Psychological wellbeing trajectories of individuals with dyslexia aged 3 - 11 years

Jordan, J.-A., & Dyer, K. (2017). Psychological wellbeing trajectories of individuals with dyslexia aged 3 - 11 years. *Dyslexia*, *23*(2), 161-180. Advance online publication. https://doi.org/10.1002/dys.1555

Published in:
Dyslexia

Document Version:
Peer reviewed version

Queen's University Belfast - Research Portal:
Link to publication record in Queen's University Belfast Research Portal

Abstract

Dyslexia has been associated with a range of psychological wellbeing issues in childhood. However, it is unclear if these difficulties stem from coping with academic struggles at school, or from other pre-existing diagnoses that sometimes co-occur with dyslexia. Using UK Millennium Cohort Study data (n=7,224) from 2003-2011, the present study compared psychological wellbeing development from ages 3-11years for children with 1) dyslexia only; 2) special educational needs excluding dyslexia; 3) comorbid dyslexia and other special educational needs; and 4) no special educational needs. Growth curve modelling results controlling for race, gender, age and family income suggested that with the exception of conduct difficulties, psychological wellbeing issues related to dyslexia do not occur preschool, rather they commence upon starting school.

Keywords: dyslexia; longitudinal; psychological wellbeing; school; Millennium Cohort Study

Dyslexia is a developmental learning difficulty that has an estimated prevalence rate of 5 – 17% in school-age children (Shaywitz, 1998). The challenges dyslexia presents for school attainment and academic achievement are well-documented (e.g. Ridsdale, 2005); however, it has also been identified as a risk factor for problems in psychological wellbeing. Psychological wellbeing is a multifaceted concept, and is considered to encompass areas such as emotional wellbeing, peer relations, prosocial skills, conduct problems, and hyperactivity (Goodman, 1997). Evidence suggests that children with dyslexia are more likely to develop emotional difficulties related to self-esteem, depression and anxiety compared to those without dyslexia both in childhood and later adulthood (Burden, 2008; Carroll, Maughan, Goodman, & Meltzer, 2005; Jordan, McGladdery, & Dyer, 2014; Ridsdale, 2005). However, as Mayes and Calhoun (2006) point out, many of these previous studies on dyslexia and wellbeing (e.g. Dahle, Knivsberg, & Andreassen, 2011; Parhiala et al. 2015), did not distinguish between children with "dyslexia only" and those with "dyslexia and other comorbid difficulties" (e.g., ADHD, ASD).

Recent research has illustrated that children with a range of special education needs (SEN) such as autism, ADHD, and hearing loss are at risk for increased difficulties in psychological wellbeing (Dammeyer, 2010; Iizuka et al., 2010). Iizuka et al. (2010) reported that children with a discrete diagnosis of high-functioning autism had significantly greater emotional and peer problems relative to a control sample with no SEN. However, the majority of generic research examining emotional problems in children with SEN have involved cross-sectional studies of school-age children that were not screened for co-morbid learning difficulties (Salomone et al., 2014). Since children with SEN are thought to often

exhibit problems before entering school, it is difficult to ascertain whether dyslexia alone or co-morbid SEN are responsible for the alleged pre-school relationship between dyslexia and psychosocial difficulties (Rimvall, Elberling, Rask, Helenius, Skovgaard, & Jeppesen, 2014). The present study aimed to clarify how dyslexia, in the absence of co-occurring difficulties, impacts upon the development of psychological wellbeing problems upon entering school. Specifically, it attempted to ascertain if school-related challenges faced by children with dyslexia contribute to emergence of psychological difficulties or if dyslexia alone is a pre-existing risk factor for such difficulties.

Conduct difficulties

In addition to emotional problems, wider-reaching developmental and behavioural issues have been associated with dyslexia. Conduct problems such as aggression, anger dyscontrol, and challenging behaviour have been reported as more common amongst children with specific reading difficulty (Russell, Ryder, Norwich, & Ford, 2015) and evidenced to persist into adulthood (Kirk & Reid, 2001). Reading difficulties have been strongly associated with attentional problems and ADHD; 18-42% of children with reading difficulty having co-occurring ADHD (Gayán, Willcutt, Fisher, Francks, Cardon, Olson, 2005; Gilger, Pennington, & DeFries, 1992; Willcutt, Pennington, Boada, Ogline, Tunick, Chhabildas, 2001.) A number of researchers have suggested that of the various difficulties comprising ADHD, it is attentional deficits that specifically mediate the relationship between reading difficulty and behaviour problems. Hyperactivity/impulsivity, on the other hand, has been found to have little bearing on this relationship (e.g. Kempe, Gustafson & Samuelsson, 2011). Although, recent evidence has proposed a greater role for hyperactivity, with a national longitudinal study identifying that specific word reading difficulties at 7 years of age were predictive of hyperactivity and conduct problems at 11 years of age (Russell et al., 2015).

Peer relations and social development

Social development appears to have a more complex relationship with dyslexia than emotional and behavioural issues. Studies have found that dyslexia does not impact on peer relationships and socialisation per se, and that these relationships can actually be a strong protective factor in school for this population (Ingesson, 2007). However, negative peer relationships can be linked to dyslexia in other ways. Bullying has been highlighted as a prominent problem for children with dyslexia relative to children without the disorder, with some estimating bullying rates to be four times higher in children with dyslexia than other children (Glazzard, 2010; Ingesson, 2007). The interaction between such aversive peer experiences, self-esteem and dyslexia could account for impaired social development obtained in some dyslexic populations (e.g., Dahle, Knivsberg, & Andreassen, 2011).

Origins of psychological wellbeing difficulties

Dyslexia is considered to have a neurobiological origin with the evidence pointing to atypical functioning of brain systems (e.g. left hemisphere posterior) during reading tasks (Butterworth & Kovas, 2013). However, design issues related to the aforementioned studies (e.g. failure to consider comorbid diagnoses) make it difficult to determine whether dyslexia itself leads to poorer well-being or do wellbeing difficulties simply co-occur with dyslexia through a shared biopsychosocial pathway. Whitehouse, Spector, and Cherkas (2009) compared monozygotic and dizygotic adult twins to identify a potential genetic cause for the link between dyslexia and anxiety. Although a strong association was found between the two factors, the results indicated no shared genetic origin, meaning environmental and developmental factors are more likely to explain the dyslexia-anxiety relationship. Such an interpretation makes logical sense as a number of negative childhood experiences such as

social isolation, bullying, poor academic achievement, and parent-child relationship discord have exhibited reciprocal relationships with both dyslexia and mental health difficulties in children (e.g. Burden, 2008; Frederickson & Jacobs, 2001; Singer, 2005; Snowling, Muter, & Carroll, 2007). For example, poor academic achievement may lead to reduced psychological wellbeing when children with dyslexia notice 'differences' between themselves and their peers, in that they have greater difficulty with reading-related tasks (Pollak, 2005). They may also experience negative reactions from peers/adults and reduced self-esteem, starting a vicious cycle of impaired performance and wellbeing (Ridsdale, 2005).

In contrast to this formulation, recent longitudinal research suggests that children with dyslexia are impaired in some aspects of psychosocial functioning before they enter school (e.g. social skills and attention), as opposed to such difficulties being secondary to the challenges these children experience in school (Parhiala et al., 2015). However, it should be acknowledged that the Parhiala et al. (2015) study has a number of limitations that restrict inferences based on their results. These include a small sample size, lack of control for comorbid difficulties, and use of parental measures only.

Present research

Most previous research into dyslexia and wellbeing has relied on self-selected, non-representative samples and retrospective or cross-sectional methodologies. To overcome these issues, the present research used data from the Millennium Cohort Study which, to date, has followed children born at the start of the millennium, from 9 months to 11 years of age. The prospective nature of MCS design offers a unique opportunity to explore mental health in the periods before and after entry into school. The MCS has a number of methodologically robust features, including a large sample size; both parental and teacher based assessments of

well-being; and information on comordid difficulties. It also allows the present research to cover a much longer period of childhood development than previous investigations.

Growth curve modelling was used to compare development separately for children with 1) dyslexia only; 2) special educational needs not including dyslexia; 3) comorbid dyslexia and other special educational needs; and 4) no special educational needs. It was hypothesised that children with dyslexia would have comparable scores on psychological wellbeing to children with no dyslexia or other special educational needs before school-age, but that upon entering school, children with dyslexia would exhibit a significantly different developmental trajectory, indicative of greater problems in psychological wellbeing, compared to children with no dyslexia or other special educational needs. If supported, this hypothesis would indicate that psychological difficulties do not co-occur with dyslexia but are more associated with dyslexia interacting with other psychosocial factors (e.g., frustration at schoolwork).

Method

The Millennium Cohort Study (MCS) is a large scale UK wide longitudinal study which followed families of children who were born at the start of the millennium. The MCS was funded by the Economic and Social Research Council (ESRC), with further funding from National Evaluation of the Children's Fund. Cluster sampling (based on geographical wards) was used alongside disproportionate stratification to over-represent smaller countries, ethnic minorities, and areas of high deprivation. Child benefit records, and health visitor information were used to identify eligible children. At each MCS wave, data were collected on the cohort children and their families using interviews and self-completion questionnaires. In waves 2 (2003), 3 (2005), 4 (2007), and 5 (2011) the cohort children were aged 3, 5, 7 and

11 years respectively. In each of these waves the main respondent to the survey was usually the child's mother, and they were asked a series of questions about their child's development including their psychological wellbeing. In wave 5 of the study when the cohort children were aged 11 years, data were collected from main respondents on 13,287 children. In the same survey wave, teachers in England and Wales were invited to take part in a survey about 9,610 of the cohort children. Responses from teachers were received for 77% (n=7,430) of the cohort children.

The present study comprised data from 7,275 children in the MCS where there was sufficient data to determine the SEN status of the children. After removing a small proportion of sample from non-valid stratas (i.e. NI or Scotland which were not covered in the survey), a final sample of 7,224 remained. A secondary data analysis was conducted by creating a combined MCS dataset with developmental information for these children merged in from the main respondent wave 2, 3, 4, and 5 datasets.

Measures

SEN status: In wave 5 of the survey, teachers were asked 'does this child have Special Educational Needs (SEN)'. If the teacher responded "yes" they were then provided with a list of SEN reasons (e.g. dyslexia; problem with speech or language, autism spectrum disorder, ADHD), and asked to tick all those that applied to the cohort child. In the present study the SEN status of the cohort children at age 11 years was determined on the basis of this information; cohort children were classified as one of four SEN status groups:

Dyslexia Only: The child has special educational needs that are attributable to dyslexia only; they had no other types of SEN.

Other SEN: According to the child's teacher the child does not have dyslexia, but has other types of SEN (e.g., ADHD, autism, speech and language problems,

hearing problems). For a full list of SENs see Centre for Longitudinal Studies (2012).

Dyslexia Comorbid: Multiple special educational needs apply for the cohort child and these include dyslexia as well as other comorbid SEN.

No SEN: Teacher responded that the child had no current special educational needs at all.

Psychological difficulties: The Strength and Difficulties Questionnaire (SDQ; Goodman, 1997) was used to assess aspects of psychological difficulties. This 25-item measure is composed of five 5-item subscales: 1) *emotional symptoms*; 2) *conduct problems*; 3) *hyperactivity/inattention*; 4) *peer relationship problems* and 5) *prosocial behaviour*. *Total Difficulties* score can be calculated by summing the four problem subscales and omitting prosocial behaviour. Each item is scored on a three-point scale (0 – 2) in which respondents indicate if a statement is "Not True", "Somewhat True" or "Certainly True". Higher subscale scores indicate greater difficulties on the four problem scales, whereas a lower subscale score on the prosocial behaviour subscales is suggestive of more difficulties. Several versions of the measure exist that can be completed by parents, teachers, and children (3 – 16 years old). Example items from each subscale are as follows: emotional symptoms ('many worries'); conduct problems ('often lies or cheats'); hyperactivity/inattention ('restless, overactive'); peer relationship problems (picked on or bullied by other children'); prosocial behaviour ('helpful if someone is hurt'). Two versions of the SDQ were used in the MCS; (2-4 year-old version at age 3 years; 4-17 year-old version in all other waves). There were two minor differences between the versions: 1) two items relating to arguing and spitefulness are included in the 2-4 year-old version; 2) the version for older children included two items on

cheating and stealing. Distributional analysis revealed skew in the SDQ subscale data, with most scores concentrated towards better wellbeing.

The SDQ has good psychometric properties and is one of the most widely used measures of psychological difficulties in children and adolescents. A robust five-factor structure and concurrent/discriminant validity have been supported in numerous studies (see Stone, Otten, Engels, Vermulst, & Janssens, 2010). Internal consistency for the subscales and total scale have been estimated as ranging 0.72 – 0.83 (parent), 0.75 – 0.83 (teacher), and 0.65 – 0.82 (self-report) (Becker, Woerner, Hasselhorn, Banaschewski, & Rothenberger (2004; Goodman, Meltzer, & Bailey, 1998).

The parent and teacher versions of the SDQ were used in the present study. Parents completed the measure at child ages 3, 5, 7, and 11 years, whereas teachers rated the children at ages 7 and 11 years as part of the MCS.

Race: In the present analysis Caucasians were coded as 0 and all other racial groups were coded as 1.

Equivalised income bands: As a proxy measure of socioeconomic status/deprivation, equivalised income was incorporated into the analysis. This variable is a measure of financial income that has been adjusted for household size/composition, and was coded by 5 bands (0 = bottom income band, 4 = top income band).

Results

All analyses presented here were adjusted using the stratification, clustering and Finite Population Correction factor (fpc) design variables and weighted for attrition/non response in accordance with the Millennium Cohort Study guidelines published by Jones and Ketende (2010) and Ketende and Jones (2011). Due to the design of the MCS (i.e. simple

random sampling was not used) these adjustments are necessary and help to prevent underestimating standard errors and non-response bias (Jones and Ketende, 2010). Unweighted and weighted sample characteristics are shown in Table 1. The statistical approach employed in the present study comprised two stages. Firstly, regression models were used to compare psychological wellbeing at school for the children from the four groups at ages 7 and 11 years. Secondly, trajectories of psychological wellbeing from ages 3-11 years in the home environment were examined for the four groups using growth curve modelling. Growth curve modelling involves the application of structural equation modelling methodology to the analysis of longitudinal data. In contrast to other methods of longitudinal analysis (e.g. repeated measures ANOVA), growth curve modelling accounts for measurement error. Deviations of the observed scores from each fitted trajectory are attributed to measurement error. Bollen and Curran (2006) offer a detailed account of the methodology including its benefits and applications. This method was used to compare the initial status (age 3) and growth rates (development between ages 3 and 11 years) of the SEN status groups on each of the SDQ subscales.

<insert Table 1 about here>

Psychological wellbeing in school by SEN status

Weighted means for teacher-reported SDQ total and subscale scores are presented in Table 2 for ages 7 and 11 years. Regressions using weighted data were ran to examine the relationship between SEN status and teacher-reported SDQ total and subscale scores at ages 7 and 11 years (Tables 3 & 4). The regressions at age 11 years are based on the 7,212 children

from the wave 5 teacher survey for whom the SDQ questions had been completed by their teacher. From the children in the wave 5 teacher survey, 4,402 had data in the wave 4 teacher dataset as well; therefore the regressions at age 7 years are based on this subsample of 4,402 children. Gender, age, race and income were included as covariates in these analyses, and No SEN was the reference group against which the Dyslexia Only, Dyslexia Comorbid and Other SEN groups were compared. At ages 7 and 11 years, children with Dyslexia Only had significantly higher total difficulties than those with No SEN in a classroom context. The subscale analysis revealed these difficulties were mainly due to higher levels of hyperactivity/inattention at age 7 years, and both emotional symptoms and hyperactivity/inattention at age 11 years. By contrast the Dyslexia Comorbid and Other SEN groups had more widespread difficulties at ages 7 and 11 years. Specifically, in the areas that the Dyslexia Only group had difficulty, the Dyslexia Comorbid and Other SEN groups also had difficulty. At age 7 years, unlike the Dyslexia Only group, the Other SEN exhibited emotional, prosocial and conduct difficulties, and both the Other SEN and Dyslexia Comorbid groups had difficulty with peer relations. Similarly, four years later, both the Other SEN and Dyslexia Comorbid groups had difficulty in peer, prosocial and conduct related areas, whereas Dyslexia Only did not.

<insert Table 2 about here>

<insert Table 3 about here>

<insert Table 4 about here>

Psychological wellbeing at home by SEN status

Parents were asked to complete the SDQ questionnaire at 4 time points thus allowing for statistical comparisons between SEN status groups in terms of growth rates. Figure 1 shows weighted SDQ total and subscale scores based on parental reports from ages 3 – 11 years.

The growth curve models are based on the 7,224 cohort children from the wave 5 teacher survey who met the inclusion criteria for the present study. All models were estimated by Robust Maximum Likelihood (MLR) which can be used with missing data because it makes use of all of the available data; therefore those individuals who had missing values as a result of non-response at a particular wave were also included in the analysis. All models were conducted in Mplus 7 using the cluster, strata and weight commands to adjust for design and attrition. The MCS has an uneven design, meaning there are unequal intervals between waves 2-5 (ages 3, 5, 7, and 11 years). In addition, for each survey wave data collection spanned several months and children were not necessarily tested at the same relative time point for each study wave; as a result the intervals between waves varied from child to child. Given these design features and that SDQ scores vary with age (youthinmind, 2013) all models were specified with individually varying times of observation (Muthén and Muthén, 1998-2010).

In the baseline model stage of the analysis, quadratic and linear models were compared using nested model comparisons. These comparisons indicated that quadratic models provided a significantly better fit to the data for the SDQ total and subscale models. Parameter estimates for these baseline models are shown in Table 5. The intercept value for each model represents the initial status based of the fitted trajectory; specifically, the intercept is the estimated mean score at age 3 years. Slope loadings show the estimated average change (between waves), and a significant quadratic indicates a curve in the trajectory. For example, the average total difficulties score at age 3 years was 8.73, and this decreased by an average of .57 points and there is a non-linear trajectory. The slope loadings show that on average there was a significant decrease in total, peer, prosocial, hyperactivity and conduct related difficulties over time. Only emotional symptoms increased over time.

<insert Table 5 about here>

In the next stage of the analysis SEN status was added as a predictor to the models. This was done by adding three dummy coded variables (Dyslexia Only, Dyslexia Comorbid, and Other SEN) which were referenced against No SEN. Adding SEN to the model means that the intercept, slope and quadratic terms now represent initial status, growth and acceleration for the No SEN group. Given that the quadratic coefficients were quite small in the baseline models and are not of particular theoretical interest in the present research, the discussion here is limited to the intercept and slope coefficient differences between the SEN groups (Table 6).

At age 3 years, relative to those with No SEN, parents of children with Dyslexia Only tended to report greater problems in conduct (γ = 0.54, SE = 0.27, $p < 0.05$). The

Dyslexia Only group had a significantly greater increase over time in total difficulties (γ = 0.47, SE = 0.18, $p < .05$) and hyperactivity/inattention (γ = 0.29, SE = 0.10, $p < 0.05$). Specifically, while total and hyperactivity/inattention decreased over time for those with No SEN, increases or flat growth was observed for the Dyslexia Only group.

The Dyslexia Comorbid group had greater total difficulties (γ = 1.75, SE = 0.68, $p < 0.05$), prosocial, (γ = -0.70, SE= 0.23, $p < .05$), hyperactivity (γ = 0.83, SE = 0.27, $p < 0.05$), and conduct (γ = 0.73, SE = 0.25, $p < .05$) at age 3 years than the No SEN group. Similar slope loadings for the Dyslexia Comorbid and No SEN group indicate that the Dyslexia Comorbid group did not outgrow these difficulties.

As a group, children with Other SEN had much more widespread difficulties than those with Dyslexia Only and Dyslexia Comorbid at age 3 years; in fact, they displayed significantly higher initial levels of difficulty on total SDQ and all subscales compared to those with No SEN (total, γ = 3.07, SE = 0.29, $p < 0.001$; emotional, γ = 0.35, SE = .07, $p < .001$; peer, γ = 0.72, SE = 0.09, $p < 0.001$; prosocial, γ = -0.38, SE = 0.10, $p < 0.001$; hyperactive, γ = 1.28, SE = 0.12, $p < 0.001$; conduct, γ = 0.79, SE = .10, $p < 0.001$). In addition, compared to those with No SEN, the Other SEN group had greater increases/lower decreases in difficulties over time on many of the psychological wellbeing measures (total, γ = 0.41, SE = 0.15, $p < 0.05$; prosocial, γ = -0.19, SE = 0.04, $p < 0.001$; hyperactive, γ = 0.26, SE = 0.05, $p < 0.001$).

<insert Table 6 about here>

In the final models gender, income and race were added as covariates, with males and caucasians dummy coded as 0 (Table 7). Controlling for gender, race and income had

little impact on the overall pattern of findings Lower equivalised income and being male were associated with most forms of psychological well-being difficulties, but generally speaking had little impact on the growth rates. The relationship between race and the scales was quite complex. For example, being non-causasian was associated with more emotional difficulties, but better prosocial skills and less hyperactivity and conduct problems, although some of these differences appear to have weakened over time.

<insert Table 7 about here>

Relationship between parent and teacher assessments of child psychological wellbeing

Pearson product-moment correlations (one tailed) were performed to assess the relationship between parent and teacher reports of child psychological well-being at ages 7 and 11 years. Cohen's guidelines (Cohen 1988, 1992) were used to classify the sizes of the correlations. At age 7 years, medium to large sized correlations were found for emotion (r = .245; n = 4348; $p < .001$), conduct (r = .329; n = 4357; $p < .001$), hyperactivity (r = .470; n = 4348; $p < .001$), peer (r = .311; n = 4346; $p < .001$), prosocial (r = .260; n = 4353; $p < .001$) and total (r = .453; n = 4336; $p < .001$) difficulties. A similar pattern was evident at age 11 years: emotion (r = .352; n = 7018; $p < .001$), conduct (r = .401; n = 7017; $p < .001$), hyperactivity (r = .500 ; n = 7003; $p < .001$), peer (r = .435; n = 7019; $p < .001$), prosocial (r = .267; n = 7020; $p < .001$), and total (r = .532; n = 6987; $p < .001$).

Discussion

At age 11 years, teacher reports indicated that 4.3% of children had SEN as a result of dyslexia, with just over half of those children having an additional SEN. After controlling for possible confounding variables, children with dyslexia-only exhibited no difficulties relative to peers with No SEN before they had started school, aside from mild conduct

problems. In contrast, children with both dyslexia *and* comorbid SEN had significantly greater hyperactivity/inattention, prosocial difficulties, and conduct problems before school age. Such findings indicate that pre-school deficits in psychological wellbeing such as hyperactivity/inattention and reduced prosocial behaviour are likely to be related to comorbid SENs as opposed to dyslexia per se. In addition, the evidence suggests that mild conduct difficulties are associated with dyslexia and are not a product of the school environment. Overall, the findings highlight the importance of examining dyslexia-only and dyslexia-comorbid children separately, and suggests that the social skills and attentional difficulties reported by some clinicians and researchers (e.g., Parhiala et al. 2015) in children with dyslexia before school age may be an artefact of other special needs and likely unrelated to dyslexia.

The isolated pre-school elevations in conduct problems in the dyslexia-only group relative to the no SEN group was an unexpected finding. Based on theoretical understanding and trends in previous research (e.g., Parhiala et al., 2015), pre-school differences would be predicted to be across several domains of wellbeing (e.g., social skills and attention). Conduct problems before school amongst children with dyslexia could stem from more generic difficulties associated with dyslexia; for example, working memory (Gathercole, Alloway, Willis, & Adams, 2006) and time perception (Gooch, Snowling, & Hulme, 2011) impairments could lead to frustration and resultant conduct problems. Another possible explanation for the early conduct difficulties comes from Ferguson & Lynskey (1997) who also found that children with reading difficulty exhibited early conduct problems. The authors suggested that these behaviour problems may actually put children at risk of developing later reading difficulties. However, this study did not look specifically at dyslexia or measure conduct problems pre-school; therefore, it is also possible that while these difficulties tend to

co-occur, they are not causally related. Further research is needed to understand the relationship between early conduct difficulties and dyslexia.

Alarmingly in the present analysis, comparisons of growth rates between SEN groups show poorer *subsequent* psychological wellbeing development in children with dyslexia relative to children with no SEN over the course of early school years (ages 5 -11 years) on factors such as total psychological wellbeing and hyperactivity/inattention. Generally speaking children with other types of SEN including those with comorbid dyslexia, also showed poorer development – or maintained pre-school difficulties – in these areas over this period; albeit only the Dyslexia Comorbid and Other SEN groups showed more widespread difficulties.

The analysis of the teacher assigned SDQ scores at ages 7 and 11 years provides corroborative evidence for this adverse developmental divergence between children with dyslexia only and no SEN during their school years. Consistent with the parent data, the teacher data suggested that those with dyslexia had greater total difficulties in psychological wellbeing and greater hyperactivity/inattention compared to the no SEN group. In contrast to the parent data, however, which showed no indication of emotional symptoms in the dyslexia only group, children with dyslexia at age 11 years displayed greater emotional symptoms than their peers without SEN at school. Overall moderate to large correlations were found between the teacher and parent rating of child well-being; however, the relationship was relatively weak for emotional difficulties.

It is possible that either the difficulties associated with dyslexia manifest in a different way at school or that teachers perceive the difficulties differently to parents. For example, a child's conduct problems can manifest to a greater degree in less-controlled home environments, yet are much less frequent in highly-controlled environments such as a classroom (Frederickson & Cline, 2009). Alternatively, response bias could be at play as

teachers have been shown to be less willing to rate their students as having conduct problems compared to parents (e.g., Becker et al., 2004). Of course, it may not be purely a perception issue; the very nature of how parents and teachers respond to dyslexia could contribute to differences in the manifestation of children's difficulties. Either way, both the teacher and parent ratings analyses point to poorer overall psychological wellbeing in the early schooling period for children with dyslexia.

Previous dyslexia research which did not exclude those with comordid difficulties produced mixed results regarding whether dyslexia is associated with social difficulties (e.g. Ingesson, 2007; Pariala et al., 2015). The present research, which employed a more rigorous design, suggests that dyslexia alone is not associated with significant peer problems in early childhood. Links between dyslexia and emotional and attentional difficulties have also been previously observed; although again it is hard to untangle whether these were due to dyslexia or other comorbid difficulties (e.g. Burden, 2008; Carroll, Maughan, Goodman, & Meltzer, 2005). The present findings indicate that emotional and attention related difficulties can develop in the absence of other comorbid difficulties after starting school. A number of possible explanations could account for the hyperactivity/inattention and emotional symptoms that children with dyslexia develop after starting school. Research suggests that cognitive development in children with dyslexia evolves less by reading and knowledge acquisition and more by seeking stimulation and inputs from the environment (Ferrer, Shaywitz, Holahan, Marchione, & Shaywitz, 2010). If parents/teachers are unaware of or fail to appropriately support of such a learning profile, it may be construed directly as a problem behaviour (e.g., hyperactivity/inattention). Alternatively, repeated negative feedback/reduced positive reinforcement as a result of such behaviours may indirectly contribute to the development of psychological difficulties in these children. It is likely that such factors are just a few of many possible interacting psychosocial variables that contribute to the

development of impaired psychological wellbeing in children with dyslexia. Upon entering school, a child with dyslexia can potentially face a number of challenges as a result of their difficulties (e.g., reading problems, bullying). These challenges could have a negative impact on the child's overall wellbeing and, as a coping response, manifest in a number of well-documented negative behaviours such as "under"-reactions (e.g., withdrawal, generalised anxiety) and "over" reactions (e.g., disruptive behaviour, acting out; Thomson, 1996). In the long-term, these responses are potentially counterproductive and exacerbatory, leading to poorer adjustment/academic achievement and thus further deterioration in wellbeing.

Practical implications

In terms of practical and clinical implications of the study findings, it is clear that dyslexia can have a long-term impact on the emotional and psychological wellbeing of children. Although the severity of the impact is not as great as children with other SENs, it is still significantly greater over time relative to children with no diagnoses. Consequently, to some extent, children with dyslexia or early literacy difficulties represent a moderate at-risk population for developing problems in psychological wellbeing. Awareness of this developmental issue should be raised among both schools and parents of children with dyslexia/literacy difficulties for early identification. The developmental literature provides robust support for the effectiveness of prevention, early identification, and early intervention programs for psychological wellbeing in children (Wilson, Havighurst, & Harley, 2012). Numerous parent-child and school-based programs have demonstrated effectiveness in increasing emotional competence and decreasing hyperactivity/behavioural problems in children, including the Promoting Alternative Thinking Strategies (PATHS) curriculum in the UK (Greenberg, Cook and Quamma, 1995) and the Headstart REDI programme in the USA (Bierman et al., 2012). Children with suspected dyslexia and/or literacy difficulties may

benefit from closer monitoring of terms of emotional-behavioural development upon entry into the schooling system. Early identification of such issues followed by liaising with parents and enrolment on an emotional development program could have long-term psychological and academic benefits for these children.

Limitations and future directions

A potential issue with the secondary data used in the current study is measurement error. As useful and rich as the MCS database is for examining longitudinal relationships, the quality of some of the data obtained via simple survey methods may not as robust as more quasi-experimental designs. Dyslexia SEN status was based on reports from the child's teacher and the survey did not seek proof of diagnosis. In the UK teachers are consulted when an educational psychologists is assessing a child for SEN, hence teachers are well briefed on their children's SEN status. However, it is possible that some teachers may disagree with the educational psychologists view and may have provided their opinion rather than the child's official SEN status. Furthermore, it is likely that not all children will have received a formal dyslexia diagnosis by age 11 years, and, in particular, those with milder dyslexia may receive their diagnosis later. Consequently, the present findings may not generalise as well to children who are diagnosed at a later age.

While the present study was careful to exclude those with other SEN such as speech and language problems, it is possible t that some of the children in the Dyslexia Only group will receive an additional SEN diagnosis at a later stage and these children could have different outcomes to those who do not go onto to have further SEN needs identified. When further waves of the MCS data become available it will be possible to explore this issue further.

Although the present study has identified a clear developmental trajectory of psychological difficulties in children with dyslexia that emerges during school years, the causal mechanism of this trend is uncertain. The data do not explain *why* children with dyslexia have specific pre-school conduct difficulties, but then deviate from their peers over time and develop additional problem of psychological wellbeing during school age. The overall profile difficulties for children with dyslexia, is unlikely to be explained by a generic mental health model for all children with SEN since children with dyslexia demonstrated a different developmental pathway of difficulties from other SEN populations, suggesting potentially unique processes. Previous dyslexia research has provided some evidence of the psychological and environmental antecedents at play; however, these factors are likely to be multifarious with complex interrelationships. Future studies should assess these variables comprehensively and use larger scale modelling techniques (e.g., structural equation modelling) to explore how the various contributory factors interact and engender such psychological difficulties in children with dyslexia.

Additionally, although the literature asserts that early intervention and parent/school programmes can be successful in attenuating psychological difficulties in young children, this has not been examined with reference to dyslexia or in terms of developmental trajectory as identified in the current investigation. Future intervention studies should examine longitudinal developmental changes in psychological wellbeing of children with dyslexia in response to such programmes. Finally, in the present analysis quite a wide range of SENs were included in the other SEN group (e.g. hearing difficulties, autism, speech and language problems). It is likely there is considerable heterogeneity in terms of the psychological well-being difficulties associated with each of these SENs, or combinations of these SENs. The model employed in the present research could be applied to other SEN groups to gain a greater understanding of the specific difficulties associated other SENs.

Conclusion

The current study provides some clarification on the issue of whether dyslexia is a direct causal factor in engendering poorer psychological wellbeing in children or the psychosocial factors upon commencing school are more critical, interacting with this learning difficulty to elicit mental health problems. Pre-school difficulties in psychological wellbeing such as hyperactivity/inattention are more likely to be related to comorbid SEN rather than dyslexia. However, upon reaching school age, children with dyslexia deteriorate significantly over time in terms of their overall wellbeing relative to children without dyslexia. This finding has significant implications for managing the psychosocial factors at play for this population upon entering school and providing targeted early interventions.

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Table 1

Unweighted and weighted sample characteristics

SEN status		Weighted statistics								
	n	n	SEN group as % of sample (95% CI)	Gender (M/F)	Race (C/NC)	Mean income	Mean age in months (SE)			
							W2	W 3	W 4	W5
No SEN	5,779	7,960	78.7% (77.4% - 80.0%)	47%/ 53%	84%/16%	2.13	37.55 (.06)	62.50 (.06)	86.82 (.07)	133.75 (.07)
Dyslexia Only	143	204	2.0% (1.6% - 2.5%)	66% / 34%	90%/10%	2.35	37.49 (.23)	61.82 (.27)	86.30 (.31)	133.29 (.40)
Dyslexia Comorbid	157	230	2.3% (1.9% - 2.7%)	71% / 29%	89%/11%	1.85	37.16 (.23)	62.50 (.24)	86.83 (.23)	133.49 (.31)
Other SEN	1,145	1,714	17.0% (15.8% - 18.2%)	65% / 35%	84%/16%	1.52	37.51 (.09)	61.81 (.13)	86.32 (.12)	132.89 (.17)
Total	7,224	10,109	100%	51% / 49%	84%/16%	2.02	37.54 (.05)	62.37 (.06)	86.73 (.06)	133.58 (.07)

Note.

SE= standard error; CI = confidence interval, C=Caucasian, NC=Non-Caucasian, W= wave

Table 2

Weighted teacher assigned SDQ scores at ages 7 and 11 years

		Mean score (SE)	
SDQ scale	SEN status	7 years	11 years
Total	No SEN	5.25 (0.11)	4.59 (0.08)
	Dyslexia Only	8.04 (0.73)	6.42 (0.53)
	Dyslexia Comorbid	8.80 (0.54)	11.32 (0.71)
	Other SEN	10.63 (0.35)	11.26 (0.28)
Emotional	No SEN	1.34 (0.04)	1.19 (0.03)
	Dyslexia Only	1.79 (0.29)	1.55 (0.21)
	Dyslexia Comorbid	1.52 (0.23)	2.80 (0.22)
	Other SEN	2.25 (0.12)	2.50 (0.08)
Peer	No SEN	0.96 (0.03)	0.95 (0.03)
	Dyslexia Only	1.24 (0.17)	1.01 (0.14)
	Dyslexia Comorbid	1.91 (0.26)	2.43 (0.22)
	Other SEN	2.02 (0.10)	2.42 (0.08)
Prosocial	No SEN	8.07 (0.04)	8.26 (0.04)
	Dyslexia Only	7.94 (0.23)	8.18 (0.18)
	Dyslexia Comorbid	7.31 (0.24)	7.28 (0.20)
	Other SEN	6.76 (0.11)	6.82 (0.09)
Hyperactive	No SEN	2.33 (0.05)	1.90 (0.04)
	Dyslexia Only	4.17 (0.33)	3.12 (0.27)
	Dyslexia Comorbid	4.50 (0.32)	4.54 (0.27)
	Other SEN	4.79 (0.14)	4.58 (0.11)
Conduct	No SEN	0.59 (0.03)	0.55 (0.02)
	Dyslexia Only	0.84 (0.19)	0.74 (0.12)
	Dyslexia Comorbid	0.83 (0.15)	1.55 (0.20)
	Other SEN	1.56 (0.11)	1.76 (0.10)

Table 3
Predictors of teacher-reported SDQ total and subscale scores at age 7 years

SDQ scale		Dyslexia Only	Dyslexia Comorbid	Other SEN	Gender	Age	Race	Income
Total	B (SE)	2.65 (0.75)	2.87 (0.55)	4.67 (0.36)	-1.55 (0.17)	-0.50 (0.41)	-0.35 (0.32)	-0.62 (0.08)
	t	3.55*	5.17*	12.99*	-9.18*	-1.22	-1.12	-8.26*
Emotional	B (SE)	0.50 (0.30)	0.16 (0.24)	0.86 (0.13)	0.26 (0.07)	-0.16 (0.15)	-0.31 (0.11)	-0.12 (0.03)
	t	1.70	0.69	6.67*	3.68*	-1.11	-2.89*	-4.89*
Peer	B (SE)	0.31 (0.18)	0.90 (0.26)	0.98 (0.10)	-0.06 (0.05)	0.01 (0.11)	0.04 (0.08)	-0.10 (0.02)
	t	1.77	3.50*	9.68*	-1.17	0.14	0.54	-4.85*
Prosocial	B (SE)	0.05 (0.25)	-0.41 (0.25)	-1.00 (0.11)	1.10 (0.07)	0.12 (0.15)	-0.21 (0.12)	0.14 (0.03)
	t	0.19	-1.66	-8.99*	15.39*	0.80	-1.75	4.58*
Hyperactive	B (SE)	1.62 (0.32)	1.70 (0.32)	2.03 (0.15)	-1.32 (0.08)	-0.42 (0.20)	-0.02 (0.16)	-0.25 (0.03)
	t	5.02*	5.28*	13.84*	-16.26*	-2.10*	-0.11	-7.14*
Conduct	B (SE)	0.21 (0.20)	0.07 (0.15)	0.80 (0.11)	-0.42 (0.05)	0.07 (0.11)	-0.07 (0.08)	-0.15 (0.02)
	t	1.09	0.46	7.29*	-8.22*	0.62	-0.79	-6.89*

Note.
B= unstandardized beta; SE=standard error; *= $p < .05$

Table 4

Predictors of teacher-reported SDQ total and subscale scores at age 11 years

SDQ Scale		Dyslexia Only	Dyslexia Comorbid	Other SEN	Gender	Age	Race	Income
Total	B (SE)	1.57 (0.49)	5.97 (0.68)	5.79 (0.25)	-1.98 (0.14)	0.01 (0.24)	-0.80 (0.23)	-0.81 (0.06)
	t	3.19*	8.83*	23.06*	-13.84*	0.05	-3.43*	-14.74*
Emotional	B (SE)	0.41 (0.20)	1.60 (0.22)	1.26 (0.08)	0.19 (0.05)	0.02 (0.08)	-0.35 (0.07)	-0.14 (0.02)
	t	2.03*	7.40*	15.84*	3.82*	0.22	-4.82*	-6.55*
Peer	B (SE)	0.04 (0.14)	1.38 (0.22)	1.34 (0.08)	-0.22 (0.05)	0.09 (0.08)	-0.16 (0.06)	-0.14 (0.02)
	t	0.30	6.31*	17.16*	-4.77*	1.17	-2.45*	-7.77*
Prosocial	B (SE)	0.10 (0.18)	-0.65 (0.19)	-1.11 (0.08)	1.16 (0.05)	0.01 (0.09)	-0.20 (0.07)	0.18 (0.02)
	t	0.58	-3.37*	-13.14*	22.90*	0.09	-2.79*	8.09*
Hyperactive	B (SE)	0.97 (0.24)	2.18 (0.25)	2.19 (0.10)	-1.45 (0.07)	-0.28 (0.10)	-0.22 (0.09)	-0.31 (0.02)
	t	3.98*	8.63*	21.30*	-22.25*	-2.81*	-2.44*	-13.54*
Conduct	B (SE)	0.15 (0.12)	0.83 (0.19)	1.01 (0.09)	-0.48 (0.04)	0.17 (0.07)	-0.06 (0.07)	-0.21 (0.02)
	t	1.30	4.35*	11.80*	-11.93*	2.33*	-0.84	-11.53*

Note.

B= unstandardized beta; SE=standard error; *= $p < .05$

Table 5

Baseline models for parental reported SDQ total and subscale scores

	Total	Emotional	Peer	Prosocial	Hyperactivity	Conduct
Intercept	9.773*	1.395*	1.584*	7.380*	3.938*	2.655*
Slope	-0.947*	0.006	-0.182*	0.415*	-0.200*	-0.477*
Quadratic	0.086*	0.006*	0.019*	-0.030*	0.013*	0.040*
Variance (intercept)	15.126*	0.839*	0.893*	1.889*	3.003*	1.953*
Variance (slope)	0.708*	0.129*	0.092*	0.176*	0.202*	0.074*
Variance (quadratic)	0.006*	0.001*	0.001*	0.001*	0.002*	0.001
R (int. slope)	0.337	0.014	-0.032	-0.234*	0.042	-0.154*

Note.

* = $p < .05$

Intercept is the estimated mean score at age 3 years.

Slope loadings show the estimated average change (between waves).

Table 6

Models for parental reported SDQ total and subscale scores with SEN status

	Total	Emotional	Peer	Prosocial	Hyperactive	Conduct
Intercept	9.197*	1.336*	1.454*	7.466*	3.692*	2.487*
Slope	-1.028*	-0.009	-0.187*	0.443*	-0.252*	-0.479*
Quadratic	0.088*	0.005*	0.018*	-0.033*	0.017*	0.039*
Variance (intercept)	13.893*	0.827*	0.809*	1.858*	2.790*	1.855*
Variance (slope)	0.654*	0.126*	0.088*	0.168*	0.190*	0.071*
Variance (quadratic)	0.006*	0.001*	0.001*	0.001*	0.002*	0.001
R (int. slope)	0.126	0.012	-0.029	-0.238*	-0.012	-0.157*
Intercept on Dyslexia	0.685	0.009	-0.046	-0.051	0.241	0.535*
Intercept on comorbid	1.754*	0.017	0.385	-0.704*	0.825*	0.731*
Intercept on SEN	3.073*	0.353*	0.722*	-0.383*	1.284*	0.794*
Slope on dyslexia	0.473*	0.126	0.100	-0.053	0.288*	-0.051
Slope on comorbid	0.183	0.163	-0.057	0.147	0.181	-0.186
Slope on SEN	0.413*	0.041	0.028	-0.192*	0.259*	0.060
Quadratic on dyslexia	-0.033	-0.012	-0.008	0.009	-0.018	0.004
Quadratic on comorbid	0.016	-0.007	0.013	-0.010	-0.002	0.020
Quadratic on SEN	-0.007	0.008	0.006	0.017*	-0.016*	-0.002

Note.

* = $p < .05$

Intercept is the estimated mean score at age 3 years for the No SEN group.

Slope loadings show the estimated average change (between waves) for the No SEN group.

Intercept on Dyslexia is the difference in estimated mean score at age 3 years for the Dyslexia Only group relative to the No SEN group.

Slope on Dyslexia is the difference in estimated average change (between waves) for the Dyslexia only group relative to the No SEN group.

Table 7

Models for parental reported SDQ total and subscale scores with SEN status and gender, race and income

	Total	**Emotional**	**Peer**	**Prosocial**	**Hyperactive**	**Conduct**
Intercept	12.011*	1.620*	1.945*	7.032*	4.734*	3.459*
Slope	-1.038*	0.024	-0.164*	0.441*	-0.223*	-0.564*
Quadratic	0.087*	0.002	0.015*	-0.034*	0.013*	0.047*
Variance (intercept)	12.000*	0.724*	0.751*	1.663*	2.547*	1.603*
Variance (slope)	0.746*	0.120*	0.093*	0.133*	0.195*	0.055
Variance (quadratic)	0.006*	0.001*	0.001*	0.001*	0.002*	0.000
R (int. slope)	-0.071	0.026	-0.043	-0.170*	-0.034	-0.123*
Intercept on Dyslexia	0.737	0.084	-0.030	0.070	0.166	0.524*
Intercept on comorbid	1.286*	0.000	0.291	-0.577*	0.592*	0.581*
Intercept on SEN	2.294*	0.253*	0.577*	-0.323*	1.013*	0.579*
Slope on dyslexia	0.445*	0.119	0.094	-0.075	0.292*	-0.051
Slope on comorbid	0.192	0.169	-0.048	0.147	0.180	-0.177
Slope on SEN	0.408*	0.044	0.024	-0.160*	0.239*	0.058
Quadratic on dyslexia	-0.030	-0.011	-0.007	0.011	-0.019	0.004
Quadratic on comorbid	0.015	-0.008	0.013	-0.009	-0.002	0.019
Quadratic on SEN	-0.006	0.008	0.006	0.014*	-0.015*	-0.002
Intercept on gender	-0.767*	0.052	-0.157*	0.389*	-0.521*	-0.225*
Slope on gender	-0.068	0.025	0.010	0.027	-0.036	-0.035
Acceleration on gender	0.008	0.000	0.000	-0.001	0.001	0.004
Intercept on race	-0.157	0.151*	0.021	0.329*	-0.153*	-0.260*
Slope on race	0.047	-0.068*	-0.004	-0.159*	0.045*	0.117*
Quadratic on race	-0.003	0.004	0.000	0.014*	-0.002	-0.010*
Intercept on income	-1.083*	-0.170*	-0.195*	0.046	-0.325*	-0.343*
Slope on income	0.013	-0.010	-0.010	0.020	-0.013	0.027*
Quadratic on income	-0.001	0.001	0.001	-0.001	0.002	-0.003*

Note. * = $p < .05$

Intercept is the estimated mean score at age 3 years for the No SEN group.
Slope loadings show the estimated average change (between waves) for the No SEN group.
Intercept on Dyslexia is the difference in estimated mean score at age 3 years for the Dyslexia Only group relative to the No SEN group.
Slope on Dyslexia is the difference in estimated average change (between waves) for the Dyslexia only group relative to the No SEN group.