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Trajectories of prosociality from early to middle childhood in children at risk of Developmental Language Disorder

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ABSTRACT

Longitudinal research into the development of prosociality during childhood contributes to our understanding of individual differences in social and emotional outcomes. There is a dearth of literature on the development of prosociality in children with Developmental Language Disorder (DLD). Data from the UK based Millennium Cohort Study was used to investigate prosociality from age 5 to 11 years in 738 children at risk of Developmental Language Disorder (r-DLD) and 12,972 children in a general population (GP) comparison group. Multilevel mixed effects regression models were run to investigate the mean change in prosociality and latent class growth analysis was used to identify heterogeneous groups of children who shared similar patterns of development. Overall, children at risk of DLD were less prosocial at age 5 and, although they did become more prosocial by the age of 11, they did not reach the same levels of prosociality as those in the GP group. Subsequent sub group analysis revealed four distinct developmental trajectories: stable high (19 %), stable slightly low (36 %), decreasing to slightly low (5 %), and increasing to high (40 %). Children at risk of DLD were less likely than those in the GP group to be in the stable high class and more likely to be in the stable slightly low class. For children at risk of DLD, being prosocial was protective against concurrent social and emotional difficulties. But being prosocial in early childhood was not protective against later social and emotional difficulties nor did the absence of prosociality in early childhood make social and emotional difficulties in middle childhood inevitable. Rather, the presence of prosociality in middle childhood was the key protective factor, regardless of prosociality in early childhood. Prosociality is not a key area of concern for children at risk of DLD. Instead, it is an area of relative strength, which can be nurtured to mitigate social and emotional difficulties in children at risk of DLD, particularly in middle childhood.

1. Developmental Language Disorder

Developmental Language Disorder (DLD) affects approximately 5–7 % of children (Norbury et al., 2016; Tomblin et al., 1997). It is a neurodevelopmental disorder which is characterised by difficulties in using and/or understanding oral language in the absence of any other neurodevelopment disorder or substantial hearing loss (Bishop et al., 2016). Although DLD is defined by persistent difficulties with oral language, relative to other children the same age, children with DLD often experience difficulties in other areas of

Abbreviations: r-DLD, risk of Developmental Language Disorder; GP, general population; MCS, Millennium Cohort Study; SDQ, Strengths and Difficulties Questionnaire

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functioning, such as social and emotional problems (St Clair et al., 2011), high levels of challenging behaviour (Yew & O'Kearney, 2013), social withdrawal (Hart et al., 2004), and being more fearful about joining into social situations (Fujiki et al., 2004). These related difficulties in children with DLD are not inevitable. There is considerable heterogeneity in the profiles of such difficulties with some children more affected than others (Conti-Ramsden et al., 2019; Pickles et al., 2016). Some recent evidence suggests that such individual differences may be partly driven by genetic effects (Newbury et al., 2019).

2. The development of prosociality

Prosociality is a key aspect of social behaviour and it involves being positively responsive to others' needs and welfare (Eisenberg, Fabes, Spinrad, & 2006). Children who are prosocial tend to be helpful, sharing, and comforting towards other children (Eisenberg et al., 2015). As with almost all behaviours, both environmental factors, such as guidance from socialisation agents (e.g. modelling behaviours from others), and genetics, such as infant temperament, are thought to influence the development of prosociality (Eisenberg et al., 2006; Jensen et al., 2014). The relative contributions of genetics and the environment change during the course of development. In early childhood, the environment is important for children's prosocial behaviour and accounts for nearly half of individual differences (Knafo & Plomin, 2006) but as children grow older and approach middle childhood, the effect of the environment is almost negligible and inherited genetic factors account for most of the differences in prosociality between children (Knafo & Plomin, 2006). Therefore, as children grow older, the differences in prosociality are increasingly explained by inherited genetic factors.

The development of prosociality is heterogeneous, meaning that different groups of children follow different patterns of development over time. Cote, Tremblay, Nagin, Zoccolillo, and Vitaro (2002) investigated one aspect of prosociality, helpfulness, in a sample of approximately 2,000 children. The same group of children were followed from the age of 6 to 12 years. Three distinct developmental trajectories were identified: low, moderate, and high – each of which were stable over the 6 year study period. That is, the levels of prosociality the children showed when they were 12 years old were broadly similar to those when they were 6 years old. Somewhat different findings were reported by Kokko, Tremblay, Lacourse, Nagin, and Vitaro (2006), who investigated prosociality in a sample of approximately 1,000 boys and followed them from the age of 6 to 12 years. Two distinct developmental trajectories were identified: low declining and moderate declining. For the former, prosociality started low and declined over the 6 year study period, and for the latter, prosociality started at a moderate level and also declined over the 6 year study period. The apparent difference in result between the two studies may be due to differences in the types of prosociality under investigation, Cote et al. (2002) measured helpfulness whereas Kokko et al. (2006) measured a wider range of prosocial behaviours, including but not limited to helpfulness.

In further contrast to the previous two studies, Nantel-Vivier, Pihl, Cote, and Tremblay (2014) reported increases in prosociality during childhood. They followed a group of over 10,000 children over a longer period of time, from age 2 to 11 years, and measured a number of different prosocial behaviours. Three distinct developmental trajectories were identified: low, moderate, and high – each of which increased over the 9 year study period. These findings demonstrate that the evidence to date is mixed at best, with studies reporting an increase, decrease, and no change in prosociality during childhood. With such inconsistent findings, further work is needed to shed light on the development of prosociality during childhood and how it differs in those at risk of DLD.

3. Language ability and prosociality

Some, but not all, prosocial behaviours require language. For example, sharing toys does not require language but the progression from such behaviours, i.e. the subsequent social interactions, such as pretend play using the toys, may require developmentally age appropriate language. Therefore, it might be expected that there is a causal relationship between oral language and prosociality, the effect of which may be in either direction. Children with better language skills may have more meaningful social interactions with more opportunities to understand the needs of others and therefore increase the desire to be prosocial (Harris, 1992). Such an assertion is in line with the social information processing theory (Crick & Dodge, 1996), which states that children's cognitive abilities play an important role in their response to social interactions. The theory predicts that children with better oral language skills will be able to express themselves more competently during social interactions leading to more meaningful social exchanges. This may increase the likelihood of prosocial behaviours in subsequent interactions. This prediction is supported in work by Girard, Pingault, Doyle, Falissard, and Tremblay (2016), who found that better expressive language skills at age 3 years were associated with higher levels of prosociality at age 5 years. The reverse relationship might also be expected, i.e. higher levels of prosociality leads to better language skills, as usage based approaches to language acquisition highlight the vital importance of viewing language development within a social communicative context (Tomasello, 2003). More frequent social interactions, such as prosocial behaviours, might provide more opportunities to learn and practise language with others (Hoff, 2006). Recent evidence does not support this prediction. Higher levels of prosociality at age 3 years are not associated with better expressive language skills at age 5 years (Girard et al., 2016). These studies suggest that children who have better expressive language skills are subsequently more prosocial but children who are more prosocial do not subsequently develop better language skills.

4. Developmental Language Disorder and prosociality

One might predict that children with DLD may be at a disadvantage early in the development of prosociality. They may have fewer or poorer quality social interactions with their primary caregiver thus limiting the frequency of meaningful social exchanges and hampering efforts to model and practise prosocial behaviours. Recent research supports this assertion. Children at risk of DLD

have lower scores on a parent-child relationship measurement, which is perhaps indicative of fewer opportunities to learn from parental social exchanges (St Clair et al., 2019). Furthermore, given that heritability of DLD is high (Bishop & Hayiou-Thomas, 2008), children with DLD may grow up in families where parents also have language difficulties, which may further limit the frequency or quality of meaningful social exchanges. But not all children with DLD will be at a disadvantage for the development of prosociality.

The cross-sectional studies on prosociality in children with DLD point towards effects based on the severity and type of disorder. In a small clinincal sample, children with DLD did not differ in their levels of prosociality compared to controls (Farmer, 2000). In a larger sample of children with DLD, those with less severe language problems demonstrated higher levels of prosocial behaviour compared to those with more severe problems (Hart et al., 2004), suggesting that the severity of language problems may be important. But this was not confirmed in work by Bakopoulou and Dockrell (2016), who found that children with DLD had poorer prosocial skills compared to age-matched controls but they also fared worse compared to younger children matched for receptive language, suggesting that poorer prosocial skills cannot be solely explained by poor language ability.

To the best of our knowledge, only two studies have investigated the longitudinal trajectories of prosociality in individuals with DLD. The first followed 65 children from 8 to 16 years and found that those with a history of DLD were generally within the normal range, showing an increasing trend between age 8 and 12 (Lindsay & Dockrell, 2012), but there was no comparison group. The second study followed 131 young people with a history of DLD from 11 to 24 years (Toseeb et al., 2017). Again, on the whole, prosociality was within the normal range and the trajectories were stable over time. Most young people with a history of DLD had prosocial skills that were comparable to those without a history of DLD. But there were a minority of young people with a history DLD who had significantly lower levels of prosociality than those without. Therefore, whilst the cross-sectional work shows a deficit in prosociality in children with DLD, the longitudinal studies point towards heterogeneity in profiles, which needs to be investigated further.

5. Prosociality and psychosocial difficulties

Prosociality has a complicated relationship with social and emotional difficulties, henceforth referred to as psychosocial difficulties. Higher levels of prosociality are associated with emotional problems in some studies (Bandura et al., 1999) but not others (Hay & Pawlby, 2003). Contrary to this, by and large, higher levels of prosociality are associated with fewer behavioural problems (Perren et al., 2007). If children display prosocial behaviour at either extreme, i.e. they are too prosocial or not prosocial at all, then this may contribute to psychosocial difficulties. For example, overly high levels of prosocial behaviour may be indicative of high levels of empathy, care, and guilt and therefore put children at risk of psychosocial difficulties (Hay & Pawlby, 2003; Perren et al., 2007), meaning that children who are highly prosocial may be overly worried about the wellbeing of others, which in turn may increase their own distress. Given that empathy allows us to recognise someone in distress and be prosocial towards them (Decety, Bartal, Uzefovsky, & Knafo-Noam, 2016), very low levels of prosociality may be indicative of lack of empathy, which is associated with an increase risk of psychosocial difficulties (Hastings et al., 2000).

As children and adolescents with DLD experience a number of psychosocial difficulties, such as depression and anxiety (Botting et al., 2016), conduct problems and hyperactivity (Pickles et al., 2016), and peer and emotional problems (Conti-Ramsden et al., 2019), the role of prosociality as a potential protective factor warrants further investigation. There is some preliminary evidence of the protective nature of prosociality against psychosocial difficulties in individuals with DLD. Prosociality is associated with fewer peer problems during adolescence in individuals with DLD (Mok et al., 2014). Moreover, prosociality during adolescence is associated with fewer friendship difficulties in young adulthood for those with a history of DLD (Toseeb et al., 2017). There is also evidence for similar associations during middle childhood for those with DLD. Children with DLD who are more prosocial at age 7 years have fewer psychosocial difficulties at age 11 years (Toseeb et al., under review).

6. The current study

To the best of our knowledge, the current study is the first to investigate the development of prosociality from early to middle childhood in children at risk of DLD (and a general population comparison group that excludes children at risk for DLD). By using the term at risk of DLD (r-DLD), we were able to investigate children who started primary school with lower than expected language ability assessed by standardised test and/or parental report of language concerns. A number of research questions motivated the study. Firstly, as a group, how do children at risk of DLD change over time in their levels of prosociality and how does this compare to children in the general population (research question 1)? Secondly, what are the heterogeneous patterns of development in prosociality from early to middle childhood (research question 2)? We expected heterogeneity but we were unable to predict the distinct profiles of development, i.e. increasing, decreasing, or stable, given the mixed findings from previous literature. Next, we investigated whether children at risk of DLD were more or less likely to fall into specific patterns of prosociality development compared to the general population (research question 3). Keeping in mind previous longitudinal studies of individuals with DLD (Lindsay & Dockrell, 2012; Toseeb et al., 2017), we expected that despite having lower levels of prosociality than the general population, children at risk of DLD will still be within the normal range but that there will be considerable individual differences. We expected some children at risk of DLD to be in subgroups with lower prosociality across development. Finally, we were interested in whether being prosocial was protective against psychosocial difficulties in children at risk of DLD (research question 4). We expected that those children at risk of DLD who were more prosocial would have fewer psychosocial difficulties.

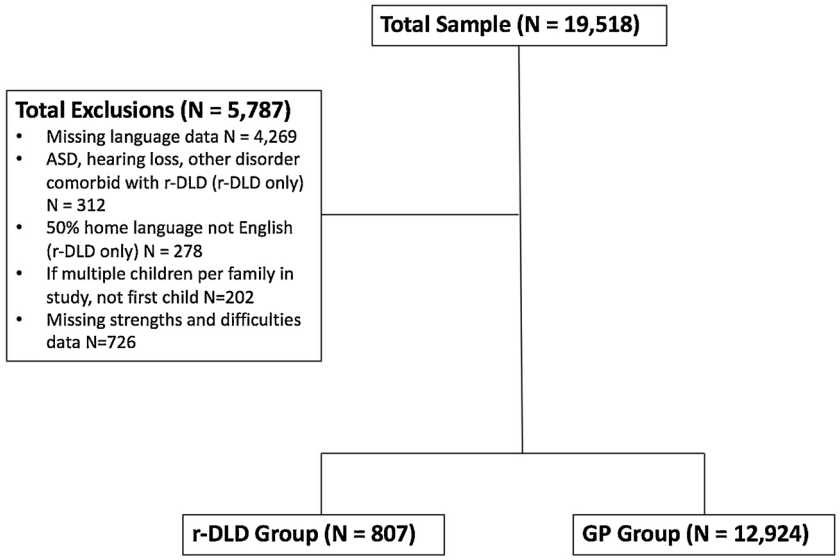

Fig. 1. Flow diagram representing final sample selection. Note. The values displayed are unweighted values.

7. Method

7.1. Ethical approval

The dataset used in this study was collected as part of the Millennium Cohort Study (MCS). Ethical approval was sought for each of the waves from the National Health Service (NHS) Research Ethics Committee (REC). NHS RECs are appointed by the strategic health authorities in England and safeguard the rights, safety, dignity, and well-being of participants. Committees consist of lay and expert members. Full details of the ethical process for the MCS is available at https://cls.ucl.ac.uk/wp-content/uploads/2017/07/MCS-Ethical-Approval-and-Consent-2019.pdf. This secondary analysis of the data was approved by the Education Ethics Committee, University of York (reference: 18/8).

7.2. Study sample

The MCS follows the lives of 19,518 children born in the United Kingdom (UK). Data was accessed via the UK Data Archive (http://www.data-archive.ac.uk/). Full details of the MCS, including methodological information, are reported elsewhere (Connelly & Platt, 2014). As shown in Fig. 1, a number of exclusionary criteria were applied. From the overall sample of 19,518, children with missing language data (parent report or direct assessment) at age 5 years, as described later, were excluded (n = 4,269). Parent reports of additional support in the classroom and special educational needs were examined for evidence of Autism Spectrum Disorder (ASD), hearing difficulties or Down Syndrome at age 7 and age 11. Children who met our r-DLD criteria, described later, but also had the conditions described in the previous sentence were excluded (n = 312). As we were interested in those with a primary language difficulty, children who met criteria for the r-DLD group but were in a family environment where English was not spoken at least 50 % of the time were excluded (n = 278). Where there were multiple children per family in the cohort, all children except the first were excluded (n = 202). Finally, children with missing data on the primary measure of prosociality and psychosocial difficulties, the Strengths and Difficulties Questionnaire (SDQ, Goodman, 1997) were excluded (n = 726). This resulted in an unweighted sample size of 13,731.

7.2.1. Children at risk of DLD

We implemented criteria to identify children at risk of DLD which have previously been used in the same cohort (Forrest et al., 2018; St Clair et al., 2019). Children had to meet at least one of the following two language criteria to be included in the r-DLD group. Either they received a positive response to the statements 'Language developing slowly' or 'Doesn't understand others' from parent report at age 5 (n = 412). This provided a measure of functional language in everyday use. Children were not included if parents endorsed items relating to speech or hearing problems, such as 'S/he pronounces words poorly', 'S/he doesn't hear well' and 'S/he stutters'. See Hughes, Sciberras, and Goldfeld (2016) for a similar measure of parental report of language difficulties relating to psychosocial difficulties. Secondly, participants were included if they scored 1.5 *SD* below the mean (T score of 35 or below) on the British Ability Scales (BAS) naming vocabulary subtest (n = 460) (Elliot et al., 1996). This test provides a measure of expressive language ability, requiring participants to name pictures of objects and has a reliability coefficient of .65 at age 5 (Elliot et al., 1996). A cut point of more than 1.25 *SD* below the mean on language tasks has been previously recommended (Reilly et al., 2014). Given that there was only one standardised language test available in the MCS, we have used the threshold of 1.5 *SD* below the mean to

provide a conservative estimate of children at risk of DLD. This decision also follows previous work in the same cohort of using a 1.5 *SD* cut point to define language impairment (Law et al., 2012). There were 65 children who met both criteria of parent report of language difficulties and low score on the naming vocabulary subtest at age 5. Although there are two distinctive routes to being categorised as r-DLD, previous research with this classification has shown striking similarities in results when analysed separately by each r-DLD criteria (Forrest et al., 2018; St Clair et al., 2019), giving reassurance that the combined variable is a valid measure of risk for DLD. The prevalence estimate of the risk of DLD in our sample was 6 %, which is in line with previous estimates of 5–7 % (Norbury et al., 2016; Tomblin et al., 1997).

Up until this point we have referred to the unweighted sample sizes to allow for the replication of our study sample. From here onwards, we refer to weighted sample sizes to account for unequal sample attrition, the application of disproportionate stratification, and missing data (Mostafa, 2014). In light of this, the weighted final sample size of children at risk of DLD at age 5 was 738 (mean age 5.21 years, SE 0.01 years) of which 66 % were boys.

7.2.2. Children in the GP group

All children who did not meet criteria for the r-DLD group were then entered into the general population (GP) comparison group, including those who may have autism (N = 358) or hearing loss (N = 1,147) but did not meet criteria for r-DLD. Those with Down Syndrome all additionally met the r-DLD criteria and were not included in this study. This ensured that our comparison group is representative of the UK population without evidence of substantial language difficulties at age 5 years. Current recommendations emphasise the importance of comparison groups who are not free from all other difficulties, including other neurodevelopmental conditions (Fombonne, 2016). This ensures that our estimates of difficulties associated with our r-DLD are not inflated by creating a GP comparison group that is artificially clean and not representative of UK children in general. This yielded a weighted final sample of 12,972 children in the GP comparison group at age 5 (mean age 5.21 years, SE 0.004 years) of which 50 % were boys.

7.3. Measures

7.3.1. Socioeconomic status

Income from all sources (e.g., main job, government benefits etc.) was assessed and standardised using the OECD modified scale (Hagenaars et al., 1994). Those families below 60 % median income level were categorised as low household income (or poverty).

7.3.2. Expressive language

The naming vocabulary subscale of the British Ability Scales (BAS, Elliot et al., 1996) was used to assess expressive language when the child was 5 years old and the verbal similarities subscale was used at aged 11 years. For the naming vocabulary subscale, which was used to assess knowledge of item names, each child was shown a series of pictures of objects and asked to name what they saw. The verbal similarities subscale was used to assess the child's verbal reasoning and verbal knowledge. The interviewer read out three words to the child, who was asked to say how the three things were similar or go together. Standardised scores, which are scores adjusted for the child's age group and the mean of the norming sample, were used in all the analyses.

7.3.3. Prosociality

The prosocial subscale of the parent report SDQ (Goodman, 1997) was completed by the primary caregiver when the child was aged 5, 7, and 11 years old. The internal consistency of the subscale within each time point was good (Cronbach's alphas: 0.67 to 0.70). The questions asked about age appropriate prosocial behaviours such as "considerate of other people's feelings" and "often volunteers to help others". Sum scores for the subscale ranged from 0 to 10 with higher scores indicating higher levels of prosociality. A new fourfold classification has been suggested for the interpretation of SDQ scores. For prosociality, the four categories are: *close to average* (8–10), *slightly low* (7), *low* (6), *very low* (0–5) (sdqinfo.com).

7.3.4. Psychosocial difficulties

The parent report SDQ (Goodman, 1997) was used to measure psychosocial difficulties when the child was 5 and 11 years old. The internal consistency of the subscale within each time point was good (Cronbach's alphas: 0.52–0.79). Each of the 4 difficulties subscales (peer, emotion, conduct, and hyperactivity) were summed separately. The scores for each subscale ranged from 0 to 10, with higher scores indicating more difficulties.

7.4. Statistical analysis

All latent class growth analyses were run in Mplus 7.3 (Muthen & Muthen, 2012) and all other analyses were run using Stata/SE 14.2 (StataCorp, 2015). To account for unequal sample attrition, missing data, and the application of disproportionate stratification, survey weights and analytic techniques were used (Mostafa, 2014). All reported values are weighted estimates.

Group differences were estimated using logistic regression models (for binary outcomes variables) and linear regression models (for continuous outcome variables). For these analyses, group (r-DLD or GP) was entered as the independent variable and the dependent variable was entered as one of the following: gender, socioeconomic status, expressive language (age 5 or 11 years), prosociality (age 5, 7, or 11 years), emotional problems, peer problems, conduct problems, or hyperactivity.

7.4.1. Research question 1

Multilevel mixed effects Poisson regression was used to investigate the mean change in prosociality over time. The outcome variable was prosociality. The predictors in the fixed part of the model were linear time, quadratic time, group (r-DLD or GP), and the interaction between group and quadratic time. The model was repeated with the interaction between group and linear time. Socioeconomic status and gender were included as covariates. Anonymised participant number and linear time were included in the random part of the model.

7.4.2. Research question 2

Latent class growth analysis (Muthen & Muthen, 2012), using Poisson regression, was run to determine if there were meaningful groups of children sharing similar patterns of development in prosociality over time. The fit of two to six classes was assessed for intercept only, linear, and quadratic models. All models included group (r-DLD or GP), gender, socioeconomic status, peer, emotional, conduct, and hyperactivity difficulties, all at age 5 years, as covariates because these have all been previously associated with prosociality. The most parsimonious model was assessed by evaluating the model fit statistics, specifically the Akaike Information Criterion (AIC) and the sample size adjusted Bayesian Information Criterion (BIC). Better fitting models were indicated by lower values. Entropy measures were also used to assess how accurately the children were classified into the chosen model, with higher values (range 0–1) indicating better classification. The Lo-Mendell Rubin (LRT) adjusted likelihood test identified the best model, with non significance indicating the previous model as the most appropriate fit for the data. Finally, the interpretability of classes was considered.

7.4.3. Research question 3

Differences in class membership based on group were estimated using four separate logistic regression models, one for each class. A dummy variable was created for each class, which was entered as the outcome variable. Group was entered as the predictor. This was then repeated for models that included gender and socioeconomic status as predictors. Then the four logistic regression models were repeated and the group variable was replaced with severity of r-DLD, which was the group of children who were identified as r-DLD by both parent report and direct assessment of expressive language (and compared to those who were identified as r-DLD based on one of the two criteria). Following this, two regression models were run to investigate whether expressive language ability was different between the classes at age 5 and 11 years.

7.4.4. Research question 4

Four multiple linear regression models were then run to investigate whether prosocial trajectory classes predicted psychosocial difficulties when the children at risk of DLD were 11 years old. The outcome variable was entered as one of the psychosocial difficulties. The predictor variables were class (stable high as the reference class) with gender, socioeconomic status at age 11, and psychosocial difficulties at age 5 years as covariates. For example, for the first regression model, emotional problems at age 11 years was entered as the outcome variable, the predictor was class (stable high, stable slightly low, decreasing to slightly low, or increasing to high) with gender, socioeconomic status at age 11, and emotional problems at age 5 years as covariates. This was then repeated for the other three measures of psychosocial difficulties (peer problems, conduct problems, and hyperactivity).

8. Results

8.1. r-DLD and GP profiles

The r-DLD and GP group profiles are shown in Table 1. Logistic regression models showed that the r-DLD group had significantly fewer females compared to the GP comparison group and children in the r-DLD group were more likely to be from a low socioeconomic background compared to children in the GP comparison group. As expected, linear regression models showed that children in the r-DLD group had poorer expressive language at ages 5 and 11 years. They also had lower prosociality scores at ages 5, 7, and 11 years compared to children in the GP comparison group. Furthermore, in terms of psychosocial difficulties, children at risk of DLD had more emotional, peer, and conduct problems as well as higher levels of hyperactivity at age 11 years.

8.2. Development of prosociality over time

A mixed effect Poisson regression model was run to investigate the development of prosociality for children in the r-DLD and GP comparison groups (research question 1). See Fig. 2 for a visual illustration of these developmental trajectories. Overall, there was an increase in prosociality between the ages of 5 and 7 years, as indicated by a significant linear effect of time, ($b = 0.05$ [0.04,0.06], $p < .001$). There was also an increase in prosociality between the ages of 7 and 11 years, but the rate of increase was slower compared to that between 5 and 7 years, as indicated by a significant quadratic effect ($b = -0.003$ [-0.003, -0.002], $p < .001$). Children in the r-DLD group had lower prosociality scores compared to children in the GP comparison group ($b = -0.03$ [-0.06, -0.01], $p = .007$). The interaction between group and quadratic and linear effect of time was not significant, *ps* $> .39$, indicating the overall rate of change between the ages of 5 and 11 years old was equivalent for children in the r-DLD group and the GP comparison group.

Table 1
Between Group Comparisons of Psycholinguistic Profiles and Psychosocial Difficulties at age 11 Years.

	GP (n = 12,972; 94 %)	r-DLD (n = 738; 6 %)	Test Statistics	Effect Size *d*
Psycholinguistic profiles				
Gender *n* (% females)	6522 (50 %)	251 (34 %)***	0.51 [0.41, 0.63]	–
Socioeconomic Status	3963 (31 %)	442 (60 %)***	3.40 [2.62, 4.24]	–
Expressive Language				
5 years	110.54 (13.15)	84.36 (18.23)***	−26.28 [−28.21, −24.35]	1.95
11 years	121.59 (15.20)	109.41 (21.15)***	−12.18 [−14.13, −10.23]	0.78
Prosociality				
5 years	8.41 (1.63)	8.02 (1.80) ***	−0.40 [−0.58, −0.21]	−0.24
7 years	8.63 (1.59)	8.31 (1.74)**	−0.32 [−0.50, −0.14]	−0.20
11 years	8.80 (1.53)	8.47 (1.79)**	−0.23 [−0.46, −0.01]	−0.21
Psychosocial difficulties at 11 years				
Emotional problems	1.83 (1.98)	2.49 (2.08)***	0.59 [0.38, 0.79]	0.33
Peer problems	1.32 (1.68)	1.86 (1.77)***	0.40 [0.22, 0.57]	0.32
Conduct problems	1.42 (1.63)	1.93 (1.76)*	0.25 [0.04, 0.46]	0.31
Hyperactivity	3.07 (2.42)	4.02 (2.59)***	0.59 [0.32, 0.87]	0.39

*** $p < .001$; ** $p < .01$; * $p < .05$. For binary outcome variables (gender and socioeconomic status) values are number (%). For continuous outcomes variables, values are mean (standard deviation). Test statistics are odds ratios [95 % confidence intervals] for binary outcome variables and unstandardised regression coefficients [95 % confidence intervals] for continuous outcome variables. Note. Language data was not collected at age 7.

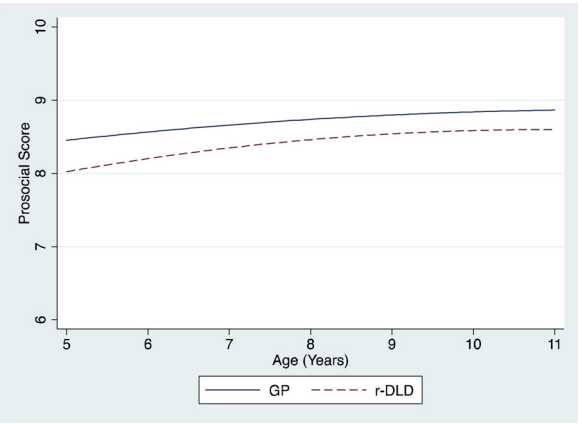

Fig. 2. Development of prosociality for children in the r-DLD and GP comparison groups.

8.3. Prosociality trajectory classes

Latent growth curve models, using Poisson regression, were evaluated to investigate between two and six classes with differing trajectories of prosociality between the ages of 5 and 11 years old (research question 2). Model fit statistics and model selection criteria are shown in the supplementary materials (Table S1). The four class quadratic solution was the most parsimonious based on model fit statistics and interpretability (AIC = 107500.998, sample size adjusted BIC = 107805.463, entropy = 0.521, and LRT $p < .001$). As show in Fig. 3, the four classes were: stable high (n = 2,497, 18 %), stable slightly low (n = 4,881, 35 %), decreasing to slightly low (n = 764, 6 %), and increasing to high (n = 5,589, 41 %). Children in the stable high class had prosociality in the upper end of the average range from age 5 to 11 years old. The stable slightly low class had slightly low levels of prosociality from age 5 to 11 years old. The decreasing to slightly low class had close to average levels of prosociality at age 5 years old but by age 11 years old, this decreased to slightly low. Finally, whilst the increasing to high class consistently had close to average levels of prosociality, their prosociality increased from the lower end of the average range at age 5 years old to the upper end of the average range by age 11 years old.

Differences in class membership based on group (r-DLD or GP) were estimated using logistic regression models (research question 3). Children in the r-DLD group were less likely to be in the stable high class (OR 0.62, 95 % CI 0.45, 0.86, p = .004) and more likely to be in the stable slightly low class (OR 1.28, 95 % CI 1.04, 1.58, p = .022) compared to children in the GP comparison group. There were no significant differences between groups for the decreasing to slightly low class (OR 0.81, 95 % CI 0.51, 1.27, p = .354) or increasing to high class (OR 1.05, 95 % CI 0.85, 1.28, p = .671). Comparisons of class membership by gender, socioeconomic status, consistency of the r-DLD identification, and expressive language ability are shown in the supplementary materials.

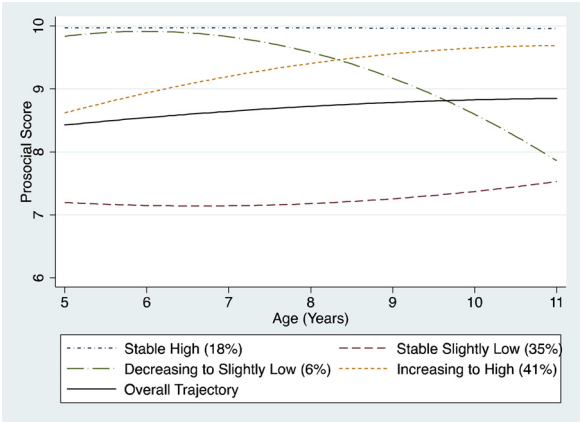

Fig. 3. Prosociality classes from early to middle childhood. Prosocial scores of 6 are low, 7 are slightly low, and 8-10 are close to average.

8.4. Psychosocial difficulties at 11 years for children in the r-DLD group

Finally, we ran a number of multiple linear regression models to investigate whether prosocial trajectory classes predicted psychosocial difficulties when the children at risk of DLD were 11 years old (research question 4). As shown in Table 2, children at risk of DLD, who were in the stable high class, had fewer emotional, peer, and conduct problems and lower levels of hyperactivity compared to those in the stable slightly low and decreasing to slightly low classes, with the exception of the comparisons for emotional problems to stable slightly low and hyperactivity to decreasing to slightly low class. Children at risk of DLD who were in the stable high class did not, however, have fewer emotional, peer, and conduct problems or lower levels of hyperactivity compared to the children in the increasing to high prosociality class. For both of these classes, the levels of prosociality were similar at age 11, which suggests that concurrent rather than earlier levels of prosociality are protective against psychosocial difficulties during middle childhood in children at risk of DLD.

9. Discussion

In this population based longitudinal study of children, for the first time, we compared the development of prosociality in young children at risk of developmental language disorder (DLD) to a general population comparison group. Overall, our findings indicate that there are four patterns of prosociality from early to middle childhood – stable high, stable slightly low, decreasing to slightly low, and increasing to high. These patterns are similar to previous findings – the two stable trajectories replicate the findings of Cote et al. (2002) while the decreasing trajectory replicated Kokko et al. (2006). The increasing pattern found in this analysis bears resemblance to the increasing trends in Nantel-Vivier et al. (2014) findings. Thus, the patterns found within different papers in the previous literature are replicated within this single analysis, providing further evidence of the heterogeneous nature of prosociality across development.

Table 2
Between Class Comparisons of Psychosocial Difficulties at age 11 Years for Children at Risk of Developmental Language Disorder.

	Emotional Problems at 11 years	Peer Problems at 11 years	Conduct Problems at 11 years	Hyperactivity at 11 years
Mean scores				
Stable High **(n = 84;11 %)**	1.76 (1.79)	1.13 (1.26)	0.99 (1.26)	2.50 (2.35)
Stable Slightly Low **(n = 313; 42 %)**	2.74 (2.14)	2.11 (1.73)	2.61 (1.88)	4.89 (2.54)
Decreasing to Slightly Low **(n = 93; 6 %)**	3.31 (2.31)	2.84 (2.27)	2.29 (1.68)	4.32 (2.36)
Increasing to High **(n = 299; 41 %)**	2.29 (1.99)	1.66 (1.75)	1.39 (1.46)	3.44 (2.43)
Regression Analyses				
Stable High **(n = 84;11 %)**	0 [Reference]	0 [Reference]	0 [Reference]	0 [Reference]
Stable Slightly Low **(n = 313; 42 %)**	0.55 [−0.03, 1.14]	0.57 [0.15, 1.00]**	0.72 [0.23, 1.20]**	1.11 [0.31, 1.92]**
Decreasing to Slightly Low **(n = 93; 6 %)**	1.26 [0.29, 2.25]*	1.64 [0.65, 2.63]**	0.77 [0.04, 1.49]*	1.11 [−0.06, 2.29]
Increasing to High **(n = 299; 41 %)**	0.09 [−0.52, 0.72]	0.23 [−0.20, 0.66]	−0.16 [−0.59, 0.27]	0.05 [−0.72, 0.82]

*p < .05, **p < .01, ***p < .001. Note. Values are means (standard deviation). There were four multiple regression models each with a differing outcome variable: emotional problems, peer problems, conduct problems, and hyperactivity. For the regression models the values are unstandardised betas [95 % confidence intervals]. All models included class as the main predictor and the covariates were gender, socioeconomic status at age 11 years, and earlier problems (e.g., when the outcome variable was emotional problems at age 11 years, earlier problems refers to emotional problems at age 5 years). The covariates have been omitted from this table for ease of comprehension but are included in the supplementary materials.

This study uniquely identified both differing trajectories of prosociality across early to middle childhood, but also evaluated prosociality in children at risk of DLD. Our study demonstrates that children at risk of DLD are less prosocial in early childhood and, although they do become more prosocial, they do not reach the same levels of prosociality in middle childhood as their unaffected peers, but rather improve their prosocial skills at the same rate, effectively maintaining their deficit across time. In spite of this group level difference, we found that children at risk of DLD were within the normal range of prosociality, which is in agreement with previous work with adolescents and young adults with DLD (Lindsay & Dockrell, 2012; Toseeb et al., 2017). Indeed, their deficit in prosocial skills at each time point is moderate with only a small effect size. These findings confirm that prosociality is not a key area of concern for children at risk of DLD and is in fact an area of relative strength which should be nurtured to promote more positive development.

When evaluating where children at risk of DLD fit within the trajectory groups, we found that 42 % of children at risk of DLD (vs 36 % of the comparison sample) have slightly low levels of prosociality and do not show any improvement from early to middle childhood. In addition to this, fewer children at risk of DLD (11 % of children at risk of DLD vs 17 % of the comparison sample) have stable high levels of prosociality from early to middle childhood. These findings indicate that children at risk of DLD are more likely to maintain a lower level of prosociality across development, perhaps indicating the importance of promoting the early development of prosocial skills prior to 5 years of age. However, children at risk of DLD are represented in the two subgroups with changing trajectories of prosociality, but they are not more or less likely to be in these groups. Future work should investigate the risk factors for consistently low levels of prosociality in children with DLD in order to aid the identification of ways to promote prosociality in groups at high risk of language difficulties.

Finally, our results confirm that being prosocial is protective against psychosocial difficulties in children at risk of DLD. In these children, higher prosocial skills in middle childhood relate to fewer psychosocial difficulties in middle childhood. Our findings show that for children at risk of DLD earlier levels of prosociality are not protective against later psychosocial difficulties. Subgroups with lower levels of prosociality in early childhood, but higher prosocial skills in middle childhood, did not have increased psychosocial difficulties in middle childhood. Conversely, subgroups with higher early prosocial skills and lower skills in later childhood are at increased risk of psychosocial difficulties in middle childhood. These results indicate that it is the concurrent levels of prosociality which is either a protective or a risk factor in relation to psychosocial difficulties. Our findings are in line with previous work on prosociality in children and adolescents with DLD (Mok et al., 2014; Toseeb et al., 2017) and extend previous work as they show that deficits in prosociality during early childhood can be compensated for in middle childhood. However, combined with our previous findings that children at risk of DLD are over-represented in the stable slightly low group it appears that fewer children at risk of DLD are gaining the protective prosocial skills between early and middle childhood.

There are interesting clinical implications for our study. The results indicate that it is concurrent prosociality that is predictive of psychosocial difficulties, but also that children at risk of DLD are less likely to have high prosocial skills. This may indicate that if prosociality is nurtured and encouraged in children at risk of DLD they may have fewer psychosocial difficulties. Indeed, if prosocial skills are developed from a lower to higher level by middle childhood, children at risk of DLD may have similar levels of psychosocial difficulties compared to children who were consistently prosocial throughout childhood. This indicates that prosociality is an area where, if nurtured, may help remediate longer term psychosocial difficulties, perhaps by improving children's peer relationships. This has resonance with recent findings within this same sample that increased emotional problems in children at risk of DLD was partially mediated by earlier peer problems (Forrest et al., 2018).

Future research should evaluate how strategies to encourage more empathy and helping behavior in children with DLD could improve both more general prosocial behavior as well as peer relationships, potentially leading to a reduction in psychosocial difficulties. Furthermore, more generally this research has implications for school policy. General policies to encourage prosocial behaviours may have a lasting effect of reducing related psychosocial difficulties in both children at particular risk, such as our children at risk of DLD, but more generally for all school children. Additionally, parental encouragement of helping behaviours and empathy in children may have a similarly protective effect on related psychosocial difficulties. In general population samples, children are highly succeptible to peer influence with regards to prosocial behaviour (Foulkes et al., 2018) and school based interventions are effective at increasing the levels of prosocial behaviour (Durlak et al., 2011). What is less clear is the extent to which these effects are also observed in children with DLD and thus should be the focus of future research in this area.

A major strength of our work is the large population based sample. This allowed for accurate estimates of prosociality and psychosocial difficulties within the UK population. Children who have been referred to services often have more severe problems and so are not representative of the heterogeneity in the general population, which leads to estimation bias. Evaluating language difficulties in a population cohort enhances the literature by expanding on findings found in clinical populations to evaluate whether the same relationship is found at a broader level without the estimation bias inherent within a clinical sample. Indeed, these findings, as well as previous findings using the r-DLD classification (Forrest et al., 2018; St Clair et al., 2019), are consistent with the literature looking at clinically identified children and adolescents with DLD.

Our definition of "risk of DLD" is both a strength and a weakness of the current paper. Our categorisation is in line with recent recommendations (Bishop et al., 2016) to combine both a parent report of significant language difficulties alongside a measure of language ability, in this case expressive language. Within cohort data, our categorisation relying on both standardised testing and parent report enhances our chances of capturing children with more than just clinical level expressive deficits. As looking at expressive language alone would mask significant difficulties in other domains of language, such as receptive language, syntax development, and pragmatic language, a combined approach was considered more appropriate than a single indicator alone. As mentioned previously, when results from previous work with this definition have been separated by each individual criteria, the results have been strikingly similar to the combined results, indicating these two criteria are identifying similar child – those at risk of

having DLD.

However, caution should be exercised when generalising these findings to children with deficits in other aspects of language or children with diagnosed language disorders, such as DLD. The lack of a clinical marker of DLD, or a definitive diagnosis question regarding language disorders within the MCS, is a weakness of this study and our findings should interepreted with this limitation in mind. Our measure of prosociality, the SDQ prosocial scale, could also be improved. We only evaluated parent report of prosocial skills within a five item subscale as there are ethical and practical limitations of what can be measured in depth in a cohort study. Teachers may be more accurate than parents at reporting prosocial behaviour in children of a similar age. Parents tend to only have their own children to use a reference whereas teachers come across lots of other children and so may be better placed to make comparisons. Additionaly, a more comprehensive measure of prosociality would allow for practical recommendations to be made about the nature of prosocial behaviours that are protective against psychosical difficulties in children with DLD. For example, it may be that prosocial behaviours that are spontaneous and driven by the child are more effective than those which are part of a structured activity, driven by a parent and/or teacher. If this is the case, then it would suggest that interventions should focus on teaching children the importance of being prosocial and allowing them to come up with their own ways of being prosocial.

9.1. Conclusions

Overall, children at risk of DLD have lower levels of prosociality in early childhood and, although they do become more prosocial over time, they do not reach the same levels of prosociality in middle childhood compared to their unaffected peers. There is considerable heterogeneity in the development of prosociality in children at risk of DLD, which is masked by overall group differences. Being prosocial in middle childhood is protective against psychosocial difficulties in middle childhood. For children at risk of DLD, prosociality in early childhood does not mitigate against psychosocial difficulties in middle childhood unless the levels of prosociality are maintained through to middle childhood. Similarly, the absence of prosociality in early childhood does not make psychosocial difficulties in middle childhood inevitable as long as the levels of prosociality increase by middle childhood. Overall, this suggests that even in children who do not show high levels of prosociality earlier in development, late onset prosociality might help create resilience against psychosocial difficulties.

CRediT authorship contribution statement

Umar Toseeb: Conceptualization, Methodology, Software, Formal analysis, Writing - original draft, Writing - review & editing, Visualization, Supervision, Funding acquisition. **Michelle C. St Clair:** Conceptualization, Methodology, Validation, Resources, Writing - review & editing.

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Appendix A. Supplementary data

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