small to large effect sizes). Children with transient LD also had higher scores than controls at the beginning of elementary school, but only for externalizing behaviors and victimization (medium effect sizes).

Discussion

The objective of this study was to document language, academic and psychosocial outcomes in elementary school in children presenting persistent or transient expressive/receptive LD between 18 months and 5 years of age. Results showed that children with persistent LD had language, academic and psychosocial difficulties throughout elementary school. Children with transient LD did not differ from controls on all language and academic outcomes. However, they had psychosocial difficulties at the beginning of elementary school; they had more externalizing behaviors and were more victimized than controls. Nonetheless, they had fewer psychosocial difficulties than children with persistent LD who cumulated them throughout elementary school.

Thus, children with transient LD seem to lie between children with persistent LD and controls on psychosocial outcomes, having an intermediate level of difficulties. Therefore, results highlighted that there are distinct profiles of language, academic and psychosocial outcomes for children with early expressive/receptive LD as a function of persistence.

Stability of Language Skills into the Elementary School Years

Proportions of children with persistent vs. transient LD in the current study were similar to those of previous studies (Caglar-Ryeng, et al., 2020; Ellis Weismer, 2007; Law, et al., 2000; Rescorla & Dale, 2013). In addition, in line with previous studies, there were differences in early receptive skills between children with transient LD and those with persistent LD (Bishop & Edmundson, 1987; Ellis Weismer, 2007; Ghassabian et al., 2014; Rescorla & Dale, 2013). Although children with transient LD were considered to have caught up to peers by age 5, their expressive and receptive language skills at this age were slightly lower than those of controls (marginally significant differences), which has been reported in previous studies (Ellis Weismer, 2007; Law, et al., 2000; Rescorla, 2013; Rescorla & Dale, 2013). However, in elementary school years, they were no more distinguishable from controls. Thus, we replicate results from Dale et al. (2014) and expand the scope to cover oral communication throughout elementary school, suggesting that children with transient LD do recover from early LD, whether the early LD was expressive and identified at age 2, as in the Dale and colleagues' (2014) study, or mixed, and identified earlier, as in the current study.

Our results also concur with previous studies in showing that children with persistent LD have a broad range of language difficulties at school age, including vocabulary and morphosyntax difficulties (Bishop & Adams, 1990; Paul et al., 1996; 1997). Similar to Bishop

and Adams (1990), we found that children with persistent LD showed continuing difficulties in vocabulary and morphosyntax at the beginning of school age. Though methods used in the current study do not allow to identify/diagnose DLD, this language profile is consistent with DLD (Caglar-Ryeng, et al., 2020; Ellis Weismer, 2007; Rescorla, 2013).

In sum, at age 18 months, children with transient LD appeared to fall between children with persistent LD and those with typical language development on the language endowment spectrum. Between 18 months and 5 years of age, they seemed to move towards children with typical language development to reach their language levels by the beginning of elementary school. Children with persistent LD were found to have a language profile consistent with DLD. Therefore, in line with previous studies (Ellis Weismer, 2007; Rescorla & Dale, 2013), our findings support to a certain degree a dimensional account of early LD.

Differing Trajectories of Academic Achievement

Children with persistent and transient LD did not differ on academic achievement in the literacy and numeracy domains. However, we found that children with persistent LD had poorer outcomes in numeracy, but not in literacy, compared to controls. Previous studies indeed generated conflicting results with respect to reading difficulties in children with persistent LD. Bishop and Adams (1990) found reading difficulties at age 8 in children with persistent expressive or receptive language problems, whereas Paul et al. (1997) did not find persistent reading problems at 8 years in children with expressive LD at age 2 and persistent language problems at age 8. Further, Paul and colleagues (1997) found that the mathematic skills of children with persistent expressive LD were poorer than those of controls. Thus, our results

replicate their findings in children with persistent expressive/receptive LD in early elementary school, and expand on them through to the end of elementary school.

Psychosocial Adjustment Difficulties in Elementary School

The story regarding psychosocial adjustment is slightly different. We found that, regardless of persistence, children with early LD had psychosocial difficulties, but that children with transient LD seem to fall between children with persistent LD and controls with respect to psychosocial difficulties. Our study is the first to highlight this contrast between language/learning and psychosocial outcomes in children with early persistent or transient LD.

ADHD, externalizing and internalizing behaviors as well as social difficulties have been documented in children with early LD in previous studies (Aram, et al., 1984; Beitchman, et al., 1996; Benasich, et al., 1993; Curtis, et al., 2018; Redmond & Rice, 1998, 2002; Shevell, et al., 2005; Shevell, et al., 2005; Toseeb & St Clair, 2020; Yew & O'Kearney, 2013). We also found social difficulties (victimization and peer rejection), and ADHD and externalizing behaviors, but not internalizing behaviors, in children with persistent LD. In children with transient LD, we found social difficulties (victimization) and externalizing behaviors, but only at the beginning of elementary school. Our results suggest that psychosocial difficulties at the elementary school period vary according to LD persistence, replicating in part results reported by Snowling et al. (2006) and Beitchman et al. (1996) but in adolescence in children whose LD was first identified later. They showed that both children with persistent or transient expressive/receptive language problems displayed more ADHD behaviors or psychiatric disorders than controls in adolescence (12-16 years) (Beitchman, et al., 1996; Snowling, et al., 2006). However, our study is the first to

suggest that children with transient LD may experience an intermediate level of psychosocial difficulties.

Hypotheses for Later Difficulties

The main innovative feature of our study is the variety of outcomes examined concurrently, at multiple time points, and throughout elementary school. The study highlighted the pervasive contrast in the nature of school-age difficulties experienced by children with persistent versus transient LD. Children with persistent LD experienced a wider range of difficulties in elementary school. Though it was hypothesized that these difficulties stem from their persistent poor expressive/receptive language skills (Dionne, 2005; Dionne, et al., 2003; Kopp, 1989; Girard, et al., 2014; St-Clair, et al., 2019), it is unclear, however, whether they stem from something else. Gilger and Kaplan (2001) argued that the combinative and interactive effects of genetic and environmental risk factors during the pre- and postnatal periods could have subtle effects on brain development leading to co-occurring developmental difficulties in children. Indeed, language, academic and psychosocial difficulties share some genetic and environmental etiological factors (Cragg & Gilmore, 2014; Craig, et al., 2016; Dionne, et al., 2013; Harlaar, et al., 2010; Hoff, 2014; Rvachew, 2010; Webster & Shevell, 2004). However, more empirical evidence is needed to support the atypical brain development hypothesis (Gilger & Kaplan, 2001) as a basis for the wide scope of difficulties experienced by children with persistent LD.

In contrast, children with transient LD appear specifically vulnerable to later behavioral and social difficulties. The possibility of ensuing difficulties in children with transient LD inspired the term “illusory recovery” (Scarborough & Dobrich, 1990). The hypothesis is that

catching up to children with typical language development by the end of the preschool years does not eliminate the risk of difficulties. Dale and colleagues (2014) found that children with transient expressive LD between 2 and 4 years of age did no worse than children with typical language development when their language and reading skills were assessed at age 7 and 12, thus refuting the phenomenon of illusory recovery. We also found little evidence for ensuing language and academic difficulties in children with transient LD. Still, we did find that transient LD was associated with more externalizing behaviors and victimization in the early school years.

Beitchman and colleagues (1996) proposed two explanations for psychosocial difficulties in children with early LD, regardless of recovery status. First, they suggested that socioeconomic adversity, which is more prevalent in families of children with early LD, could be at play. However, this hypothesis appears rather unlikely in our study given that children with persistent LD, transient LD and controls did not differ on most family characteristics, and because we included covariates to control for socioeconomic risk factors. Yet, the proportion of mothers not having a high school diploma in the Transient LD group was double than in the Persistent LD group. Mothers input to children may have been of poorer quality (Hawa & Spanoudis, 2014), and transient early LD may have been environmental in origin (Bishop et al., 2003). Therefore, as suggested by Beitchman and colleagues (1996), socioeconomic adversity could partly be at play, at least in children with transient LD.

Second, they proposed that early LD could have an effect on later psychosocial adjustment (Beitchman, et al., 1996). This hypothesis has received some empirical support (Dionne, 2005; Dionne, et al., 2003; Girard, et al., 2014). For instance, Dionne et al. (2003) and Girard et al. (2014) found that low language skills lead to an increase in aggressive behaviors in toddlers and preschoolers. It is possible that limited language skills during the early years, a

sensitive period in self-regulation development (Cole, et al., 2010; Kopp, 1989; Roben, et al., 2013; Vallotton & Ayoub, 2011), have enduring effects on externalizing behaviors (Dionne, 2005; Dionne, et al., 2003; Girard, et al., 2014) and ADHD behaviors, even when early LD resolves, which could put children at risk of victimization and peer rejection (Boivin, et al., 2013; Rice, 1993). However, these hypotheses need to be verified in further studies.

Clinical Implications

Clinicians should consider that children with persistent LD are at risk of a wide range of difficulties in elementary school years, whereas children with transient LD may only be at risk of psychosocial difficulties. Early identification of LD and early interventions to prevent LD persistence should therefore be a priority. The efficacy of early language interventions by speech-language pathologists or parents is well established (Baxendale & Hesketh, 2003; Buschmann, et al., 2015; Girolametto, 2010; Roberts & Kaiser, 2015). For instance, Girolametto et al. (2001) reported a recovery rate of 86% at 5 years of age following a parent intervention implemented in children with expressive LD identified at age 2, a rate much higher than the expected 50% remission rate without intervention (Buschmann, et al., 2015; Law, et al., 2000). In addition to language-focused interventions, since directionality and causality of difficulties still need to be established, interventions could target common denominators for various developmental difficulties. For instance, executive functions and working memory are involved in language and numeracy as well as in ADHD (Cragg & Gilmore, 2014; Craig, et al., 2016). Interventions could also target emotional and behavioral regulation through cognitive behavioral therapy (Chaloult, 2008). Its efficacy in reducing externalizing (Furlong, et al., 2012) and social difficulties (Kalvin, et al., 2015) is well established, but its efficacy in children with early LD needs to be demonstrated, since cognitive strategies rely largely on verbal interactions.

Strengths and Limitations

This study presents some limitations that are important to consider in interpreting the findings. First, because we used data from a longitudinal population-based study, the identification of early LD and persistence did not rely on comprehensive language assessments nor on diagnosis tools to identify DLD. However, both vocabulary checklists and the PPVT show good concurrent validity with other language measures (Dunn & Dunn, 1997; Dunn, et al., 1993; Fenson, et al., 1993; Fenson, et al., 2000), were used in previous studies to identify early LD and persistence (Dale, et al., 2014; Dionne, et al., 2011; Ghassabian, et al., 2014; Henrichs, et al., 2013), and are used in clinical settings on a regular basis. Furthermore, we used arbitrary cut-offs to identify early LD and persistence, based on previous studies (Ghassabian, et al., 2014; Henrichs, et al., 2013; Henrichs, et al., 2011; Rescorla & Achenbach, 2002). Though our results (i.e., the stability of language skills into the elementary school years) support the chosen methods of identification (i.e. ages, developmental span, measures, cut-offs), future studies could use alternative strategies, such as clinical diagnoses (e.g., DLD) or group-based multi-trajectory modeling (Nagin, et al., 2018) to identify distinct language trajectories among children with early LD. In addition, comparison with a group of children with late-emerging LD would have improved the design but was beyond the scope of this study.

Second, the use of a twin sample implies the non-independence of data, but this was minimized by the use of a cluster for family in statistical analyses, a two-week delay between parental assessments of each child at age 18 months, direct assessment at age 5 years, and different teacher assessments throughout elementary school. In addition, though twins are at higher risk of LD than singletons (Rice et al., 2014; Rutter et al., 2003; Thorpe, 2006), origins of

LD appear to be the same and language development not qualitatively different (Rice et al., 2014; Rutter et al., 2003; Thorpe, 2006).

Third, missing data and attrition need to be considered. Nevertheless, the attrition rate in the QNTS was low (average of 3% per year) (Boivin, et al., 2012) and Maximum Likelihood estimator was used to fit the model to all non-missing data. Finally, even given the large population sample, group sizes of children with persistent and transient LD were small and thus statistical power was low. We also opted for a conservative approach and limited our typical language group to those who fell between the 25th and 75th percentiles to avoid overinflating comparisons. This study, however, remains exploratory in nature, and results need to be replicated in future studies with larger sample size and using multivariate analyses.

In conclusion, this study examined a variety of school-age outcomes concurrently at multiple time points throughout elementary school and highlighted the contrast between persistent and transient LD on language, academic and psychosocial outcomes. The persistence of early LD was associated with a wide range of difficulties in elementary school whereas recovery from early LD, even though associated with good language and academic outcomes, may be "illusory" with regards to psychosocial difficulties.

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Table 1. Group means and standard deviations (SD) for expressive and receptive vocabulary scores at 18 months and 5 years, and *p*-values of t-tests results.

		Persistent LD n=30	**Transient LD n=29**	**Controls n=163**	**Persistent vs. Transient LD**	**Persistent LD vs. Controls**	**Transient LD vs. Controls**
					p	*p*	*p*
18 months	Expressive vocabulary	-1.32 (.49)	-1.27 (.40)	-.07 (.62)	.690	.000	.000
	Receptive vocabulary	-1.75 (.67)	-1.33 (.64)	.11 (.55)	.017	.000	.000
5 years	Expressive vocabulary	-1.13 (.35)	-.18 (.54)	.03 (.59)	.000	.000	.082
	Receptive vocabulary	-1.24 (.59)	-.05 (.49)	.10 (.53)	.000	.000	.161

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Table 2. Group means and standard deviations (SD) for language, academic and psychosocial outcomes.

		Persistent LD n=30	Transient LD n=29	Controls n=163
Language and academic outcomes				
Grade 1	Vocabulary	-1.03 (.81)	.16 (.76)	.07 (.59)
Grade 1	Morphosyntax	-.47 (.85)	.08 (.83)	-.04 (.81)
Kindergarten to Grade 6	Communication	-.80 (.95)	-.02 (.87)	.04 (.70)
Grades 1 to 6	Literacy	-.44 (.84)	.23 (.86)	-.01 (.79)
Grades 1 to 6	Numeracy	-.51 (.94)	.17 (.88)	.10 (.74)
Psychosocial outcomes				
Kindergarten and Grade 1	ADHD behaviors	.62 (.82)	.19 (.85)	-.10 (.75)
	Externalizing behaviors	.43 (1.07)	.37 (.98)	-.16 (.64)
	Internalizing behaviors	.18 (.67)	-.07 (.70)	-.05 (.65)
	Peer rejection	.46 (1.06)	.15 (.64)	-.02 (.72)
	Victimization	.29 (.91)	.32 (.87)	-.13 (.73)
Grade 4	Peer rejection	.35 (1.08)	-.13 (.72)	-.14 (.87)
	Victimization	.34 (1.34)	.05 (.97)	-.14 (.84)
Grades 3, 4 and 6	ADHD behaviors	.06 (.66)	.12 (.80)	.06 (.82)
	Externalizing behaviors	.26 (.94)	.20 (1.04)	.03 (.87)
	Internalizing behaviors	.23 (.68)	.12 (.75)	.04 (.69)

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Table 3. Group coefficients, *p*-values and confidence intervals (CI; 95%) for language and academic outcomes (adjusted for covariates).

		Persistent vs. Transient LD			**Persistent LD vs. Controls**			**Transient LD vs. Controls**			**n**
		Coef. (SE)	***p***	**CI**	**Coef. (SE)**	***p***	**CI**	**Coef. (SE)**	***p***	**CI**	
Grade 1	Vocabulary	-.79 (.19)	.000	-1.16 – -.42	-.92 (.14)	.000	-1.19 – -.66	-.13 (.15)	.371	-.42 – .16	183
Grade 1	Morphosyntax	-.43 (.26)	.107	-.94 – .09	-.43 (.19)	.025	-.81 – -.05	-.01 (.21)	.975	-.41 – .40	172
Kindergarten to Grade 6	Communication	-.70 (.21)	.001	-1.12 – -.29	-.80 (.15)	.000	-1.10 – -.49	-.09 (.17)	.576	-.42 – .23	193
Grades 1 to 6	Literacy	-.43 (.23)	.060	-.88 – .02	-.30 (.17)	.071	-.62 – .03	.13 (.18)	.467	-.22 – .49	189
Grades 1 to 6	Numeracy	-.27 (.22)	.229	-.70 – .17	-.40 (.16)	.014	-.71 – -.08	-.13 (.18)	.468	-.47 – .22	189

Table 4. Group coefficients, *p*-values and confidence intervals (CI; 95%) for psychosocial outcomes (adjusted for covariates).

		Persistent vs. Transient LD			**Persistent LD vs. Controls**			**Transient LD vs. Controls**			**n**
		Coef. (SE)	***p***	**CI**	**Coef. (SE)**	***p***	**CI**	**Coef. (SE)**	***p***	**CI**	
Kindergarten and Grade 1	ADHD behaviors	.63 (.22)	.005	.19 – 1.06	.83 (.16)	.000	.51 – 1.15	.20 (.18)	.244	-.14 – .55	181
	Externalizing behaviors	.32 (.21)	.133	-.10 – .74	.78 (.16)	.000	.47 – 1.08	.46 (.16)	.005	.14 – .78	191
	Internalizing behaviors	.18 (.20)	.371	-.21 – .57	.19 (.14)	.188	-.09 – .47	.01 (.16)	.938	-.29 – .32	181
Grade 1	Peer rejection	.07 (.22)	.748	-.36 – .50	.31 (.16)	.054	-.01 – .63	.24 (.17)	.156	-.09 – .58	191
	Victimization	.07 (.22)	.753	-.37 – .50	.50 (.16)	.002	.18 – .82	.43 (.17)	.013	.09 – .76	191
Grade 4	Peer rejection	.53 (.29)	.073	-.05 – 1.11	.50 (.23)	.030	.05 – .94	-.03 (.21)	.880	-.45 – .39	157
	Victimization	.37 (.30)	.227	-.23 – .96	.53 (.24)	.026	.06 – .99	.16 (.22)	.478	-.28 – .59	157
Grades 3, 4 and 6	ADHD behaviors	.03 (.23)	.891	-.42 – .48	.04 (.17)	.789	-.28 – .37	.01 (.18)	.943	-.34 – .37	185
	Externalizing behaviors	.28 (.25)	.262	-.21 – .78	.38 (.19)	.040	.02 – .74	.10 (.20)	.623	-.29 – .48	193
	Internalizing behaviors	.09 (.21)	.660	-.32 – .51	.18 (.15)	.253	-.13 – .48	.08 (.17)	.626	-.25 – .41	185

874 *Figure 1.* Sample's language distribution and creation of subgroups.
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