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Research Article

Early Risk Factors and Emotional Difficulties in Children at Risk of Developmental Language Disorder: A Population Cohort Study

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Purpose: This study evaluated the pathways between developmental language disorder (DLD), psychosocial risk factors, and the development of emotional difficulties from ages 3 to 11 years within the Millennium Cohort Study.
Method: A total of 14,494 singletons (49.4% female) from the Millennium Cohort Study were evaluated within this study. Risk of DLD (rDLD) was defined as age 5 parent-reported language problems and/or –1.5 *SD*s on a Naming Vocabulary subtest at the age of 5 years. Children without rDLD formed the general population comparison group. Psychosocial risk factors included 9-month temperamental traits, parental psychological distress, and maternal attachment as well as age 3 emotional regulation abilities, parent–child relationship, and peer problems. The parent report Strengths and Difficulties Questionnaire Emotional Difficulty subscale at 3, 5, 7, and 11 years of age was the outcome variable. The trajectory of emotional difficulties was evaluated within a variable-centered approach and a person-centered approach, using growth mixture modeling.
Results: Children with rDLD (n = 884) had increased levels of emotional problems when compared to the general population group (n = 13,344). Psychosocial risk factors were increased in children with rDLD, fully mediated the increased emotional difficulties at 3 years, and partially mediated the increased emotional difficulties at 11 years. Children with rDLD were more likely to be included in emotional trajectory subgroups with an increasing pattern of emotional problems. rDLD was an additional risk factor for lower levels of emotional self-regulation and increased peer problems when controlling for the emotional difficulties trajectory subgroup.
Conclusion: This article indicates that the increased emotional difficulties found in children with rDLD are likely a function of early language difficulties influencing other domains of development, specifically social interactions (parent and peer) and emotional self-regulation abilities. Clinically, this reiterates the importance of early identification and treatment of children with language delays or clinical level language disorders.
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There is accumulating evidence that the presence of an early language difficulty, such as developmental language disorder (DLD), is a risk factor for later emotional problems (Yew & O'Kearney, 2013). Traditionally, emotional difficulties in children with DLD have only been studied after diagnosis. This is a logical approach—it is easy to study psychosocial difficulties in this group when their developmental differences are readily apparent. However, this approach has drawbacks, as it is difficult to establish the direction of causal factors and may oversample the most severely affected cases if sampling is based on clinical identification only (Law, Reilly, & Snow, 2013). Prior to identification, children will likely have underdeveloped language skills, which could influence their social and emotional development (Im-Bolter & Cohen, 2007). In order to evaluate risk and etiology of emotional difficulties in children with DLD, researchers must look at development before DLD would be apparent, which would involve either sibling studies in families with children at risk of DLD or evidence of DLD in large-scale cohort studies. The latter approach is used in this article.

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This article utilizes the term *developmental language disorder* to refer to children with substantial difficulties in speaking or understanding language, where the cause of these difficulties is unknown. This terminology is in line with recent recommendations from a panel of experts who advised on both standardized diagnostic criteria (Bishop, Snowling, Thompson, Greenhalgh, & CATALISE Consortium, 2016) and recommended the use of DLD as the established term for these children (Bishop, Snowling, Thompson, Greenhalgh, & CATALISE-2 Consortium, 2017). The terminology and definition of DLD replace a wide range of alternative terms, such as *specific language impairment, developmental dysphasia,* and *language learning impairment*, among others. However, all previous terminology and definitions share the idea of capturing children who have substantial language difficulties that cannot be accounted for by other conditions (e.g., autism or hearing loss), and therefore we refer to DLD throughout the article when referencing older studies. This decision is in line with long-term studies switching to using this term (e.g., Conti-Ramsden, Durkin, Toseeb, Botting, & Pickles, 2018) when they previously used older terms. It was also thought advisable to stick with one label to prevent confusion, although many of the studies cited will have used either *specific language impairment* or a range of other terms in their articles. However, as mentioned above, these other terms all essentially relate to the same group of children with substantial, unexplained language difficulties. This issue is further discussed in the discussion.

Social Relationships

The developmental pathways between early language difficulties and later emotional problems remain unclear, and numerous accounts have been proposed. First, emotional difficulties may arise from a disruption of typical social learning processes caused by the presence of DLD (Redmond & Rice, 1998). Indeed, the usage-based theory of language development indicates that children learn language through social interactions (Tomasello, 2009). Typically developing children slowly build their understanding of their social world and begin to participate in it themselves by immersion in language and the cues that coincide with it (such as tone of voice, facial expressions, and gestures). However, the social world of children with DLD may look very different, including a nearly universal extended state of preverbal communication (language delay) and, consequently, a longer period of being unable to express themselves effectively (Rice, 2007). This could have far-reaching consequences. For example, struggling to participate in communicative acts and frustration of not being understood or understanding could lead to fewer successful social learning opportunities, with both parents/caregivers and peers.

Within the social information processing model, fewer successful social learning opportunities reduce future success within social situations, due to fewer experiences to draw upon (Crick & Dodge, 1994). Indeed, there is a well-documented increase in peer problems and peer victimization in children with DLD compared to their typically developing peers (Conti-Ramsden & Botting, 2004; Lindsay & Dockrell, 2000). More generally, peer difficulties and victimization, in particular, are associated with elevated emotional difficulties (Reijntjes, Kamphuis, Prinzie, & Telch, 2010), indicating that elevated peer difficulties in children with DLD could contribute to the elevated rates of emotional difficulties. Similarly, language difficulties may also relate to a strained parent–child relationship, as parents might not understand their child's tantrums and frustration are rooted in language difficulties. This, in turn, may relate to a suboptimal parent–child relationship, which in itself is a risk factor for emotional difficulties (Asselmann, Wittchen, Lieb, & Beesdo-Baum, 2015). In this scenario, elevated risk of emotional difficulties is a consequence of the reduced and suboptimal social learning opportunities, which manifests as social difficulties and could be considered a secondary consequence of the underlying language difficulty. One possible implication of this assumption was to propose that these additional difficulties may mediate the relationship between DLD and increased emotional difficulties. Indeed, support for this idea was found in Forrest, Gibson, Halligan, and St Clair (2018), with peer problems at the age of 7 years accounting for some of the relationship between DLD and increased emotional difficulties at the age of 14 years.

Emotional Regulation

Another potential route from language difficulties to emotional problems is via emotional dysregulation. Emotional regulation is the ability to respond to emotions in a socially appropriate and flexible manner, such as learning to cope with feelings of disappointment. Vygotsky proposed that language is a key tool in the development of self-regulatory skills as children gradually learn to use "inner speech" to help regulate their emotions (Stanley, 2011). There is limited research in this area, but one study has found DLD to be associated with delays in inner speech (Lidstone, Meins, & Fernyhough, 2012). Additionally, difficulty with emotional vocabulary and limited linguistic capacity to express and discuss these emotions may reduce effectiveness in understanding and regulating emotions (Fujiki, Spackman, Brinton, & Illig, 2008). This reduced language ability may directly relate to reduced emotion recognition, as parents encourage self-regulation and recognition through conversations about emotions (Dunn, Brown, & Beardsall, 1991), which, for children with DLD, may occur later in development once they acquire sufficient language to support such conversations. Indeed, early vocabulary ability has been associated with later self-regulatory skills, underlying a distinct link between language ability and emotional self-regulation (Vallotton & Ayoub, 2011). This reduced self-regulation ability may lead directly not only to emotional difficulties (Flouri, Midouhas, & Joshi, 2014) but also to unsuccessful attempts at socialization and, possibly, peer rejection (Trentacosta & Shaw, 2009).

Additional Explanations

Finally, it is also possible that linguistic and emotional difficulties stem from underlying "third variables" that give rise to both difficulties. Candidates for such explanations are factors such as shared genetic risk, underlying neurodevelopmental vulnerabilities, negative temperamental biases, early differences in social cognition, and/or environmental factors, such as exposure to maltreatment, family stress, or poverty (Prior, Bavin, Cini, Eadie, & Reilly, 2011). Indeed, Flouri et al. (2014) indicated that the increased emotional difficulties associated with poverty were moderated by children's verbal ability, such that children in poverty with high language ability did not have elevated emotional symptoms. This indicates that high language ability may be viewed as a resilient factor in the context of a low–socioeconomic status (SES) environment and, consequently, that low language ability may put children at an additional risk. As low language ability is more likely in children growing up in socioeconomic disadvantage (B. Hart & Risley, 1995), this may be yet another route to increased emotional difficulties.

A Longitudinal Approach

Although promising and potentially clinically informative, the evidence underlying the accounts of the links between language and emotional difficulties is usually limited by convenience sampling or cross-sectional data. An exception to this was the trajectory study by St Clair, Pickles, Durkin, and Conti-Ramsden (2011), which suggested that children with early language problems had consistently elevated emotional problems across development. This finding was replicated by Lindsay and Dockrell (2012) and was further elucidated in a large prospective study where, consistent with St Clair et al. and Lindsay and Dockrell's results, trajectories of emotional difficulties among children with early language difficulties were consistently elevated compared to a typically developing group from ages 4 to 10 years (Yew & O'Kearney, 2015). Taken together, these trajectories suggest that early language problems do not result in an ever increasing, "snowball"-like effect. Rather, early language problems present a persistent risk to emotional problems throughout childhood. Thus, the early childhood period may be a key period to investigate in order to understand the etiology of these increased difficulties in children with DLD.

A possible explanation for the elevated levels of emotional problems in children with language difficulties may be a difference in developmental pathways to emotional problems between children with and without language problems, although only one study to date (Yew & O'Kearney, 2015) has examined this. Overall trajectories for girls and boys were evaluated. Variability in the intercept and growth trajectory were evaluated based on DLD and the interactive effects with key predictors of emotional problems (temperamental, peer, and parental factors). Although the results showed only intercept differences and no differences in growth curves between children with and without language difficulties, the risk conferred by parenting hostility to later emotional problems was stronger among boys with language problems, whereas the protective effect of temperamental sociability was not present among girls with language problems.

What has been understudied in the DLD and emotional difficulties literature is the variability in outcomes. Not all children with DLD go on to develop substantial emotional difficulties or show increased rates for psychiatric difficulties (Beitchman, Brownlie, & Bao, 2014; Snowling, Bishop, Stothard, Chipchase, & Kaplan, 2006). However, little research has investigated the variability in the development of emotional difficulties, let alone any investigation in how children with DLD fit within different trajectory pathways.

Understanding pathways leading to heterogeneity of outcomes for children with DLD and discovering how the relationships between language, other risk factors, and emotional adjustment may vary between children with DLD and those with typical language development may have important clinical implications. For example, a clinical assessment informed by nuances such as interactions between family background, language abilities, and child temperament could help to inform allocation of resources and development of new intervention approaches. The current article aims to address these gaps in the literature as a stepping stone to such improvements in clinical practices.

Current Study

The current study investigates a large, nationally representative U.K. cohort, the Millennium Cohort Study (MCS), to explore pathways between DLD, early psychosocial risk factors, and the development of emotional difficulties from age 3 to 11. Previous work with MCS has investigated the relationship between age 3 language ability and conduct problems and prosocial behavior at the age of 5 years (Girard, Pingault, Doyle, Falissard, & Tremblay, 2016a, 2016b). Language ability and parental concerns of language difficulties at the age of 5 years have been shown to be a risk factor for special educational needs related to speech, language, and communication needs later in development in this sample (Dockrell & Hurry, 2018). As mentioned previously, Forrest et al. (2018) found that peer problems partially mediated the increased emotional difficulties found in children at risk of DLD. Other prospective studies suggest that children with DLD would face a persistent elevation in emotional problems across childhood, without a "snowball/cascading" effect (Yew & O'Kearney, 2015).

The current work aims to further evaluate the associations between language and emotional difficulties, specifically looking at how these are related to known early environment psychosocial risk factors for emotional difficulties, of which there is only limited previous research (e.g., Yew & O'Kearney, 2015). We take a developmental perspective to investigate emotional problems across childhood and also investigate how there may be changing relationships to early environmental risk factors across

development. This study also aims to help improve understanding of the variability in emotional outcomes, because although research indicates elevated risk, all children with DLD do not go on to experience emotional problems. Our two-pronged approach to data analysis is described below.

Study 1

Study 1 used a variable-centered approach and had the following aims: first, to replicate the well-established finding of increased emotional problems across development in children at risk of DLD. To do so, we evaluated the trajectory of emotional difficulties in children with and without risk of DLD (rDLD) from age 3 to 11 years. This will also extend the current literature by looking at emotional problems early in development (age 3) prior to the definition of being at risk of DLD.

Second, we aimed to compare the rates and predictive power of hypothesized risk factors for emotional difficulties between those with and without rDLD. We compared the levels of known, general early predictors of emotional problems (temperamental traits, parental psychological distress, parent–child relationship, child self-regulation and emotional dysregulation, and early peer difficulties) between an rDLD and a general population (GP) group. Previous research has indicated that associations to emotional problems are generally similar across delayed and nondelayed groups but that there is an increased severity of risk factors in children with DLD (e.g., Yew & O'Kearney, 2015). Thus, an increased prevalence of early environmental risk factors was predicted in the rDLD group. We also looked for differentially predictive early risk factors based on rDLD status to either confirm or contradict the previous findings.

Finally, we aimed to evaluate the combined mediating role of the significant early risk factor predictors in explaining the difference in emotional difficulties between the rDLD and GP groups. To do this, we evaluated whether the established increased early childhood risk factors in children at risk of DLD could account or partially account for the increased emotional difficulties associated with rDLD in early and late childhood.

Study 2

Study 2 extended Study 1 by examining the heterogeneity in trajectories of emotional difficulties. We used a person-centered approach (growth mixture models [GMMs]) to investigate subgroups in trajectories of emotional difficulties across development.

First, we aimed to investigate whether there exist differing subgroups of individuals with varying emotional difficulty trajectories and whether children at risk of DLD had a higher likelihood of inclusion in at-risk trajectory groups. The subgrouping analysis was done for the entire sample, and the distribution of individuals at risk of DLD across the trajectory subgroups was evaluated.

Second, we aimed to compare the rates of early risk factors within each trajectory subgroup and across the rDLD and GP members within each of the emotional trajectory subgroups. This aim of this analysis is to extend and validate the results of Study 1. We expected the early risk factors to vary depending on the emotional difficulty trajectory subgroup—fewer risk factors for adaptive trajectories and increased risk factors for more at-risk trajectories. We do not make specific hypotheses regarding whether there will be rDLD/GP differences within each emotional difficulty trajectory, as any increased risk factors found in the entire sample may be due to higher proportions of children at risk of DLD in at-risk trajectories. Thus, whether the increased rates of any risk factors in children at risk of DLD found in Study 1 are specific to rDLD or more a function of specific emotional difficulty trajectory will be evaluated. To the authors' knowledge, no previous research has disentangled these two possibilities and investigated whether there are increased risk factors for emotional problems in children at risk of DLD in comparison to a GP group with a similar trajectory of emotional problems.

Method

Participants

The MCS is a U.K. birth cohort of children born between September 2000 and January 2002 (Connelly & Platt, 2014). The cohort members and families were evaluated at 9 months and at 3, 5, 7, and 11 years. The full sample size was 19,518 children. In total, 5,024 individuals were excluded from this analysis (537 due to multiple births and 4,487 due to missing Strengths and Difficulties Questionnaire (SDQ) or DLD status data. The current sample is 14,494 singletons (49.4% female). The original study had full ethical approval from the Multicentre Research Ethics Committee (Connelly & Platt, 2014).

Measures

With the exception of the British Abilities Scales (BAS; Elliott, Smith, & McCulloch, 1997), all measures were administered via questionnaire to the main respondent, usually the main caregiver, the majority of whom were mothers (Dex & Joshi, 2004). For further details on all measurements, see the Appendix and Johnson, Atkinson, and Rosenberg (2015). Excepting the SDQ and the BAS, most measures were reduced versions.

SDQ

The SDQ (Goodman, 1997), a 25-item scale with five subscales (Emotional, Peer, Conduct and Hyperactivity Difficulties, and Prosocial Behavior), was measured at 3, 5, 7, and 11 years. This is a widely used scale, including with DLD populations (e.g., St Clair et al., 2011), and is normed for children aged 2–17 years. Each item was rated on a 3-point scale (*not true*, *somewhat true*, and *certainly true*) and summed for each subscale. Only the Emotional Difficulties (outcome) and Peer Problems (predictor) subscales were analyzed (details of items within each subscale can be found in the Appendix). The SDQ Emotional subscale has a reliability of .67, and the Peer subscale has a reliability of 0.57 (Goodman, 2001). In this sample, the

reliability for the Emotional subscale was 0.52 for 3 years, 0.59 at 5 years, 0.64 at 7 years, and 0.70 for 11 years. Both subscales have good discriminant validity with psychiatric diagnoses (Goodman, 2001). According to the new banding guidelines, for the Emotional subscale at 3 years, a score of 0–2 is considered "close to average," 3 is "slightly raised," 4 is "high," and 5–10 is "very high." For the Emotional subscale at 5, 7, and 11 years, a score of 0–3 is considered "close to average," 4 is "slightly raised," 5–6 is "high," and 7–10 is "very high." We combined the high and very high categories to create a binary variable of typical and elevated emotional difficulties.

Nine-Month Measurements

The 9-month measurements were infant temperament (Carey Infant Temperament Scale; Johnson et al., 2015; Mood, Regularity in Patterns of Behavior [Eating and Sleeping], Approach/Withdrawal, Irritability, and Adaptability subscales), maternal attachment (Condon Maternal Attachment Questionnaire; Condon & Corkindale, 1998), and parental psychological distress (Malaise Inventory; Rutter, Tizard, & Whitmore, 1970). For infant temperament, scores were averaged. Sum scores were created for maternal attachment and psychological distress. See Appendix for further details on the specific measurements.

Three-Year Measures

The age 3 measurements were the Child–Parent Relationship Scale: Short Form (Driscoll & Pianta, 2011), the Child Social Behaviour Questionnaire (CSBQ; Johnson et al., 2015; Independence and Self-regulation and Emotional Dysregulation subscales), and the BAS–Second Edition (BAS-II) Naming Vocabulary subscale (Elliott et al., 1997). A sum score was created for the Child–Parent Relationship Scale, and average scores were created for the CSBQ. See Appendix for further details on the specific measurements.

Five- and 11-Year Measures

The BAS-II Naming Vocabulary and Pattern Construction subscales were administered at the age of 5 years, and the Verbal Similarity Subscale was administered at the age of 11 years (Elliott et al., 1997). The Naming Vocabulary subscale requires children to name pictures of objects and is considered a measure of expressive language ability (Law, Rush, Anandan, Cox, & Wood, 2012). The Pattern Construction subscale is a measure of spatial ability and requires the child to reconstruct patterns with foam squares or plastic cubes according to set pictures. This is the closest measure to nonverbal IQ in the age 5 battery. The Verbal Similarities subscale is a measure of verbal knowledge and verbal reasoning and requires the child to explain how two words are similar. This is the closest measure to language ability at a later time point. Parent report of language difficulties was measured at 5 years.

rDLD

Consistent with recent recommendations on terminology relating to language difficulties, we use the term *DLD* to refer to our subsample of children with evidence of language difficulties (Bishop et al., 2016). However, given we cannot be certain as to the diagnostic status of our group, we conservatively refer to this group as being at risk of DLD, due to evidence of substantial language difficulties at 5 years in this subgroup. In order to be considered as part of the rDLD group, we had two inclusion criteria and the child needed to meet at least one criterion. Both criteria were measured at 5 years, as many children with transient language delay have been found to catch up by 5 years of age (Rice, 2007). Children were included in the rDLD group if the main respondent endorsed "language developing slowly" or "doesn't understand others" (see also Forrest et al., 2018, for other work using this classification). We did not include any difficulty that related more to speech or hearing impairments (e.g., "doesn't hear well," "pronounces words poorly," or "stutters"), which were asked within the same question. This gives us confidence that the chosen questions related specifically to language difficulties, not articulation, hearing, or speech problems. We specifically feel this additional measure provides a measure of receptive language difficulties but may also index word finding problems or grammatical difficulties. Similar questions have been used in other cohort studies to index language disorder (Hughes, Sciberras, & Goldfeld, 2016), and parent reports have been advocated as just as important as standardized testing (Bishop & McDonald, 2009). Participants were also included in the rDLD group if they scored 1.5 *SD*s below the mean (*T* score of 35 or below) on the BAS-II Naming Vocabulary subtest, capturing expressive language deficits. Previous literature has also used the BAS-II Naming Vocabulary to capture language delays in this sample (Law et al., 2012). There were 884 (or 6.21%) individuals considered as having a language disorder at 5 years. A total of 438 children met criteria under the parental report criterion, whereas 523 met criteria under the naming vocabulary criterion. There were 77 children who met both criteria. See Table 1 and the initial section in the results for evidence of equivalent results for alternate classification of rDLD using only naming vocabulary or only parent report when compared to the combined rDLD classification used in this article.

Children at risk of DLD were removed if there was a salient cause of DLD. Any children meeting criteria for rDLD with a family environment where English was not spoken at least 50% of the time were dropped from the analysis (n = 278). Additional salient causes of DLD were evaluated by reports of special education need/additional classroom support and diagnoses. There were a total of 1,260 children with hearing loss (in both ears), 502 with evidence of autism spectrum disorder or Asperger's, and 12 with evidence of Down syndrome. Those individuals who met criteria for both the rDLD classification and the exclusion criteria were not included in this study. We did not use any exclusion criteria based on nonverbal intelligence in line with recent recommendations (Bishop et al., 2016).

Individuals who showed evidence of hearing loss, autism spectrum disorder, or Down syndrome but did not

meet our rDLD criteria were included in the GP comparison group. This ensured our comparison group did not show substantial language impairment but did represent the general U.K. population. The importance of suitable comparison groups that are not necessarily free from other conditions in the context of studying developmental disorders and mental health was recently evaluated by Fombonne (2016). As Fombonne points out, a representative sample of all people in the population that do not meet our rDLD inclusion criteria will guarantee an accurate estimate of the risk associated with rDLD. If we excluded all individuals with these additional conditions, we would introduce bias in the risk associated with rDLD by creating a control group that is artificially clean and not representative of U.K. children in general (Fombonne, 2016). Thus, the remainder of the sample that did not have any evidence of rDLD was included in our comparison group, termed *general population*. There were 13,344 (93.79%) individuals included in this comparison group.

Children at risk of DLD also had lower age 3 naming vocabulary standard scores (β = −.92, 95% CI [−1.01, −.82], $p < .001$; $M = 39.12$, $SE = 0.57$ for rDLD and $M = 51.09$, $SE = 0.19$ for GP), indicating our age 5 rDLD classification also related to reduced language ability at the age of 3 years on average. Additionally, children at risk of DLD at the age of 5 years had significantly lower BAS verbal similarity scores at the age of 11 years in comparison to the GP subsample (β = −.64, 95% CI [−.74, −.53], $p < .001$; $M = 52.09$, $SE = 0.59$ for rDLD and $M = 59.20$, $SE = 0.23$ for GP), indicating a reduced language-related ability in comparison to the GP group was retained over time. As a group, children at risk of DLD showed consistent deficits in language ability across childhood, which validates our age 5 rDLD classification.

Analysis Strategy

Imputation

To reduce bias and improve power in our analyses, multiple imputation was chosen over listwise deletion/complete case analysis. This missing value mechanism was assumed to be missing at random. The "mi compute" procedure in Stata 14 (Stata Corp., 2015) was utilised. The outcome variable of SDQ Emotional subscale and the SDQ Peer subscale were not imputed due to high levels of valid data. The remaining predictor variables were entered into the imputation model due to higher levels of missing data. Both the predictor variable and a computed interaction terms with the age 5 rDLD classification were predicted. The interaction term was necessary to include in order to avoid underpowering the potential for finding interactions (Schafer & Olsen, 1998). See Supplemental Material S1 for further details.

Regression Estimation

Regression with the mi estimate, which combines 20 sets of data into a single estimate, and svy prefixes were used for all imputed data. Data were analyzed with svyset command and svy prefix according to the MCS analysis documentation (Ketende & Jones, 2011). The weights used in the svyset command adjust for attrition based on the latest data wave used in the analysis. For example, any age 11 variables would require the Wave 5 weight. The svyset command also adjusts estimates with a population correction factor to produce U.K. population level estimates. All analyses controlled for child gender and the poverty indicator (Organisation for Economic Cooperation and Development poverty indicator: above or below 60% of the median income). Due to the combination of multiple imputations and the svy estimation command, it was not possible to get a measure of effect size for any analysis, as is advisable in such a large sample where the possibility of a Type I error is higher. However, wherever possible, we detail below the attempts to provide either comparable *B* or β values, which provide standardized coefficients to compare the strength of differing effects. Furthermore, all confident intervals are presented for all regression coefficients, whether *B* and β values.

Group Differences

Regression was used to investigate differences between the rDLD and GP subsamples in the demographic, 9-month, and 3-year risk factors. Regression was also used to evaluate the differences in the risk factors between the rDLD and GP subsamples within the trajectory subgroups. In comparing risk factors (and the prevalence of rDLD itself) within each overall trajectory subgroup, regression was also used, but a dummy variable, where each subgroup was compared to the combined remaining subgroups, was the predictor. Robust regression, which relaxes distributional assumptions, was used when the data were nonnormally distributed but did not have extreme skewness. Several variables (regularity, approach, adaptability, malaise, age 3 peer problems, emotional problems at 3 and 11 years old) had the most frequent response being either the lowest or highest score. As such, negative binomial regression was used. Regressions utilized *z* scores to provide standardized β coefficients, but this was not possible with negative binomial regression, so normal *B* coefficients are reported instead.

Longitudinal Regression

To investigate the effect of rDLD on trajectories of emotional problems, a multilevel mixed-effects linear regression integrating the age 11 sampling weights was used to evaluate emotional problems longitudinally, as the svy prefix was not compatible with this analysis. The random component accounted for the nonindependence of the longitudinal data. The fixed effects were linear and quadratic age variables, the rDLD/GP variable, and the covariates. Robust regression was used. Figure 1 was created from predicted values from the rDLD by quadratic age regression.

Multiple Regression

Two sets of multiple regression models with interaction terms were utilized to understand the moderating

effect of rDLD on predictors of age 3 and 11 emotional problems. All predictors were converted to *z* scores to allow a direct comparison of each predictor's influence on emotional difficulties. As all predictors were of a similar scale (through the transformation), comparison of the strength of each predictor was possible by evaluating the *B* coefficients. Standardized β coefficients were not possible as negative binomial regression was necessary for emotional difficulties (as described above). Analysis was conducted in three stages. First, all predictors were evaluated within a univariate regression and retained if significant. Second, all predictors from the same wave retained at Stage 1 were evaluated jointly. These regressions were first run with main effects only, with nonsignificant variables sequentially deleted. Prior to deletion, an interaction term with rDLD was evaluated to determine if rDLD moderated the prediction of emotional difficulties. If the interaction effect was significant, the variable was retained in the model even if the overall effect was nonsignificant. Third, all predictors from both time waves retained in Step 2 were combined into one multiple regression model, with the same strategy of sequential deletion of nonsignificant predictors. Multiple mediation was evaluated in a two-step process. First, we estimated the main effect of rDLD on emotional difficulties at the age of 3 and 11 years. Then, we evaluated whether the effect remained when including the retained predictors (multiple mediators) from Step 3. With the multiple imputation and svy estimation adjustments, it was not possible to utilize more formalized multiple mediation steps. Hand calculation of the total direct and indirect effects was impossible due to different regression estimation techniques between the independent variable and mediators and between mediators and the dependent variable, making the coefficients not comparable.

GMMs

GMMs look at growth across time and group individuals with similar trajectories together. We used this person-centered approach to identify subgroups of children with differing trajectories. Emotional difficulties at four time points (3, 5, 7, and 11 years) were evaluated jointly using GMMs in Mplus (Muthén & Muthén, 1998–2014).

Time was coded from 0 to 1 within the model, with age 3 years being 0, age 5 years being 0.25, age 7 years being 0.5, and age 11 years being 1.0. This maintained the relative distance between the time points within the 8-year time gap. The mean age and standard deviations for each age are as follows: age 3 years, $M = 3$ years and $SD = 1.61$ months; age 5 years, $M = 5$ years and $SD = 2.59$ months; age 7 years, $M = 7$ years and $SD = 2.70$ months; age 11 years, $M = 11$ years and $SD = 1.46$ months. There were variable amounts of missing data at different time points, with the most complete time point being age 5 years. Missing data were related to higher SDQ emotional scores at other time points, which is expected under the assumption missing at random. The attrition at various data points was accounted for in the models with the estimator being maximum likelihood robust. There were 500 random starting values in the initial stage of model optimization, which helps the model find the optimal solution that fits the data well. The models specified were GMMs for count outcomes (number of emotional symptoms) using a negative binomial distribution, which is suitable for highly skewed distributions. The variances were fixed as equal across the subgroups, and the covariances were set to zero (as well as the slope and quadratic variances), as is normal practice in GMMs. The GMMs produced comparable results to similarly defined latent class growth analysis. The GMMs were run for the entire sample.

Within each group, multiple models were compared using the Akaike information criterion (AIC), Bayesian information criterion (BIC), BIC-sample size adjusted (BIC-SSA), the Vuong–Lo–Mendell–Rubin (VLMR) likelihood ratio test (LRT), the Lo–Mendell–Ruben (LMR) adjusted LRT, and model entropy. Decreasing AIC, BIC, and BIC-SSA values indicate a more parsimonious solution. If significant, the VLMR and LMR LRT indicate a better fit for the current model when compared to a model with one fewer classes. Higher model entropy (indicating better subgroup classification) was preferred, but this was not a model choice criterion. The initial models only allowed variation between the groups on the initial intercept, beginning with one group. Subgroups were added until the AIC, BIC, or BIC-SSA generally had begun to increase, rather than decrease, and the VLMR and LMR tests become nonsignificant. The model was then allowed to vary based on intercept and linear differences, followed by variation on intercept, linear, and quadratic differences. In all cases, allowing quadratic differences increased model parsimony. The class probabilities and, most likely, membership classification were saved from the final model. Figure 2 graphs were created with the *qfit* Stata two-way graph function, with all resulting predicted fit matching the mean structure within each class with the exception of low and age 7 increasing subgroup. This class had a more complicated trajectory and was created with a *line* two-way command after first saving fitting values from a multilevel mixed regression with linear, quadratic, and cubic age factors. The addition of the cubic term resulted in accurate mean structure replicability within the graph (as can be checked between Figure 2 and Table 3).

Study 1 Results

rDLD Classification Differences

In order to justify our combination of two distinct criteria for inclusion in our rDLD classification, we have looked at how differences between the different criteria compare to the GP group. This was done for the demographic variables, the SDQ emotional difficulties total score and percentage above cutoff for all ages, and the risk factors evaluated in this article. We also directly compared children included in the rDLD category under our naming vocabulary criteria to those included under our parental report criteria (necessarily

Table 1. Demographic, 9-month, and 3-year predictor variables and the Strengths and Difficulties Questionnaire (SDQ) Emotional subscale for risk of developmental language disorder (rDLD), rDLD by naming vocabulary and rDLD by parent report, and general population (GP) subsamples.

Variables	rDLD (*n* = 884)	rDLD naming vocabulary (NV; *n* = 523)	rDLD parent report (PR; *n* = 438)	GP (*n* = 13,344)	rDLD NV vs. GP[a]	rDLD PR vs. GP[a]	rDLD NV vs. rDLD PR[a]
Demographic variables							
Average age (years;months)	3;1.9	3;2.1	3;1.8	3;1.5	0.03 (0.004, 0.06)*	0.03 (0.0001, 0.05)*	*ns*
Premature birth (< 37-week gestation)	7.0%	6.3%	7.0%	6.4%	*ns*	*ns*	*ns*
Female (%)	33.2	38.3	27.7	50.3	–0.50 (–0.71, –0.29)***	–0.98 (–1.22, –0.75)***	–0.59 (–0.92, –0.26)***
Poverty indicator (%)[b]	55.5	66.2	45.8	28.4	1.61 (1.36, 1.86)***	0.84 (0.61, 1.07)***	–1.02 (–1.37, –0.67)***
BAS-II pattern construction	42.77 (0.52)	41.03 (0.58)	43.90 (0.78)	51.28 (0.18)	–0.19 (–0.22, –0.16)^,***	–0.13 (–0.17, –0.10)^,***	0.07 (0.03, 0.12)^,**
9-Month predictors							
Mood	3.83 (0.03)	3.81 (0.05)	3.85 (0.04)	3.85 (0.01)	*ns*	*ns*	*ns*
Irritability	2.11 (0.04)	2.10 (0.05)	2.09 (0.05)	2.07 (0.01)	*ns*	*ns*	*ns*
Regularity[c]	4.01 (0.04)	3.87 (0.06)	4.11 (0.05)	4.32 (0.01)	–0.17 (–0.23, –0.12)^,***	–0.09 (–0.14, –0.04)^,***	–0.12 (–0.20, –0.04)^,**
Approach/withdrawal	1.94 (0.05)	1.97 (0.07)	1.89 (0.06)	1.76 (0.01)	0.07 (0.01, 0.14)^,*	0.07 (0.01, 0.13)^,*	*ns*
Adaptability	2.29 (0.04)	2.27 (0.06)	2.27 (0.06)	2.18 (0.01)	*ns*	*ns*	*ns*
Parental psychological distress	1.93 (0.07)	1.94 (0.10)	2.03 (0.11)	1.59 (0.02)	*ns*	0.19 (0.08, 0.29)^,**	*ns*
Maternal attachment	18.78 (0.13)	18.95 (0.18)	18.64 (0.16)	18.58 (0.03)	*ns*	*ns*	*ns*
3-Year predictors							
Independence and self-regulation[c]	2.36 (0.02)	2.37 (0.02)	2.34 (0.02)	2.47 (0.004)	–0.24 (–0.37, –0.11)***	–0.32 (–0.46, –0.19)***	*ns*
Emotional dysregulation	2.00 (0.02)	1.98 (0.03)	2.03 (0.03)	1.87 (0.01)	*ns*	0.27 (0.15, 0.39)***	*ns*
Parent–child relationship[c]	62.38 (0.40)	62.27 (0.57)	62.28 (0.56)	64.31 (0.09)	–0.17 (–0.33, –0.01)*	–0.23 (–0.39, –0.08)***	*ns*
SDQ peer problems, age 3	2.11 (0.08)	2.05 (0.11)	2.17 (0.10)	1.44 (0.02)	0.20 (0.09, 0.32)^,**	0.33 (0.23, 0.42)^,***	*ns*
SDQ emotional difficulties							
Age 3	1.77 (0.08)	1.83 (0.11)	1.76 (0.10)	1.29 (0.02)	0.22 (0.10, 0.34)^,***	0.25 (0.14, 0.36)^,***	*ns*
Age 5	2.10 (0.09)	2.16 (0.13)	2.10 (0.11)	1.29 (0.02)	0.43 (0.31, 0.55)^,***	0.45 (0.35, 0.56)^,***	*ns*
Age 7	2.19 (0.11)	2.10 (0.15)	2.22 (0.13)	1.48 (0.02)	0.25 (0.10, 0.41)^,**	0.38 (0.25, 0.51)^,***	*ns*
Age 11	2.48 (0.10)	2.45 (0.12)	2.59 (0.15)	1.84 (0.03)	0.22 (0.12, 0.32)^,***	0.31 (0.19, 0.43)^,***	*ns*
Age 3, high/very high	14.9%	16.6%	14.8%	7.4%	0.54 (0.22, 0.86)***	0.59 (0.27, 0.91)***	*ns*
Age 5, high/very high	14.2%	14.7%	13.1%	4.5%	1.10 (0.68, 1.52)***	1.07 (0.74, 1.40)***	*ns*
Age 7, high/very high	13.8%	13.3%	14.1%	6.9%	0.45 (0.07, 0.83)*	0.65 (0.30, 1.01)***	*ns*
Age 11, high/very high	18.5%	17.3%	21.3%	10.9%	0.37 (0.02, 0.71)*	0.69 (0.33, 1.06)***	*ns*

Note. Mean (*SE*) reported. Comparisons between the rDLD by each inclusion criteria to the GP subsample are included, as are the comparisons between the two rDLD inclusion criteria subgroups. BAS-II = British Abilities Scales–Second Edition; *ns* = not significant.

[a]Statistics presented are β coefficient (or *B* where marked ^) and the 95% confidence interval. [b]Measured at 9 months. [c]Higher score denotes better development; remaining variables' lower scores denote better development. *$p < .05$. **$p < .01$. ***$p < .001$.

excluding all individuals who met criteria under both measures). Please see Table 1 for the results of this analysis.

As can be seen, the vast majority of results were identical in both criteria subgroups. Only in parental psychology distress at 9 months and emotional dysregulation at 3 years did the naming vocabulary subgroup not differ from the GP subgroup, whereas there was a difference in the parental report subgroup. However, in both of these risk factors, the naming vocabulary subgroup did not differ from the parental report subgroup when directly compared. The only differences between the criteria subgroups were as follows: higher proportion of females classified by the naming vocabulary subgroup, higher poverty in the naming vocabulary subgroup, slightly lower pattern construction abilities at the age of 5 years, and reduced eating and sleeping regularity at 9 months. Of note, there were no differences between the two criteria subgroups in the SDQ emotional difficulty outcomes, which is the main focus of this article.

Descriptive Statistics

See Table 2 for full details of all descriptive statistics and differences between the rDLD and GP subgroups.

Demographic Variables

Similar to the 7.6% prevalence of DLDs among children in the United Kingdom (Norbury et al., 2016), 6.2% (n = 884) of the sample was classified as having rDLD at the age of 5 years. Children at risk of DLD were approximately 2 weeks older than those in the GP. However, this did not reflect a higher rate of premature births in the rDLD group (see Table 1). Females were significantly less likely to be classified as at risk of DLD. The rDLD subsample was 67% male, which is similar to the established gender distribution within DLD (e.g., St Clair et al., 2011). A significantly higher proportion of the families with children at risk of DLD were below the Organisation for Economic Cooperation and Development poverty indicator (60% below the median income).

Nine-Month Predictors

There were no differences between children at risk of DLD and the GP in the temperamental traits of mood or irritability. Children at risk of DLD had slightly, but significantly, less regular habits, less adaptability, and more withdrawal problems. There were higher levels of parental

Table 2. Demographic, 9-month, and 3-year predictor variables and Strengths and Difficulties Questionnaire (SDQ) Emotional subscale for the risk of developmental language disorder (rDLD) and general population (GP) subsamples.

Variables	rDLD (n = 884)	GP (n = 13,344)	All (N = 14,228)	rDLD vs. GP[a]
Demographic variables				
Average age (years;months)	3;1.9	3;1.5	3;1.5	0.03 (0.01, 0.05)**
Premature birth (< 37-week gestation)	7.0%	6.4%	6.4%	*ns*
Female (%)	33.2	50.3	49.4	–0.73 (–0.90, –0.56)***
Poverty indicator (%)[b]	55.5	28.4	29.9	1.16 (0.99, 1.33)***
BAS-II pattern construction	42.77 (0.52)	51.28 (0.18)	50.83 (0.18)	–0.16 (–0.18, –0.13)***
9-Month predictors				
Mood	3.83 (0.03)	3.85 (0.01)	3.85 (0.01)	*ns*
Irritability	2.11 (0.04)	2.07 (0.01)	2.07 (0.01)	*ns*
Regularity[c]	4.01 (0.04)	4.32 (0.01)	4.31 (0.01)	–0.13 (–0.17, –0.08)^,***
Approach/withdrawal	1.94 (0.05)	1.76 (0.01)	1.77 (0.01)	0.08 (0.03, 0.12)^,**
Adaptability	2.29 (0.04)	2.18 (0.01)	2.18 (0.01)	0.04 (0.003, 0.08)^,*
Parental psychological distress	1.93 (0.07)	1.59 (0.02)	1.61 (0.02)	0.11 (0.03, 0.19)^,**
Maternal attachment	18.78 (0.13)	18.58 (0.03)	18.59 (0.03)	*ns*
3-Year predictors				
Independence and self-regulation[c]	2.36 (0.02)	2.47 (0.004)	2.47 (0.004)	–0.28 (–0.38, –0.19)***
Emotional dysregulation	2.00 (0.02)	1.87 (0.01)	1.87 (0.01)	0.18 (0.09, 0.27)***
Parent–child relationship[c]	62.38 (0.40)	64.31 (0.09)	64.23 (0.09)	–0.19 (–0.31, –0.08)***
SDQ peer problems, age 3	2.11 (0.08)	1.44 (0.02)	1.48 (0.02)	0.27 (0.19, 0.35)^,***
SDQ emotional difficulties				
Age 3	1.77 (0.08)	1.29 (0.02)	1.32 (0.02)	0.23 (0.14, 0.32)^,***
Age 5	2.10 (0.09)	1.29 (0.02)	1.34 (0.02)	0.43 (0.35, 0.51)^,***
Age 7	2.19 (0.11)	1.48 (0.02)	1.52 (0.02)	0.33 (0.23, 0.44)^,***
Age 11	2.48 (0.10)	1.84 (0.03)	1.88 (0.03)	0.26 (0.17, 0.34)^,***
Age 3, high/very high	14.9%	7.4%	7.8%	0.53 (0.28, 0.78)***
Age 5, high/very high	14.2%	4.5%	5.0%	1.12 (0.84, 1.40)***
Age 7, high/very high	13.8%	6.9%	7.3%	0.58 (0.29, 0.87)***
Age 11, high/very high	18.5%	10.9%	11.3%	0.50 (0.24, 0.77)***

Note. Mean (*SE*) are reported. Comparison between the rDLD group and the GP group is included. BAS-II = British Abilities Scales–Second Edition; *ns* = not significant.

[a]Statistics presented are β coefficient (or *B* where marked ^) and the 95% confidence interval. [b]Measured at 9 months. [c]Higher score denotes better development, and remaining variables with lower scores denote better development.

*p < .05. **p < .01. ***p < .001.

psychological distress in children at risk of DLD, although there was no difference in maternal attachment.

Three-Year Predictors

There were higher rates of emotional dysregulation and peer problems in children at risk of DLD. There were also reduced self-regulation abilities and a reduced quality of the parent–child relationship in children at risk of DLD.

SDQ Emotional Difficulties

At ages 3, 5, 7, and 11 years, children at risk of DLD had significantly higher emotional difficulties and were also significantly more likely to have high/very high rates of difficulties.

Longitudinal Trajectories of Emotional Difficulties

See Figure 1 for the trajectories of the rDLD and GP subgroups. There was a main effect for the total sample in both linear and quadratic age trends (B = .07, 95% CI [.06, .07], p < .001; B = .01, 95% CI [.005, .009], p < .001), but there was no significant rDLD × Linear or Quadratic Age interaction term (p > .50), indicating there were no differences in the rate of growth of emotion difficulties across development dependent on rDLD.

Prediction of Emotional Difficulties

All 9-month and age 3 predictors were significantly associated with age 3 and 11 emotional difficulties.

Age 3 Emotional Difficulties

Table 3 shows the results for the joint analysis of the 9-month predictors. Fewer mood problems and more regular patterns of behavior were significantly associated with lower emotional difficulties, whereas more problems with irritability, withdrawal, and adapting to new situations were associated with more emotional difficulties. Parental psychological distress was also associated with more emotional difficulties. There was a significant rDLD × Behavioral Regularity interaction term (B = −.12, 95% CI [−.20, −.04], p < .005). Post hoc analysis indicated that there was a significantly stronger relation between regularity and emotional difficulties in individuals at risk of DLD (B = −.17, 95% CI [−.25, −.09], p < .001) than was found in the GP (B = −.04, 95% CI [−.07, −.01], p < .005).

Table 3 shows the results for the age 3 predictors. Independence/self-regulation was related to lower emotional difficulties, whereas emotional dysregulation was related to higher concurrent emotional difficulties. A stronger parent–child relationship was related to lower emotional difficulties, whereas peer difficulties were related to more problems. There were no interaction effects with rDLD.

When all predictors were combined, the only temperament traits retained were approach/withdrawal and adaptability, each associated with higher emotional problems. Parental psychological distress was also retained, associated with higher emotional difficulties. All age 3 predictors were retained, with similar associations to the previous model. As before, there was a significant rDLD × Regularity interaction term (B = −.12, 95% CI [−.20, −.05], p < .005). However, post hoc analysis indicated that there was a

Figure 1. Strengths and Difficulties Questionnaire (SDQ) Emotional subscale trajectories for the risk of developmental language disorder (DLD) and general population subsamples.

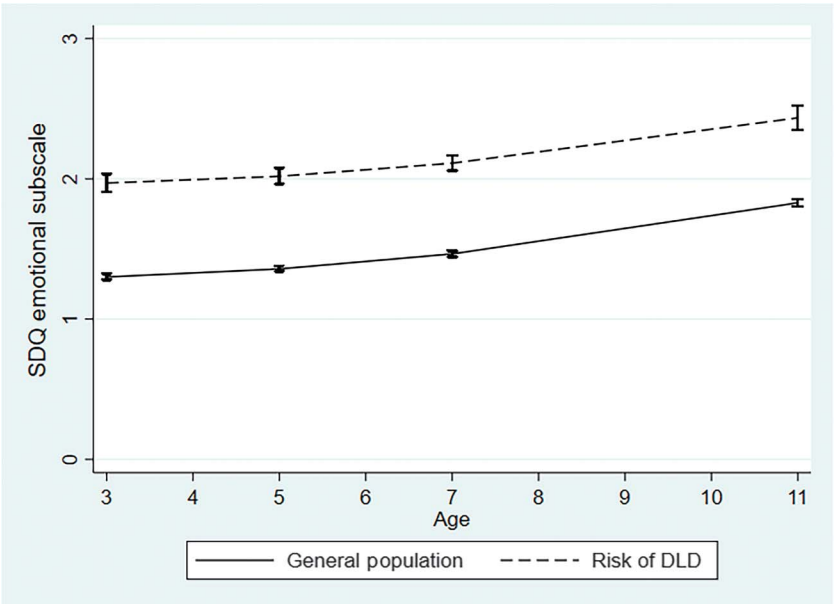


Table 3. Nine-month and age 3 predictors of age 3 and 11 emotional symptoms.

Predictions	Age 3 emotional difficulties			Age 11 emotional difficulties		
	9-month predictors	Age 3 predictors	Combined predictors	9-month predictors	Age 3 predictors	Combined predictors
9-Month predictors						
Mood	–.03 (–.06, –.01)*					
Irritability	.05 (.02, .08)**			.06 (.03, .09)***		.03 (.003, .06)*
Regularity[a]	–.05 (–.08, –.03)***		–.01 (–.04, .01)	–.05 (–.08, –.02)**		
Approach/withdrawal	.10 (.07, .13)***		.06 (.03, .09)***	.04 (.01, .07)**		.04 (.01, .07)*
Adaptability	.05 (.02, .08)**		.06 (.03, .09)**			
Parental psychological distress	.14 (.12, .17)***		.07 (.05, .10)***	.18 (.15, .20)***		.13 (.10, .16)***
3-Year predictors						
Independence and self-regulation[a]		–.08 (–.10, –.05)***	–.07 (–.09, –.04)***		–.03 (–.06, –.002)*	
Emotional dysregulation		.16 (.13, .18)***	.14 (.11, .17)***		.12 (.09, .16)***	.11 (.07, .15)***
Parent–child relationship[a]		–.13 (–.16, –.10)***	–.10 (–.13, –.07)***		–.12 (–.16, –.09)***	–.10 (–.13, –.06)***
SDQ peer problems, age 3		.21 (.19, .23)***	.21 (.19, .23)***		.15 (.12, .17)***	.14 (.11, .17)***
Covariates						
Gender	–.02 (–.07, .03)	.09 (.05, .13)***	.07 (.02, .11)**	.11 (.06, .16)***	.14 (.09, .19)***	.13 (.08, .19)***
OECD	.26 (.20, .32)***	.15 (.10, .19)***	.11 (.05, .17)***	.18 (.13, .24)***	.11 (.05, .18)***	.12 (.04, .19)**

Note. *B* coefficients with 95% confidence interval are reported. SDQ = Strengths and Difficulties Questionnaire; OECD = Organisation for Economic Cooperation and Development.

[a]Higher score denotes better development, and remaining variables with lower scores denote better development.

*$p < .05$. **$p < .01$. ***$p < .001$.

significant relationship between regularity and emotional difficulties in individuals at risk of DLD ($B = -.13$, 95% CI [−.22, −.05], $p < .01$), but there was no relationship found in the GP ($B = -.002$, 95% CI [−.03, .02], $p = .89$).

There was additionally a consistent finding that children growing up in poverty had increased emotional difficulties in comparison to children not growing up in poverty. Inclusion of 9-month, 3-year, or combined risk factors did not remove the independent predictive nature of poverty, although the strength of this relationship did reduce with more risk factors included. There were no interactive effects with rDLD.

We next looked at whether the 9-month and 3-year risk factor predictors could mediate the difference in emotional difficulties at 3 years. As reported above, there was a highly significant difference between the rDLD and GP groups without the risk factor predictors ($B = .23$, 95% CI [.14, .32], $p < .001$). However, this effect was fully mediated when the risk factors detailed above were included alongside the rDLD/GP main effect ($B = -.02$, 95% CI [−.13, .10], $p = .79$).

Age 11 Emotional Difficulties

Table 3 shows the results for the 9-month predictors. Increased levels of irritability and withdrawal were associated with more emotional difficulties. More regular patterns of behavior were associated with fewer emotional problems. There was a significant interaction between approach/withdrawal and rDLD ($B = -.09$, 95% CI [−.17, −.01], $p < .05$). Withdrawal traits had no association with emotional problems in those at risk of DLD ($B = -.05$, 95% CI [−.14, .03], $p = .21$), but there was an association in the GP ($B = .06$, 95% CI [.03, .09], $p < .001$). Increased parental distress was also associated with increased levels of emotional problems.

Table 3 shows the results for the age 3 predictors. Independence/self-regulation was related to reduced emotional difficulties, whereas emotional dysregulation was associated with increased emotional difficulties at the age of 11 years. Stronger parent–child relationships were associated with decreased emotional difficulties. Peer problems were associated with increased levels of emotional problems. There were no interaction effects with rDLD.

When all predictors were combined, only approach/withdrawal and parental psychological distress were retained from the 9-month predictors. For the age 3 predictors, self-regulation skills were not retained in the combined model. All remaining 9-month and age 3 predictors had similar associations with emotional problems, as described above. There were no interaction effects with rDLD.

As with 3 years, children growing up in poverty had increased emotional difficulties in comparison to children not growing up in poverty. Inclusion of 9-month, 3-year, or combined risk factors did not remove the independent predictive nature of poverty, although the strength of this relationship did reduce with more risk factors included, as we found at 3 years. There were no interaction effects with rDLD.

We again looked at whether the 9-month and 3-year risk factor predictors could mediate the difference in emotional difficulties at the age of 11 years. As reported above, there was a highly significant difference between the rDLD and GP groups without the risk factor predictors (B = .26, 95% CI [.17, .34], p < .001). However, this effect was partially mediated when the risk factors detailed above were included with the main effect of rDLD/GP group (B = .17, 95% CI [.03, .31], p < .05).

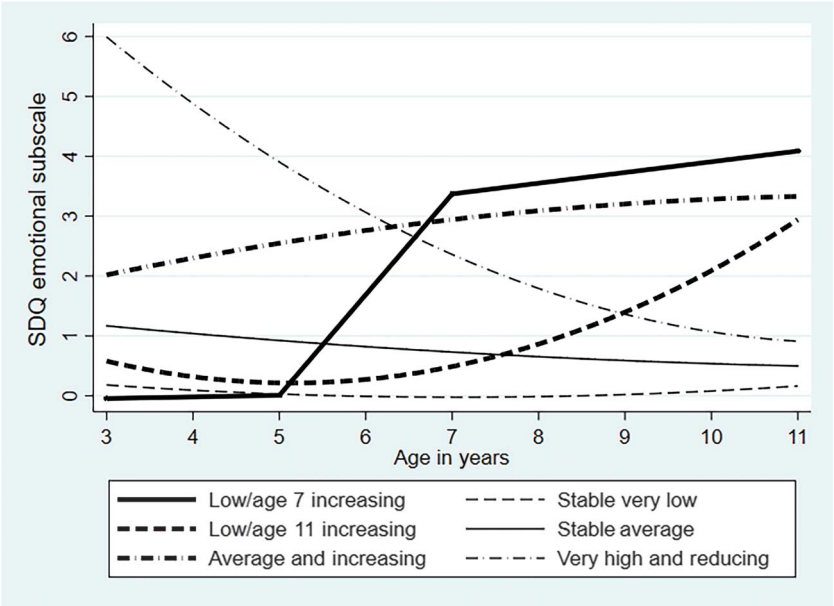
Study 2 Results

Study 2 aims to replicate and extend the results of Study 1, focusing on person-centered statistical approaches. First, we used GMMs to evaluate whether there are distinct subgroups of individuals with differing trajectories of emotional difficulties from the age of 3 to 11 years. Second, we evaluated whether children at risk of DLD are more likely to be found in at-risk developmental trajectory subgroups. Third, we evaluated whether there are differing levels of risk factors in each developmental trajectory subgroup and also looked at the influence of rDLD on the rates of risk factors within each emotional trajectory subgroup. This was evaluated by comparing the rDLD and GP members within each trajectory subgroup, which allowed us to break down the group comparisons in Study 1 by evaluating whether the increased risk factors in children at risk of DLD are simply due to increased membership in a more at-risk trajectory group or whether there are additional risks associated with rDLD even after controlling for the emotional difficulty trajectory. See Supplemental Material S1, Table S5, for the statistics relating the overall increased or decreased rates of rDLD or risk factors within each group.

Person-Centered Emotional Trajectory Subgroups

The most parsimonious model indicated there were six distinct emotional difficulty trajectory subgroups varying on intercept as well as linear and quadratic time functions. See Figure 2 for the mean patterns of emotional difficulties from the age of 3 to 11 years within each subgroup. All subgroup patterns should be considered as the mean and best fit for the entire group. Please see Supplemental Material S1, Figure S1, for individual trajectories around the average trajectory. The first subgroup, the low and age 7 increasing subgroup (N = 154, 1.2%), had very low or no emotional difficulty symptoms at the age of 3 and 5 years but had slightly raised levels at both the age of 7 and 11 years. The second subgroup, stable very low subgroup (N = 2,004, 14.1%), was characterized by a stable level of very low levels of emotional difficulty symptoms through development. The third subgroup, low and age 11 increasing subgroup (N = 1,224, 8.6%), had low levels of emotional symptoms at the age of 3, 5, and 7 years but a higher rate at the top of the "average" range at the age of 11 years. The fourth subgroup, stable average subgroup (N = 5,244, 36.9%), had average ratings of emotional difficulties throughout development but did show a slightly decreasing trend as well. The fifth subgroup, the average and increasing subgroup (N = 5,433, 38.2%), showed a slight increase in emotional difficulty symptoms across development, but remaining within the average range until the age of 11 years, when the average rate was at the low end of the "slightly raised" classification. Inspection of the individual

Figure 2. Strengths and Difficulties Questionnaire (SDQ) Emotional subscale trajectory subgroups.



trajectories in Supplemental Material S1, Table S5, indicates that this subgroup may be best classified as remaining relatively stable or slightly increasing across development at varying levels of emotional difficulties. The sixth subgroup, the very high and reducing subgroup (N = 150, 1.1%), started in the "very high" range at the age of 3 years and showed a steady decrease in emotional symptoms across development, with a "slightly raised" classification at the age of 5 years and "average" ratings for ages 7 and 11 years.

rDLD Membership and Emotional Trajectory Subgroups

As expected, there were differences in the distribution of children at risk of DLD across the varying emotional difficulty trajectory subgroups when each subgroup was compared to the remaining sample. In particular, children at risk of DLD were less likely to be in the stable very low and stable average subgroups. In contrast, children at risk of DLD were overrepresented in the average and increasing subgroup. There were no differences in the prevalence of children at risk of DLD in the low and age 7 increasing, low and age 11 increasing, and very high and reducing subgroups, all ps > .06. Please see Table 4 for the overall percentage of children at risk of DLD per subgroup and the distribution of children within both the GP and rDLD groups across all subgroups. When considering only children at risk of DLD, it is striking that over 55% of them were included in the subgroup showing an overall increasing trajectory (average and increasing subgroup). When considering only children meeting both the naming vocabulary and parent report criteria for inclusion in the rDLD group, this becomes even more striking with nearly 70% of these 77 individuals being included in the average and increasing subgroup.

Risk Factors and Emotional Trajectory Subgroups

We next investigated each of the emotional trajectory subgroups for either decreased or elevated rates of 9-month and 3-year risk factors, in addition to the demographics variables, in order to get a picture of contributors to specific patterns of emotional difficulty trajectories across childhood. Each subgroup was compared to the combined remaining subgroups. We then compared rates of risk factors within each trajectory subgroup across the rDLD and GP members for four subgroups; however, there were too few children at risk of DLD in the smallest subgroups (seven in low and age 7 increase and nine in very high and decreasing subgroups) to support meaningful comparisons.

Low and Age 7 Increasing

At 9 months, this subgroup showed fewer approach/withdrawal problems, as well as reduced adaptability problems. This group also showed increased levels of maternal attachment. At 3 years, there were higher levels of self-regulation.

Stable Very Low

This subgroup had better mood, reduced irritability, more regular patterns of behavior, reduced withdrawal difficulties, and more adaptability at 9 months. There was also reduced parental psychological distress and higher maternal attachment at 9 months. At 3 years, children in this subgroup had increased emotional self-regulation and reduced emotional dysregulation. There was also an increased parent–child relationship and reduced child peer problems. There were reduced rates of poverty in this group.

There were higher levels of maternal attachment in children at risk of DLD in this subgroup (M = 18.79, SE = 0.07 for GP; M = 19.57, SE = 0.35 for rDLD; β = .32, 95% CI [.03, .61], p < .05). There were also increased peer problems in children at risk of DLD (M = 0.86, SE = 0.03 in GP; M = 1.44, SE = 0.21 in rDLD; B = .43, 95% CI [.12, .73], p < .01).

Low and Age 11 Increasing

This subgroup had fewer adaptability issues at 9 months. At 3 years, there was also better self-regulation in this group and fewer peer problems. There were reduced rates of poverty in this group.

There were reduced rates of irritability in children at risk of DLD in this subgroup (M = 2.06, SE = 0.02 in GP; M = 1.83, SE = 0.12 in rDLD; β = −.37, 95% CI [−.73, −.02], p < .05). There was also a reduction in children's regular habits in children at risk of DLD (M = 4.36, SE = 0.03 in GP; M = 4.06, SE = 0.13 in rDLD; B = −.13, 95% CI [−.26, −.01], p < .05). At the age of 3 years, there were reduced levels of self-regulation (M = 2.50, SE = 0.01 in GP; M = 2.34, SE = 0.07 in rDLD; β = −.49, 95% CI [−.88, −.10], p < .05) and higher levels of emotional dysregulation (M = 1.85, SE = 0.02 in GP; M = 2.05, SE = 0.06 in rDLD; β = .35, 95% CI [.08, .62], p < .05). There were also increased levels of peer problems in children at risk of DLD (M = 1.26, SE = 0.05 in GP; M = 1.79, SE = 0.20 in rDLD; B = .28, 95% CI [.02, .55], p < .05).

Stable Average

This subgroup had more regular patterns of behavior at 9 months. There were also reduced parental psychological distress and increased maternal attachment at 9 months. There were increased self-regulation abilities and reduced levels of emotional dysregulation. There were also increased levels of parent–child relationship and reduced levels of peer problems at 3 years. There were reduced rates of poverty in this group.

There was a reduction in the regularity of eating and sleeping in children at risk of DLD (M = 4.35, SE = 0.03 in GP; M = 4.07, SE = 0.07 in rDLD; β = −.25, 95% CI [−.44, −.08], p < .01). There were also increased withdrawal issues in children at risk of DLD within this subgroup (M = 1.73, SE = 0.01 in GP; M = 2.03, SE = 0.09 in rDLD; β = .27, 95% CI [.10, .44], p < .01). With regard to peer problems, there were increased issues in children at risk of DLD (M = 1.27, SE = 0.03 in GP; M = 1.90, SE = 0.15 in rDLD; B = .27, 95% CI [.11, .43], p < .01).

Table 4. Trajectory subgroup rates of demographic variables and 9-month and 3-year risk factors.

Variables	Overall	Low and age 7 increase (*n* = 164, 1.2%)	Stable very low (*n* = 2,004, 14.1%)	Low and age 11 increase (*n* = 1,224, 8.6%)	Stable average (*n* = 5,244, 36.9%)	Average and increasing (*n* = 5,433, 38.2%)	Very high and decreasing (*n* = 150, 1.1%)
Demographic variables							
rDLD	6.2%	4.3%	3.5%***	4.8%	4.7%**	9.0%***	6%
% of GP subsample	—	1.18	14.5	8.7	37.5	37.1	1.1
% of rDLD subsample	—	0.8	7.9	6.7	28.1	55.4	1.0
% of rDLD meeting both criteria (*N* = 77)	—	1.3	5.3	4.0	19.7	69.7	0
Average age (years;months)	3;1.5	3;1.6	3;1.5	3;1.5	3;1.6	3;1.7	3;2.4
Premature birth (< 37-week gestation)	6.4%	12.0%	6.7%	8.2%	7.1%*	9.2%**	8.9%
Female (%)	49.4	43.5	45.6**	50.0	47.4***	53.1***	49.4
Poverty indicator (%)[+]	29.9	28.7	20.2**	25.1*	24.5***	35.6***	54.8***
BAS-II pattern construction	50.83 (0.18)	49.51 (1.05)	52.09 (0.30)***	50.53 (0.37)	51.48 (0.22)***	49.85 (0.22)***	49.93 (0.94)
9-Month predictors							
Mood	3.85 (0.01)	3.91 (0.05)	3.94 (0.02)***	3.88 (0.03)	3.86 (0.01)	3.80 (0.01)***	3.79 (0.06)
Irritability	2.07 (0.01)	2.01 (0.06)	1.95 (0.02)***	2.06 (0.02)	2.04 (0.01)	2.15 (0.01)***	2.37 (0.07)***
Regularity[a]	4.31 (0.01)	4.33 (0.08)	4.41 (0.02)***	4.35 (0.02)	4.34 (0.01)**[+]	4.23 (0.01)***[+]	4.07 (0.08)*
Approach/withdrawal	1.77 (0.01)	1.56 (0.07)**	1.61 (0.02)***	1.71 (0.03)	1.74 (0.01)[+]	1.88 (0.02)***	2.05 (0.09)**
Adaptability	2.18 (0.01)	1.96 (0.09)*	1.99 (0.03)***	2.09 (0.03)**	2.15 (0.02)	2.30 (0.02)***	2.62 (0.11)***
Parental psychological distress	1.61 (0.02)	1.53 (0.17)	1.06 (0.03)***	1.58 (0.05)	1.38 (0.03)***	2.05 (0.03)***	2.16 (0.18)**
Maternal attachment	18.59 (0.03)	19.08 (0.24)*	18.81 (0.07)***[+]	18.64 (0.09)	18.65 (0.04)*	18.41 (0.05)***	18.24 (0.29)
3-Year predictors							
Independence and self-regulation[a]	2.47 (0.004)	2.55 (0.03)**	2.53 (0.01)***	2.49 (0.01)*	2.48 (0.01)**	2.42 (0.01)***[+]	2.40 (0.03)
Emotional dysregulation	1.87 (0.01)	1.84 (0.04)	1.70 (0.01)***	1.86 (0.02)	1.81 (0.01)***	2.00 (0.01)***	2.26 (0.04)***
Parent–child relationship[a]	64.23 (0.09)	64.79 (0.59)	67.09 (0.18)***	64.61 (0.24)	65.19 (0.12)***	62.12 (0.13)***	59.37 (0.77)***
SDQ peer problems, age 3	1.48 (0.02)	1.28 (0.12)	0.88 (0.03)***[+]	1.28 (0.05)**	1.29 (0.03)***[+]	1.91 (0.03)***[+]	2.85 (0.21)***
SDQ emotional problems							
Age 3	1.32 (0.02)	0***	0.20 (0.01)***	0.55 (0.03)***	1.16 (0.02)***	2.00 (0.03)***[+]	5.99 (0.17)***
Age 5	1.34 (0.02)	0.06 (0.02)***	0***	0.32 (0.02)***	0.87 (0.01)***[+]	2.52 (0.03)***[+]	3.63 (0.18)***
Age 7	1.52 (0.02)	3.37 (0.14)***	0***	0.39 (0.02)***	0.77 (0.01)***	2.97 (0.03)***[+]	2.61 (0.18)***
Age 11	1.88 (0.03)	4.14 (0.25)***	0.16 (0.01)***[+]	2.96 (0.05)***	0.49 (0.01)***	3.39 (0.04)***	0.83 (0.08)***
Age 3, high/very high	7.8%	0%	0%	0.9%***	2.7%***	15.3%***	93.6%***
Age 5, high/very high	5.0%	0%	0%	0%	0.07%***	12.4%***	29.4%***
Age 7, high/very high	7.3%	17.4%**	0%	0%	0%	18.0%***	14.3%*
Age 11, high/very high	11.3%	36.5%***	0%	11.2%	0%	25.1%***	0.2%***

Note. Significance levels are given for each subgroup compared to the combined remaining subgroups. Where there is a "+," there was a difference within the subgroup between the risk of developmental language disorder (rDLD) and general population (GP) subgroups. BAS-II = British Abilities Scales–Second Edition; SDQ = Strengths and Difficulties Questionnaire.

[a]Higher score denotes better development, and remaining variables with lower scores denote better development.

*$p < .05$. **$p < .01$. ***$p < .001$.

There was additionally an increase in the level of emotional difficulties at the age of 5 years in children at risk of DLD in this subgroup ($M = 0.87$, $SE = 0.01$ in GP; $M = 1.05$, $SE = 0.08$ in rDLD; $B = .18$, 95% CI [.02, .33], $p < .05$). This corresponded to an increased rate of high/very high classification in children at risk of DLD at the age of 5 years (0.03% for GP and 0.9% for rDLD; $OR = 38.38$, 95% CI [1.88, 784.82], $p < .05$). However, these results should be treated with caution as this translated to four cases in the GP group and one case in the rDLD group.

Average and Increasing

This subgroup had increased rates of 9-month temperamental traits: mood difficulties, irritability problems, less regular habits, more approach/withdrawal difficulties, and more adaptability issues. Parents had more psychological distress and reduced levels of maternal attachment at 9 months. There were reduced rates of emotional regulation and increased rates of emotional dysregulation. The parent–child relationship was also worse, and there were also more peer problems in this subgroup. There were increased rates of poverty in this group.

As with the previous subgroups, there was a reduction in regular habits in children at risk of DLD ($M = 4.26$, $SE = 0.01$ in GP; $M = 3.93$, $SE = 0.06$ in rDLD; $\beta = -.33$, 95% CI [−.49, −.18], $p < .001$). Children at risk of DLD also had reduced emotional self-regulation ability ($M = 2.43$, $SE = 0.01$ in GP; $M = 2.32$, $SE = 0.02$ in rDLD; $\beta = -.28$, 95% CI [−.41, −.15], $p < .001$) and more peer problems ($M = 1.88$, $SE = 0.03$ in GP; $M = 2.37$, $SE = 0.12$ in rDLD; $B = .16$, 95% CI [.05, .26], $p < .01$). There were also higher rates of emotional difficulties at the age of 3 years ($M = 1.97$, $SE = 0.03$ in GP; $M = 2.38$, $SE = 0.10$ in rDLD; $B = .13$, 95% CI [.04, .22], $p < .01$), 5 years ($M = 2.47$, $SE = 0.03$ in GP; $M = 3.13$, $SE = 0.12$ in rDLD; $B = .22$, 95% CI [.13, .31], $p < .001$), and 7 years ($M = 2.93$, $SE = 0.03$ in GP; $M = 3.37$, $SE = 0.15$ in rDLD; $B = .11$, 95% CI [.01, .21], $p < .05$). There was also a higher rate of high/very high classification in children at risk of DLD at the age of 3 years (14.7% for GP and 23.2% for rDLD; $OR = 1.46$, 95% CI [1.09, 1.97], $p < .05$) and 5 years (11.3% for GP and 24.2% for rDLD; $OR = 2.26$, 95% CI [1.62, 3.17], $p < .001$).

Very High and Decreasing

This subgroup had increased irritability difficulties, less regular habits, more approach/withdrawal difficulties, and more adaptability issues. Parents had more psychological distress. There were also more emotional dysregulation problems and a reduced parent–child relationship at 3 years. There were also more peer problems at 3 years. There were increased rates of poverty within this group.

Discussion

This article has investigated the prevalence and trajectory of emotional problems and early risk factors for these problems in children at risk of DLD when compared to children from the GP. The findings indicate that children at risk of DLD have increased rates of emotional problems throughout early and middle childhood, replicating a wide range of literature showing similar results (e.g., Lindsay & Dockrell, 2012; Yew & O'Kearney, 2013). Our findings add to the literature in evaluating very early development, as most research investigates older children with clinically identified language disorders (e.g., St Clair et al., 2011). Our findings suggest an intricate relationship between language ability and early emotional development, as we found that children at risk of DLD as a whole group have consistently elevated levels of emotional problems across development in comparison to the GP group. Furthermore, over 55% of children at risk of DLD were in an "average and increasing" subgroup, which indicated that, on average, their emotional difficulties slightly increased across development to a level at age 11 considered to be "slightly raised." At the same time, children at risk of DLD were less likely to be a member of a subgroup showing stable low rates of emotional difficulties throughout childhood. Overall, this pattern of results confirms and extends previous findings showing increased emotional difficulties in children at risk of DLD and uniquely indicates that children at risk of DLD are more likely to end up in an at-risk trajectory group.

As mentioned in the introduction, we have used the new recommended terminology of DLD throughout this article, both in reference to our sample (considered to be at risk of DLD) and in reference to previous literature. This terminology has been suggested as a result of a multinational and multidisciplinary Delphi study (Bishop et al., 2017), which follows on a previous study using the same method for establishing a new set of criteria for DLD (Bishop et al., 2016). The aim of both of these studies has been to standardize and come to a general consensus on both the criteria for DLD and a common label for the condition of primary language difficulties without a known cause. Many of the studies cited in this article will refer to children with specific language impairment, language impairments, speech and language disorders, and a range of other terminologies. Although the transition to new diagnostic criteria and new terminology is difficult within any field, it is heartening that our results are consistent with the pattern of results found in the broader literature looking at children with primary language difficulties, regardless of the terminology used. Although our use of cohort data makes clinical diagnoses impossible, we hope the use of our terminology *risk of DLD* will help encourage other researchers to similarly use the term *DLD* in their research. Use of multiple terms to refer to essentially the same children risks further fragmenting the literature and will not aid in raising awareness of DLD in the wider community.

Group Differences in Early Risk Factors for Emotional Difficulties

The early risk factor findings need to be considered with caution in light of reduced reliability for many of the

measures, which is discussed below. We found very few group differences in the risk factors measured at 9 months before any delays in language would be identifiable. Temperamental traits relating to mood and irritability were not increased in children at risk of DLD, which does not support the idea that these children have a psychosocial deficit independent from their language difficulties. However, children at risk of DLD demonstrated less regular patterns of sleeping and eating behavior, as shown by the increased regularity difficulties. The difference between the rDLD and GP subgroups was small in magnitude but was additionally found within the majority of distinctive emotional difficulty trajectory subgroups, which indicates that problems with regular habits are specific to rDLD. This finding is noteworthy as many neurodevelopmental disorders have symptoms including difficulties in eating and sleeping (e.g., Wiggs, 2001). Dominick, Davis, Lainhart, Tager-Flusberg, and Folstein (2007) found that, in children with a history of DLD, 41% had atypical sleeping patterns and 15.4% had atypical eating behavior. This study lacked a GP control group, and to the authors' knowledge, the present result is the first of its kind in the literature and warrants future research.

Children at risk of DLD were also more likely to show problems in adapting to new situations or people and to be withdrawn at 9 months. However, although this difference in withdrawal between rDLD and GP members was replicated within the stable average subgroup, it was not within the remaining subgroups. This partially supports the idea that individuals who are temperamentally withdrawn may be less likely to engage in opportunities to advance their language skills, leading to this trait being increased in children with DLD (K. I. Hart, Fujiki, Brinton, & Hart, 2004). Increased shyness has been noted in adolescents with DLD (Wadman, Durkin, & Conti-Ramsden, 2008); therefore, the current results may be the early roots of these traits. However, the observed effect was small in magnitude, was likely exacerbated by the large sample size, was not replicated in all subgroups and has not been replicated in other studies (Prior et al., 2011), and should be interpreted with caution. Finally, there was increased parental psychological distress at 9 months for children at risk of DLD, potentially indexing cases where the main caregiver is less available to the infant, inadvertently providing a suboptimal environment for language learning (Tomasello, 2009).

All risk factors at age 3, when DLD may be more readily apparent, were significantly increased in children at risk of DLD. This was found for both child factors (self-regulation and emotional dysregulation), the parent–child relationship, and the child's peer relationship. This demonstrates that children at risk of DLD have increased additional risk factors beyond the DLD itself, which was measured at age 5. As a group, these children had reduced vocabulary ability at age 3, indicating that early delayed language may have influenced the development of related but distinct domains, particularly emotional self-regulation. Difficulties in emotional self-regulation were also elevated in children at risk of DLD within subgroups that showed increasing patterns of emotional symptoms. This fits the Vygotskian view of language as an important tool for self-regulation and research showing longitudinal associations with language ability and better emotional self-regulation skills (Vallotton & Ayoub, 2011).

Delayed language was also related to a reduced strength of the parent–child bond at age 3, indicating that reduced language may interfere with the establishment of close attachment bonds (Im-Bolter & Cohen, 2007). Similarly, children at risk of DLD had increased rates of early peer difficulties, which replicates previous findings (e.g., Lindsay & Dockrell, 2012; St Clair et al., 2011). There was also a consistent pattern across all emotional trajectory subgroups, with higher rates of peer problems found within children at risk of DLD when compared to children in the GP group with a similar trajectory of emotional difficulties. Thus, peer problems appear to co-occur with many other developmental challenges in children at risk of DLD and appear to be higher than predicted by their level of emotional symptoms alone. All in all, these findings indicate support for both hypotheses that early emotional difficulties may arise through both a disruption of early social learning processes (as evidenced by the increased parent and peer problems) and a disruption in the development of emotional regulation skills.

It was also of note that there was an increased rate of poverty in the rDLD group when compared to the GP group. This reflects this wider literature showing decreased language ability in children of low-SES parents (B. Hart & Risley, 1995) and more recent literature showing poverty is a predictor of speech, language, and communication needs within the educational system (Dockrell & Hurry, 2018; Lindsay & Strand, 2016). This significant finding is of importance regarding our rDLD classification, although we are in line with the recent recommendations not to exclude children from a diagnosis dependent on environmental factors (Bishop et al., 2016). Often, children with lower language abilities due to the different quality and quantity of language environment they receive related to SES (Zauche, Thul, Mahoney, & Stapel-Wax, 2016) are not referred to as language disordered, as the fundamental difficulty is within the language environment, not an underlying neurological difficulty. This is apparent in our sample, as although both the rDLD by naming vocabulary and parent report had increased levels of poverty in comparison to the GP group, there was an elevated level of poverty for children who qualified under the naming vocabulary criteria, potentially indexing a "less than optimal" language learning environment. Literature has not, however, found a consistent and replicable difference in language profile when DLD was proposed to be due to social differences (e.g., in the context of high poverty) or proposed to be due to biological constraints (Bishop et al., 2016). In addition, it is also becoming apparent that adults with a history of DLD have less economic power (Armstrong et al., 2017; Clegg, Hollis, Mawhood, & Rutter, 2005; Conti-Ramsden & Durkin, 2012; Elbro, Dalby, & Maarbjerg,

2011; N. Elliott, 2011; Law, Rush, Schoon, & Parsons, 2009) and thus may themselves be more likely to be below the poverty line as adults. As DLD is heritable (Barry, Yasin, & Bishop, 2007; Bishop & Hayiou-Thomas, 2007; Bishop, Laws, Adams, & Norbury, 2006; Bishop, North, & Donlan, 1996; Pickles, St Clair, & Conti-Ramsden, 2013; Stromswold, 2001; Tomblin & Buckwalter, 1998), there may be an intergenerational effect of reduced language skills relating to reduced economic power and increased likelihood of living in poverty. Further research is needed in this area to disentangle the possible links between SES and DLD.

In relation to whether low SES is a reason for the increased emotional difficulties in children at risk of DLD, we do find significant links between poverty and increased emotional difficulties. Indeed, poverty was one of the strongest consistent predictors of emotional difficulties. Thus, at least in part, the increased emotional problems at both 3 and 11 years old in the rDLD group may be due to the higher levels of poverty found in the rDLD group. However, there were no moderating factors, indicating that poverty increased the risk of increased emotional problems to a similar amount in both the rDLD and GP groups. This result is in line with similar findings (Flouri et al., 2014).

Does DLD Enhance the Effect of the Risk Factors on Emotional Difficulties?

This article also evaluated whether these early risk factors were more detrimental to children at risk of DLD, leading to an enhanced association with emotional problems. This was, on the whole, not found, as a similar relationship between most risk factors and emotional difficulties was found in children with and without rDLD. Thus, the increased rates of emotional difficulties in children at risk of DLD were not due to enhanced potency of the risk factors but rather potentially due to the absolute increased levels of the risk factors. The only consistent exception was how regularity traits at 9 months predicted age 3 emotional difficulties. In this case, there was a stronger relationship to emotional difficulties in children at risk of DLD when compared to those in the GP. Thus, the disruption to regular eating and sleeping patterns, common to many neurodevelopmental disorders, appears to both be elevated in infancy in children who are at risk of developing DLD and have an increased prediction to emotional difficulties in the preschool years. It was of note, however, that this differential association did not extend to emotional difficulties at age 11. Regularity was a predictor of late childhood emotional symptoms, but not when age 3 predictors were also included, and there were no differential effects across those with and without rDLD. This is an intriguing finding, which has interesting implications, but needs further replication and validation. Of importance is the possibility that regularity differences may be implicated in the initial elevation of emotional difficulties in toddlerhood and the preschool years. However, it would be premature to draw any firm conclusions on this finding.

DLD, Early Risk Factors, and Increased Emotional Difficulties

The results of the multiple mediation analyses indicate that the increased emotional difficulties in early childhood for children at risk of DLD were entirely mediated by the early life risk factors. There was no difference between the groups once the risk factors were included in the model, indicating that the increased emotional difficulties at age 3 were entirely due to the increased risk factors for emotional difficulties. The pattern changed in late childhood, with the effect of the early risk factors only partially mediating the difference in emotional difficulties between the rDLD and GP groups. These results show the importance of considering the wider developmental context when evaluating increased emotional difficulties. It is of note that all the predictors of age 3 emotional difficulties showed increased rates in children at risk of DLD. Thus, it appears that rDLD set a developmental cascade effect of difficulties within the domains of temperament, emotional self-regulation, and peer and parent–child relationships. It is the increased rates of these secondary problems that contribute to the increased emotional difficulties associated with rDLD in this sample, even partially mediating this effect at age 11. This finding also implies that, by age 11, either factors directly related to rDLD or additional intervening mediating factors not accounted for in this article explain the remaining increased rates of emotional difficulties in children at risk of DLD.

Subgroups of Emotional Difficulties

The subgroup analysis revealed six patterns of emotional difficulty development from age 3 to 11. Two of these are stable trajectories with low levels of symptoms, well within the average range. Two trajectories show increased levels of problems at a specific stage of development, age 7 or 11. The pattern of emotional problems in these groups may indicate that these children may have experienced a significant life event, such as divorce, parental discord, or parental death, which may explain the shift in emotional difficulties. The largest subgroup shows a gradual increase in emotional difficulties, leading to a "slightly raised" level by age 11. This subgroup must also be considered in light of increased variability in the individual trajectories, where the pattern of a gradual increase seems to best describe this subgroup as there was wide variability in the initial intercept across the full range of emotional problems. This may index a relatively normative pattern of emotional difficulties increasing, but this increase is in the context of elevated early life risk factors, at both 9 months and 3 years. Thus, it may be that these children were either predisposed or placed in suboptimal environments that produced risk factors that contributed to this pattern of development. Interestingly, the finding of increased risk factors was only

partially replicated in the final subgroup, which had very high emotional difficulties at age 3, with a steadily decreasing pattern across development. The reason for this pattern of development is not readily available but could be due to turbulent early years, followed by a more stable middle childhood.

From this trajectory subgroup analysis, it became apparent that the increased risks found in children at risk of DLD may predispose these children into a more at-risk trajectory of emotional difficulties across childhood. The fact that 55% of children at risk of DLD were members of the only subgroup that showed a consistent increasing pattern and increased risk factors across the board is telling. The early psychosocial impairments that seem to co-occur with rDLD appear to put these children on a trajectory for increasing levels of emotional problems across development. It is also of significant interest that there was a consistent pattern where presence of rDLD was associated with an increase in risk factors above and beyond what would be expected. Children at risk of DLD within subgroups with increasing emotional difficulty patterns were found to have lower levels of emotional self-regulation when compared to children with a similar trajectory of emotional difficulties. This indicates that rDLD is an additional risk factor for reduced levels of independence and self-regulation skills. Similarly, within all subgroups, children at risk of DLD had increased peer problems when compared to similar children not at risk of DLD but similar patterns of emotional difficulties. This strongly indicates that peer problems are a particular problem for children at risk of DLD.

The remaining elevated risk factors found in the general rDLD/GP group comparison that were not consistently replicated within each emotional difficulty trajectory subgroup are also of interest. In this case, it may indicate that children at risk of DLD are more likely to struggle in these domains and that these difficulties may nudge these children, alongside other children not at risk of DLD but with similar risk factors, into a more at-risk emotional difficulty trajectory. This subgroup analysis is, to the authors' knowledge, the first to break down the overall increased rates and take a more nuanced look at the situation by isolating the comparison of children at risk of DLD alongside similar children not at risk of DLD but with similar levels of emotional symptoms, as discussed above. Interestingly, within the average and increasing subgroup, there were also higher levels of emotional difficulties in children at risk of DLD up until age 11, when the two groups converged to equivalent levels. This is again a more nuanced approach and replicates the overall finding of increased overall levels of emotional difficulties in children at risk of DLD but also suggests a convergence in late childhood.

Limitations

This study is not without limitations. The measurements used within large-scale cohort studies are often, by necessity, reduced versions of longer validated measurements. The measures used in this study are no different, although the SDQ and the BAS were the full validated measures. Many of the predictor measurements had lower reliability than is traditionally acceptable, but this is perhaps understandable given the reduction of each individual scale, which influences the calculation of reliability statistics. Particular caution should be taken when considering results that are weak, not replicated when including additional predictors, or contradicted by previous research. We have already interpreted these findings in a cautious manner, mindful of this limitation. Another concern, with samples of this size, is that the power is so high that we can find statistically significant results with little practical significance. We attempted to provide β values wherever possible to give a standardized effect size and, where not possible, transformed the predictors to z scores to provide comparable B values. We also treat with caution many of our findings due to the concern of inflated Type I error rates.

Another limitation is the use of two distinct criteria for inclusion as DLD. This was necessary as there was only one standardized measure of language ability, the BAS Naming Vocabulary subtest. As this subtest measures expressive language ability, difficulties with grammatical or syntax development, as well as substantial comprehension deficits, would not be captured in this measure. Indeed, research indicates that word naming ability reaches expected levels by the age of 5 years for some children with substantial language difficulties in other language domains (Girolametto, Wiigs, Smyth, Weitzman, & Pearce, 2001). We therefore combined children who scored low on the Naming Vocabulary subtest with children with a parent report of language developing slowly or difficulties understanding others. However, when evaluating the group differences in risk factors by rDLD naming vocabulary and rDLD parent report, there were very few differences found (see Table 1). We also evaluated the correlation between emotional symptoms and risk factors by each individual criterion and found that the broad pattern of associations was replicated within each individual subgroup of children with rDLD. If anything, there was a pattern of stronger correlations with the age 3 risk factors in the rDLD by naming vocabulary subsample, whereas there were stronger associations between emotional symptoms and the 9-month risk factors in the rDLD parent report subsample. Therefore, although two distinct routes to being included in the rDLD group is a limitation, we have also shown both subgroups are broadly equivalent.

Additionally, these measures may have been subject to reporter bias. It is possible that the measures of child temperament may have been influenced by parental report of psychological distress, but parent reports are the only option for cohorts of this size. In future research, it would be advisable to integrate more self-report and teacher report data available in the MCS, in particular, in relation to the SDQ. However, in this article, it was advisable to retain similar contextual factors by evaluating only the main caregiver SDQ scores, as we wished to evaluate changes in the SDQ across development. Additionally, the authors

tried to evaluate the multiple mediation within a more traditional format, for example, using a Sobel–Goodman approach or even manually calculating the direct and indirect effects. However, there were difficulties as differing types of data required different regression estimation formats, which limited our ability to do anything more than evaluate the strength of the effect of rDLD/GP status with and without the early risk factors. However, we still view this analysis as an important consideration in evaluating the relationship between rDLD, early risk factors, and emotional difficulties across development.

Conclusion

DLD appears to influence the development of general risk factors for emotional problems, particularly problems with peers and the parent–child relationship. DLD may also alter the development of self-regulation abilities and lead to more emotional dysregulation problems. These risk factors do not have a stronger relationship to emotional problems in children at risk of DLD, with the exception of early regular eating and sleeping habits, which are both increased in children at risk of DLD and are more strongly related to early childhood emotional difficulties. In general, however, having DLD appears to increase the baseline rate of these risk factors, either fully or partially accounting for the increased emotional problems in these children. Additionally, we found that children at risk of DLD as a group appear to have an elevated level of emotional problems across development. These children neither have increasing rates of difficulties nor are their emotional difficulties reducing to normative levels across development, but rather they are maintaining their increased level of emotional difficulties throughout development. When evaluated by subgrouping differing trajectories, we found that over 55% of children at risk of DLD were found within a subgroup characterized by increasing emotional difficulties, and indeed, children at risk of DLD in this subgroup had increased emotional problems until age 11 when compared to similar children not at risk of DLD. This subgroup was characterized by increased risk factors, indicating that the increased risk factors in children at risk of DLD may be causal in their higher rate of inclusion in this more at-risk trajectory.

Finally, this research indicates intriguing directions for future clinical practice, as well as clinical research. For example, the findings may indicate that clinicians working with children suspected of DLD could usefully include questions about early temperament and regularity of bed times into routine clinical interviews. Likewise, for the assessment of children in middle childhood, a greater emphasis could be placed on exploring the quality of peer relationships, even if language development is the primary presenting concern. A greater understanding of the heterogeneity of pathways concerning emotional development could also inform future interventions designed to improve both language and self-regulatory skills. Ultimately, the findings presented here may be one piece of the puzzle that helps to move the field toward effective preventative approaches to management of emotional difficulties in children with DLD.

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Appendix

Nine-Month Measures, 3-Year Measures, and SDQ Subscales

Nine-Month Measures

Infant temperament and behavior were measured with 17 items from the Carey Infant Temperament Scale (CITS) filled in by the main respondent (Johnson et al., 2015). The CITS has five subscales as follows: Mood (five items), Regularity (four items), Approach/Withdrawal (three items), Irritability (three items), and Adaptability (two items). Items were measured on a 5-point scale based on frequency of behavior (*almost never*, *rarely*, *usually does not*, *often*, and *almost always*). Each subscale was averaged (range: 1–5) with the requirement that all items for each subscale were fully completed. Higher levels on the Mood and Regularity subscale indicated better mood/contentment and more regular patterns, whereas higher levels on all other subscales indicated more withdrawal, less adaptability, and more irritability. The Regularity subscale had adequate reliability ($\alpha = .71$), but the remaining subscales had poor or unacceptable reliability ($\alpha s < .57$).

Maternal attachment was measured with six items from the Condon Maternal Attachment Questionnaire (Condon & Corkindale, 1998). The questions retained measured irritability or annoyance when caring for their child, frequency of thinking about their child when separated, feelings on leaving their child and while caring for their child, patience, and resentment regarding things given up when their child arrived. Each item had a unique response category (see Condon & Dunn, 1988, for details). Several of the items had very sparse endorsements for some of the response categories, leading these categories to be combined with adjacent categories to ensure adequate response rates in each category. Two items were reverse coded so that all items indicated increased attachment with higher endorsements. All six items were summed (total score ranging from 7 to 23) with the requirement that all items were fully completed. The internal reliability of this reduced measure was poor ($\alpha = .51$).

The Malaise Inventory (Rutter et al., 1970) was used to measure psychosocial distress in the main respondent. The version used in the Millennium Cohort Study was a nine-item version derived from the 24-item Malaise score to ensure adequate internal consistency (Johnson et al., 2015). All items were scored as either present or absent and were summed (with a range of 0–9) with the requirement that all items were fully completed. The internal reliability of this measure was acceptable ($\alpha = .71$).

Three-Year Measures

The main respondent completed the Child–Parent Relationship Scale (Driscoll & Pianta, 2011). This 15-item scale measured parents' feelings and beliefs about their relationship with the child and the child's behavior toward the parent. Each item was rated on a 5-point scale from *definitely does not apply* to *definitely applies*. Eight items were reverse scored prior to calculation of the sum score (when all items were complete; possible range from 15 to 75), which indicated more positive relationships with higher scores. This measure has excellent reliability ($\alpha = .90$; Johnson et al., 2015).

The main respondent completed the Independence and Self-Regulation (ISR) and Emotional Dysregulation (ED) subscales of the CSBQ (Johnson et al., 2015). There were five items per subscale, with one item reverse coded. Responses were on a 3-point scale (*not true*, *somewhat true*, and *certainly true*). Higher scores indicated more independence on the ISR subscale and more emotional regulation problems on the ED subscale. All items were averaged, creating a total score ranging from 1 to 3. Reliability was low, with $\alpha = .57$ for ISR and $\alpha = .62$ for ED.

SDQ Subscales

The SDQ Emotional subscale consists of five items measuring the following domains: often complains of headaches, has many worries, often unhappy/downhearted, nervous or clingy in new situations, and many fears/easily scared. The SDQ Peer subscale consists of five items measuring the following: solitary/plays along, has at least one good friend (reversed), generally liked by other children (reversed), picked on or bullied, and gets on better with adults than with other children.

Appendix References

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