

Title: Developmental trajectories of behaviour problems and prosocial behaviours of children with intellectual disabilities in a population-based cohort

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Running Head: Trajectories of Behaviour Problems in Children with ID

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Abstract

Background: The study examined developmental trajectories of prosocial behaviours, internalising and externalising behaviour problems in children with intellectual disabilities (ID) between pre-school and middle childhood.

Method: Growth models examined the best-fitting trajectories for internalising and externalising behaviour problems, as well as prosocial behaviours, in 555 children with ID between the ages of three and 11 years from the UK Millennium Cohort Study. Models were also fitted to examine the association of child outcomes with time-varying maternal psychological distress and life satisfaction. Finally, models were extended to compare trajectories with typically developing children.

Results: Externalising behaviour problems and prosocial behaviours generally improved, whereas internalising problems did not change systematically over time. A cubic trend indicated a slowing down of improvement between ages 5 and 7 for prosocial behaviours and externalising problems. Maternal psychological distress positively co-varied with internalising and externalising behaviour problems over time. Life satisfaction was not related to changes in child behaviours over time. Compared to behavioural trajectories in typical development, intercepts were worse and trajectories also differed in the ID group.

Conclusion: Over an 8-year period, externalising behaviour problems and prosocial behaviours of children with ID tended to improve. These behavioural improvements slowed between five and seven years, possibly coinciding with school-related environmental changes. Children with ID significantly differ from children with typical development in both the initial level of difficulties (exhibiting higher externalising and internalising behaviours, and lower prosocial behaviours) and subsequent development as they age, showing comparatively lower decreases in both externalising and internalising behaviours, and lower increases in prosocial behaviours. Findings also highlight the significant role of maternal mental health problems in the trajectory of child behaviour problems.

Key points

- On average, externalising and prosocial behaviour problems improved over time for children with intellectual disability (ID), but showed a deceleration between ages 5 and 7.
- Maternal psychological distress positively covaried with externalising and prosocial behaviours.

TRAJECTORIES OF BEHAVIOURAL PROBLEMS IN CHILDREN WITH ID

- In comparison to TD children, behaviour problems and prosocial behaviours were worse for children with ID at age 3; with trajectories of behaviour problems and prosocial behaviours also differing for children with ID.
- Intervention for children with ID may be warranted, both in the early years, and throughout their development, and particularly for those whose mothers experience high levels of psychological distress.

Introduction

Intellectual disability (ID) is a term that refers to an aetiologically diverse range of conditions, characterised by below average intellectual functioning and reduced adaptive skills (WHO, 2018). Childhood prevalence of ID is between 1.5% and 2.1% of the population (Maulik, Mascarenhas, Mathers, Dua, & Saxena, 2010). Clinically concerning levels of externalising and internalising behaviour problems in children with ID are higher when compared to children who are typically developing (TD). Emerson and Hatton (2007) reported conduct disorders to be 5.7 times more prevalent in children with ID, and anxiety disorders 3.9 times more prevalent than in TD children. An increased risk for clinical levels of behaviour problems is evident from a very early age (around two to three years; Emerson & Einfeld, 2010). Children with ID also have lower levels of prosocial behaviours (i.e. behaviours that lead to social competence and successful social interactions and relationships with peers; Stump, Ratliff, Wu, & Hawley, 2009) (Emerson, 2003), which are associated with the limitations in adaptive skills but also higher levels of behaviour problems (Kearney & Healy, 2011).

Whilst the evidence of significant differences from the TD population is established, there is limited understanding of how the behaviour of children with ID changes over time during childhood. Understanding the course of change within this population allows insight into periods for targeted intervention. Amongst the few researchers who examined the trajectories of behaviour problems of children with ID, Neece, Green, and Baker (2012) suggested total behaviour problems decrease over time in a linear trajectory but less than half of their overall sample had ID. Cohort studies extending into adolescence have suggested linear decreases in internalising (Einfeld et al., 2006) and externalising behaviour problems (De Ruiter, Dekker, Verhulst, & Koot, 2007) in ID; albeit examining older children transitioning into adolescence and adulthood. In TD children, internalising and externalising behaviour problems fit better curvilinear trajectories (Bongers, Koot, van der Ende, & Verhulst, 2003) with Flouri, Midouhas, and Joshi (2014) reporting an increase in both externalising and internalising behaviour from ages 3 to 5, followed by a lull between 5 and 7. No studies to date appear to have examined the trajectory of prosocial behaviours in children with ID, though some evidence from children with autism suggests non-linear improvements over time (Russell, Golding, Norwich, Emond, Ford, & Steer, 2012).

Research on proximal environmental factors associated with behaviour problems points to maternal mental health and psychological distress as one of the family variables most closely related to both behaviour problems and prosocial behaviours of children with ID (Emerson, 2003; Hastings, Daley, Burns, & Beck, 2006; Minnes, Perry, & Weiss, 2015; Neece & Baker, 2008; Totsika et al., 2015). In the only study using multiple time points, Gray et al. (2011) reported longitudinal covariation between maternal psychological distress and child behaviour problems as children with ID

from a large Australian cohort moved into adulthood. Initial levels of maternal distress predicted internalising and externalising behaviour problems, but there was no significant covariation over time between these two measures (Gray et al., 2011).

Maternal mental health may also have different associations than well-being. Short-term longitudinal studies (with two/three time-points) have demonstrated inverse, albeit small, associations between maternal life satisfaction and overall behaviour problems of children with severe ID (Jess, Totsika, & Hastings, *in press*), autism (Totsika, Hastings, Emerson, Lancaster, Berridge, & Vagenas, 2013), and with prosocial behaviour of children with autism with and without ID (Totsika et al., 2015). This research, however, did not examine how maternal life satisfaction may relate to over time change in child behaviour problems or child prosocial behaviour.

Of the aforementioned studies, few have sought to compare trajectories of children with ID to a typically developing (TD) population. Neece, Green, and Baker (2012) reported higher initial total behaviour problems for children with ID, but also greater age-related decreases in behaviour problems compared to TD children. Further, although cross-sectional studies have highlighted both positive and negative impacts on maternal mental health outcomes when caring for a child with ID (Totsika et al., 2011), there is a paucity of research comparing the longitudinal relationship between maternal mental health and child behaviour problems or prosocial behaviours.

We sought to examine the developmental trajectories of prosocial behaviours, and internalising and externalising behaviour problems in children with ID over a period of 10 years. The aim was to understand the shape of the trajectory that best describes change in these behaviours from pre-school to mid-childhood. The second aim of the study was to examine whether maternal mental health (specifically, psychological distress and life satisfaction) co-varied with the trajectories of children's behaviour. We controlled for exposure to economic deprivation and also the presence of autism, both of which have been associated with heightened difficulties in behaviour problems or prosocial behaviours in ID (Emerson, & Einfield, 2010; Estes, Munson, Dawson, Koehler, Zhou, and Abbott, 2009; Totsika, Hastings, Emerson, Lancaster, & Berridge, 2011). The third and final aim of the study was to examine the above findings in comparison to TD children.

Methods

Following approval from the Humanities & Social Sciences Research Ethics Committee for a larger series of secondary data analysis projects (ethical application reference 53/15-16), data were utilised from the Millennium Cohort study (MCS), a longitudinal cohort study of children in the United Kingdom (UK) born between September 2000 and January 2002. MCS participants were randomly selected from UK child benefit records (at the time of study design, this was a non-means tested

welfare benefit available for all UK children with very high uptake rates). Sampling was disproportionately stratified to ensure adequate representation of all four UK countries, ethnic minorities, and areas of high deprivation. The present study draws on data across four waves: when children were aged three years (MCS2), five (MCS3), seven (MCS4), and 11 years (MCS5). Baseline data was also utilised from when children were aged 9 months (MCS1).

Participants

Data from 555 children with ID (see Measures) were used. Within the ID sample, almost two-thirds of children were male (64.5%) and most were White British (57.3%), with Asian/Asian-British children the next most prevalent ethnic group (27.7%). At three years of age, over half (60.4%) were living in families experiencing income poverty. 38 of these children had a co-diagnosis of autism (see Measures). Data for 413 of these children were available at age 3 and 330 at age 11. Child ages at the MCS waves (MCS2 to MCS5) were 2.90 years ($SD = .26$ years), 5.25 years ($SD = .25$ years), 7.24 years ($SD = .23$ years), and 11.22 years ($SD = .34$ years).

Data on maternal mental health at child age 3 were available for 353 mothers who were aged on average 30.50 years ($SD = 6.37$, range = 19 to 48 years). Of those, 99.8% identified as the child's biological mother. At child age 11, data for 283 mothers were available.

A comparative sample of 16,303 children without ID (and their mothers) was also utilised. At child age 3, data were available for 14,726 children without ID and 14,683 mothers of children without ID. Mothers were on average 31.89 years of age ($SD = 5.92$). Child ages at the MCS waves for those without ID were 3.14 years ($SD = .21$ years), 5.22 years ($SD = .25$ years), 7.23 years ($SD = .25$ years), and 11.17 years ($SD = .33$ years).

Measures

Identification of intellectual disability. Standardised cognitive assessments were administered to MCS participants by trained interviewers at age 3, 5 and 7. In an iterative process starting at age 7, children whose scores on an overall cognitive factor (g) (derived from the standardised cognitive assessment scores) were two or more standard deviations below the mean g were used to identify ID. These data were supplemented by standardised cognitive assessments at earlier time points (ages 3 and 5) for those without age 7 cognitive assessments. For the small percentage of children without cognitive assessments parent and teacher reports of special educational needs and teacher-rated performance across five academic outcomes as “well below average” were used throughout MCS waves. The process which is described in more detail elsewhere (Totsika, Hastings, Emerson, & Hatton, 2019)

resulted in the identification of 555 children with ID (unweighted N; or 2.7% weighted ID prevalence).

Child behaviour. The Strength and Difficulties Questionnaire (SDQ; Goodman, 1999) measures prosocial behaviours, and behaviour problems in children aged 2 to 17 years old. SDQ scores were obtained from main respondent report across all four data waves. The SDQ includes 25 items rated on a 3-point scale ranging from not true to certainly true. Five SDQ items are used to measure the child's prosocial behaviour. Cronbach's alphas for prosocial behaviour ranged from .71 to .77 across the four waves of measurement. Internalising behaviour problems is a composite score obtained by summing 10 SDQ items on emotional problems and peer relationships (Goodman, Lamping, & Ploubidis, 2010). Internal consistencies ranged from .66 to .77. Externalising behaviours were measured drawing on 10 SDQ items for conduct problems and hyperactivity/inattention (Goodman et al., 2010), with alpha coefficients ranging from .77 to .82.

Child age. To assess the within-person change in the three child outcome measures, individual child age was coded as age in months and centred at age 3 (i.e. time 0 \approx 0 months, measured around 3 years) with subsequent time points at age 5 (time 1 \approx 24 months), age 7 (time 2 \approx 48 months), and age 11 (time 3 \approx 96 months).

Autism. At age 7, main respondents indicated whether any doctor or health professional ever told them that their child had autism or Asperger's syndrome. This carer report was used in the present study to indicate presence of autism.

Maternal psychological distress. The Kessler (K6) scale (Kessler et al., 2002) is a brief measure developed as mental health screen for the general population. At each of the four waves, mothers rated the extent to which they had experienced six key symptoms (depressed, hopeless, restless or fidgety, worthless, or that everything was an effort) across the past 30 days. The K6 has very good concordance with DSM-IV clinical diagnoses of serious mental illness (Kessler et al., 2003), and shows consistency in measurement across different respondent demographics (Baillie, 2005). As a continuous measure, it indicates psychological distress. Internal consistency was .92 (alpha) across all four time points.

Maternal life satisfaction was measured with a single item across all four waves. At each time point, respondents were asked how satisfied they were with how their life had turned out so far (rated from 1 to 10), with higher values indicating greater satisfaction. Single-item measures of life satisfaction have good validity in relation to longer measures of life satisfaction/subjective well-being and also excellent longitudinal stability (Baird, Lucas, & Donnellan, 2010).

Family deprivation. A four item composite measure of family deprivation was created at each of the four waves: income poverty (OECD < 60% of median UK income), subjective poverty (main respondent's report of finding it quite/very difficult to manage financially vs. managing well

financially), parental unemployment (no parent in the household was working vs. at least one working), and neighbourhood deprivation (living in an area ranked at the bottom decile for the UK population, as assessed by the Index of Multiple Deprivation (IMD); Payne & Abel, 2012). At each wave, deprivation scores ranged from 0 to 4, with higher scores indicating higher levels of deprivation.

Analysis Procedure

Data were analysed with multilevel models, in which repeated observations across the four waves were nested within people. All analyses were conducted within SPSS v.23. An initial set of five unconditional means models were fitted to examine both the between and within-person variance of child behaviour (prosocial behaviour, internalising, and externalising behaviour problems). Growth models examined the age-related trajectories of the child behaviours, and thus address the initial research question that sought to characterise these trajectories in children with ID. Linear age was entered at the within-person level and allowed to randomly vary across between-person units. Both quadratic and cubic effects for age were entered as fixed predictors. These models capture the incremental within-persons variance explained by the respective age trajectories. Age terms were added into the model sequentially (age, age², and age³), with the optimal trajectory (for these and subsequent models) identified by a significant change in the -2 Log-Likelihood (Raudenbush & Bryk, 2002) when compared to the previous model. The models were then expanded, by adding a between-person predictor for the presence of autism (coded 1 for co-occurring ASD and 0 for those without ASD, as per the measure available within the MCS), and a cross-level interaction with this variable and the within-person predictor age. These models allow us to examine the age-related trajectory of child behaviours accounting for the presence of autism.

To address the second research question of co-variation with maternal mental health, maternal psychological distress and life satisfaction were entered into the aforementioned models as time-varying predictors. These models also accounted for family deprivation, modelled at both the between and within-persons level. To examine the extent to which age-related trajectories of child outcomes covaried with maternal mental health and family deprivation, the time-varying predictors were then group-mean centred and added to the model as fixed predictors of each of the three outcomes at the within-person level, whilst controlling for their (grand-mean centred) means at the between-person level (cf., Raudenbush & Bryk, 2002). All models utilised the combined (longitudinal) sampling and attrition weight provided within the MCS.

To address the third research question of how (a) child behaviour trajectories, and (b) their association with maternal mental health, differed between children with ID and TD children, we added a TD comparison group to the final models. To achieve a better balance between the two

groups, a propensity score was created using the aforementioned baseline covariates (MCS wave 1; age 9 months), using the ‘psmatch2’ package within Stata v.14. The baseline covariates were child gender, poverty (i.e. below/above 60% median income), self-rated financial status, IMD decile, at least one parent working vs. workless household, mother’s age at child’s birth, child birth weight, and mother’s gestation time. The relationships between the baseline covariates and group membership are shown in Appendix S1. The propensity score was added to the final models as a fixed factor alongside the baseline covariates, thereby creating a doubly robust model to balance the groups on a number of characteristics (Elze et al., 2017). However, propensity scores showed substantial overlap between the two groups and sensitivity analyses suggested there was little value in including the propensity scores in addition to the covariates (Elze et al., 2017). As such, analyses utilised the aforementioned baseline covariates, but without the propensity scores. We also produced unconditional growth models for the TD comparison group alone; to compare pictorially with the equivalent aforementioned models for children with ID.

Missing data for the ID group ranged from 19.8% (age) to 41.5% (maternal life satisfaction) and increased over time for all variables. Data were not found to be missing completely at random as Little’s MCAR test was significant ($\chi^2(103) = 265.445, p < .001$), but point-biserial correlations examining the relationship between missingness on the predictor variables (coded 1 = missing, 0 = non-missing) and scores on the outcome variables were small (r_{pb} ’s $\leq .11$), thus inferring data were missing at random (i.e. MAR; Garson, 2015). Multilevel analysis is robust to MAR data. All models utilised restricted maximum likelihood (REML) estimation. Maximum likelihood estimation appears to show less bias than imputation methods in longitudinal analyses (Twisk, de Boer, de Vente, & Heymans, 2013).

Results

Means and standard deviations for all time-varying variables are presented in Table 1. For both the children with ID and the TD children, prosocial behaviours and internalising behaviour problems increased across the four MCS waves, whereas externalising behaviours decreased, although these changes appeared to be non-linear. Whilst maternal distress increased across the four MCS waves and maternal life satisfaction decreased for the children with ID, in the sample of TD children maternal distress decreased, whilst maternal life satisfaction increased. Again, all changes appeared to be non-linear.

INSERT TABLE 1 HERE

Age-related Trajectories of Child Behaviours

Children with ID. The change over time in prosocial behaviours showed significant linear ($\beta = .774, p < .001$), quadratic ($\beta = -.189, p < .001$), and cubic ($\beta = .013, p < .001$) rates of change, with the cubic trajectory optimal ($\Delta -2LL(1) = 6.487, p = .011$). These results suggest that an initial increase in prosocial behaviours between 3 and 5 years was followed by a slowing of this trajectory between the ages of 5 and 7, and a subsequent further increase between 7 and 11. The cubic age trajectory accounted for 22.8% of the within-person variation in prosocial behaviour.

Internalising behaviour problems did not significantly change over time in a linear manner ($\beta = -.129, p = .588$), nor was there significant age-related change observed for quadratic ($\beta = .090, p = .261$) or cubic ($\beta = -.006, p = .363$) patterns of change, suggesting that there was no systematic pattern of change in internalising behaviour between 3 years and 11 years. The linear trajectory accounted for 21.1% of within-person variation in internalising behaviour.

Externalising behaviour scores showed significant linear ($\beta = -1.254, p < .001$), quadratic ($\beta = .324, p < .001$), and cubic ($\beta = -.023, p < .001$) change, with the cubic trajectory adjudged to be optimal ($\Delta -2LL(1) = 6.376, p = .011$). This pattern of findings suggests that the initial decrease in externalising behaviour between 3 and 5 years slowed around the ages of 5 and 7, and was then followed by a further decrease between 7 and 11 years. The cubic age trajectory accounted for 17.3% of within-person variation in externalising behaviour.

Unconditional trajectories for prosocial behaviours and externalising behavioural problems in the ID sample are shown in Figure 1.

Comparison with TD children. Children with ID had significantly lower average prosocial behaviours at age 3 ($\beta = -.461, p = .004$). Whilst the linear change in prosocial behaviours did not significantly differ based on whether the child had ID ($\beta = .221, p = .154$); quadratic ($\beta = -.123, p = .019$), and cubic ($\beta = .011, p = .010$) changes were significantly different for children with ID as compared to TD children. These results suggest that the slowing of improvement in prosocial behaviours around ages 5 to 7 is greater for children with ID; although the subsequent increase in prosocial behaviours between ages 7 and 11 is also greater for children with ID compared to TD children.

Children with ID had significantly higher internalising behaviour scores at age 3 ($\beta = 1.135, p < .001$), and the linear increase in internalising behaviour problems ($\beta = .049, p < .001$) was significantly greater for children with ID ($\beta = .188, p < .001$). Thus, compared to TD children, children with ID experienced greater increases in internalising behaviour over time.

Children with ID had significantly higher externalising behaviour scores at age 3 ($\beta = 1.18, p < .001$), and change in externalising behaviours was significantly different for linear ($\beta = 1.16, p < .001$), quadratic ($\beta = -.263, p = .005$), and cubic ($\beta = .018, p = .019$) changes, based on whether the child had ID. These findings suggest that the decrease in externalising behaviour problems between both ages 3 and 5, and 7 and 11, was less substantial for those with ID as compared to the TD group. The slowing of the decrease in externalising behaviour problems between ages 5 and 7 was less pronounced for those children with ID.

Results for the conditional growth models for all three outcomes are detailed in Appendix S2.

Co-variation with maternal mental health

Children with ID. Neither of the within-person predictors (maternal distress and maternal life satisfaction) covaried with prosocial behaviours ($\beta = -.049, p = .108$; $\beta = .035, p = .476$, respectively), suggesting that age-related changes in these variables were not significantly associated with age-related changes in prosocial behaviour.

Maternal distress positively covaried with internalising behaviours ($\beta = .160, p < .001$), suggesting that child internalising behaviour problems were higher on occasions when maternal distress was higher. However, maternal life satisfaction did not covary with internalising behaviours ($\beta = .160, p = .284$), suggesting that age-related changes in maternal life satisfaction were not significantly associated with age-related changes in child internalising behaviours.

Maternal distress positively covaried with externalising behaviours ($\beta = .119, p = .002$), such that child externalising behaviours were found to be higher on occasions when maternal distress was higher. Maternal life satisfaction ($\beta = .052$), did not covary with externalising behaviour trajectories (all p 's $> .05$), suggesting that age-related changes in maternal life satisfaction was not associated with age-related changes in child externalising behaviours.

Comparison with TD children. The covariation of maternal life satisfaction or maternal distress with prosocial behaviours did not differ between the two groups ($\beta = .085, p = .067$; $\beta = .022, p = .397$ respectively).

The covariation of maternal life satisfaction and internalising behaviour problems was significantly more positive for children with ID ($\beta = .321, p < .001$). However, the covariation between maternal distress and externalising problems did not significantly differ between children with and without ID ($\beta = .069, p = .067$).

The covariation between maternal life satisfaction or maternal distress with externalising behaviour problems were not conditional on whether children had an ID ($\beta = -.043, p = .602$; $\beta = -.015, p = .745$, respectively).

Results for these conditional growth models for all three outcomes with the maternal mental health covariates included are shown in Table 2.

Unconditional behavioural trajectories for both TD children and children with ID are shown in Figure 1. Corroborating the results in the aforementioned growth models, at age 3 the figures depict a higher initial level of prosocial behaviours for TD children compared to children with ID, whilst the initial levels of externalising and internalising behaviour problems are both comparatively lower for TD children. In comparison to children with ID, TD children are shown to exhibit a greater increase in prosocial behaviours between both ages 3 and 5, and ages 7 and 11. The figure also depicts that externalising behaviour problems decreased more rapidly for TD children compared to children with ID between the ages of 3 and 5, and between the ages of 7 and 11 (albeit less so). Finally, it is shown that the linear increase in internalising behaviour problems is greater for children with ID as compared to TD children.

INSERT TABLE 2 HERE

INSERT FIGURE 1 HERE

Discussion

Prosocial behaviours and externalising behaviour problems of children with ID improved between 3 and 11 years of age, albeit with a slowing of improvement between ages 5 and 7; with both behaviours improving in a non-linear (cubic) manner. Improvement of prosocial skills in children with ID is consistent with what is known about longitudinal change among children with other developmental disabilities (e.g. autism; Russell et al., 2012). The improvement in externalising behaviours is also consistent with previous findings from de Ruiter et al. (2007) and Einfield et al. (2006). In previous research change was linear, whereas the current study (specifically examining children with ID) suggests cubic change best describes trajectories of externalising behaviour problems and prosocial behaviours over an 8-year period. The slowing down in improvement of prosocial skills between 5 and 7 years may be related to the additional social demands placed on children when they typically enter the school environment in the UK and have to interact with both teachers and peers. Increased academic demands in the same period may account for the 'lull' in externalising behaviour improvements, alongside factors such as peer victimisation, and conflict with

teachers, that may be associated with children with ID 'acting out' (Silver, Measelle, Armstrong, & Essex, 2005).

Internalising behaviour problems did not show any systematic overall change as children aged, similar to de Ruiter et al.'s (2007) findings. One possibility for this lack of change might relate to the young age of children in our sample, compared with de Ruiter et al.'s research that extended into adolescence. Another possibility is that internalising behaviour problems are less likely than externalising behaviour problems to be affected by changing situational influences (Tzavidis, Salvati, Schmid, Flouri, & Midouhas, 2016).

Regarding the relationship between maternal mental health and child behaviour, our results indicated no significant covariation between maternal life satisfaction with trajectories of internalising, externalising behaviour problems, or prosocial behaviours. The positive (albeit somewhat small) correlations between maternal life satisfaction and behaviour problems in short-term longitudinal studies of young children with ID and those with autism (Totsika et al., 2015) may not replicate across a longer developmental period. In contrast, higher levels of maternal psychological distress were associated with higher levels of externalising and internalising behaviour problems over time (i.e. on occasions where maternal distress was higher, so were children's behaviour problems). This was not the case for the trajectory of prosocial behaviours which did not covary with the trajectory of maternal distress. The association between maternal distress and behaviour problems may be apparent early in the development of children with ID and it continues throughout childhood, but it appears to be specific to child behaviour problems not prosocial behaviours. Gray et al. (2011) found that co-variation over time was present for maternal mental health and child social relating problems (a construct different to prosocial behaviour), but it was not present for externalising or internalising related problems. The difference in the pattern of findings might be related to the childhood period examined: we focused on the first 11 years of life, whereas Gray et al. (2011) studied ages 12 to 23 years.

When comparing children with ID to a TD sample, initial levels (at around age 3) were worse for externalising, internalising, and prosocial behaviours, echoing earlier findings (Neece et al., 2012) and highlighting the potential need for early intervention for children with ID. Descriptive statistics showed that scores for all three of the aforementioned outcomes were worse (at all time points) for children with ID as compared to the TD sample. In addition, children with ID experienced a greater increase in internalising behaviour problems over time. Externalising problems followed a trajectory of improvement overall. However, improvements were less for children with ID between ages 3 and 5, and 7 and 11. Children with ID did experience less deceleration of improvement in externalising behaviours between ages 5 and 7 compared to TD children (perhaps due to range restriction). In contrast, the deceleration in prosocial behaviour gains between ages 5 and 7 was greater for children

with ID than TD children, lending support to our earlier conjecture that behaviour differences between the two groups become more apparent at this 'school entry' time-point. Interestingly though, the improvement in prosocial behaviours between ages 7 and 11 was greater for children with ID than TD children. The comparisons of behavioural trajectories between children with ID and TD children suggest that there are issues that may contribute to differences in development (e.g. bullying, stigmatisation) that have a particularly negative impact on children with ID as they age. With respect to the covariation with maternal mental health, there were very few between group differences. Only the relationship between maternal life satisfaction and internalising behaviour problems differed between the two groups. This relationship was stronger (and more positive) in the ID group, a finding that seems counter-intuitive and would require replication.

While a strength is the use of population-based data from the UK, findings need to be considered in light of some limitations. First, both child behaviour and parental well-being was mostly rated by the same person (the mother), so covariation between maternal well-being and the child's behaviour could also be explained by the impact that the parent's mood has upon their ratings (Boyle & Pickles, 1997). Further, growth curve modelling of group-average trajectories assumes a relatively homogenous cohort. Person-level analyses by Hauser-Cram and Woodman (2016), with a sample including 50% children with ID, suggested substantial variation in the extent to which such children show non-linear changes in externalising and internalising behaviour problems. Future studies should focus on exploring heterogeneity of behavioural trajectories in this population. Glidden and Schoolcraft (2003) also suggested maternal mental health shows heterogeneity as children with ID age. Although the present study did examine risk factors potentially associated with heterogeneity in child developmental trajectories, such as deprivation, and autism, future researchers may wish to examine clusters of trajectories in children with ID (and their mothers), and the extent to which maternal mental health may account for such heterogeneity. Other proximal environmental variables may also be important to examine, for example parenting (Rodas, Chavira, & Baker, 2017).

Reference List

- Baillie, A. J. (2005). Predictive gender and education bias in Kessler's psychological distress scale (K10). *Social Psychiatry and Psychiatric Epidemiology*, 40(9), 743-748.
- Baird, B.M., Lucas, R.E., & Donnellan, M.B. (2010). Life satisfaction across the lifespan: Findings from two nationally representative panel studies. *Social Indicators Research*, 99, 183-203.
- Bongers, I. L., Koot, H. M., Van der Ende, J., & Verhulst, F. C. (2003). The normative development of child and adolescent problem behavior. *Journal of Abnormal Psychology*, 112(2), 179.
- Boyle, M. H., & Pickles, A. R. (1997). Influence of maternal depressive symptoms on ratings of childhood behavior. *Journal of Abnormal Child Psychology*, 25(5), 399-412.
- De Ruiter, K. P., Dekker, M. C., Verhulst, F. C., & Koot, H. M. (2007). Developmental course of psychopathology in youths with and without intellectual disabilities. *Journal of Child Psychology and Psychiatry*, 48(5), 498-507.
- Einfield, S.L., Piccinnin, A.M., Mackinnon, A., Hofer, S.M., Taffe, J., Gray, K.M., Bontempo, D.E., Hoffman, L.R., Parmenter, T. & Tonge, B.J. (2006). Psychopathology in young people with intellectual disability. *Journal of the American Medical Association*, 296, 1981–1989.
- Elze, M. C., Gregson, J., Baber, U., Williamson, E., Sartori, S., Mehran, R., ... & Pocock, S. J. (2017). Comparison of propensity score methods and covariate adjustment: evaluation in 4 cardiovascular studies. *Journal of the American College of Cardiology*, 69(3), 345-357.
- Emerson, E. (2003). Mothers of children and adolescents with intellectual disability: social and economic situation, mental health status, and the self-assessed social and psychological impact of the child's difficulties. *Journal of Intellectual Disability Research*, 47(4-5), 385-399.
- Emerson, E., & Hatton, C. (2007). Mental health of children and adolescents with intellectual disabilities in Britain. *The British Journal of Psychiatry*, 191(6), 493-499.
- Emerson, E., & Einfeld, S. (2010). Emotional and behavioural difficulties in young children with and without developmental delay: a bi-national perspective. *Journal of Child Psychology and Psychiatry*, 51(5), 583-593.
- Estes, A., Munson, J., Dawson, G., Koehler, E., Zhou, X. H., & Abbott, R. (2009). Parenting stress and psychological functioning among mothers of preschool children with autism and developmental delay. *Autism*, 13(4), 375-387.

- Flouri, E., Tzavidis, N., & Kallis, C. (2010). Adverse life events, area socioeconomic disadvantage, and psychopathology and resilience in young children: the importance of risk factors' accumulation and protective factors' specificity. *European Child & Adolescent Psychiatry, 19*(6), 535-546.
- Flouri, E., Midouhas, E., & Joshi, H. (2014). Family poverty and trajectories of children's emotional and behavioural problems: the moderating roles of self-regulation and verbal cognitive ability. *Journal of Abnormal Child Psychology, 42*(6), 1043-1056.
- Garson, G. D. (2015). *Missing Values Analysis and Data Imputation*. Asheboro, NC: Statistical Associates Publishers.
- Glidden, L. M., & Schoolcraft, S. A. (2003). Depression: Its trajectory and correlates in mothers rearing children with intellectual disability. *Journal of Intellectual Disability Research, 47*(4), 250-263.
- Goodman, R. (1999). The extended version of the Strengths and Difficulties Questionnaire as a guide to child psychiatric caseness and consequent burden. *The Journal of Child Psychology and Psychiatry and Allied Disciplines, 40*(5), 791-799.
- Goodman, A., Lamping, D. L., & Ploubidis, G. B. (2010). When to use broader internalising and externalising subscales instead of the hypothesised five subscales on the Strengths and Difficulties Questionnaire (SDQ): data from British parents, teachers and children. *Journal of Abnormal Child Psychology, 38*(8), 1179-1191.
- Gray, K. M., Piccinin, A. M., Hofer, S. M., Mackinnon, A., Bontempo, D. E., Einfeld, S. L., ... & Tonge, B. J. (2011). The longitudinal relationship between behavior and emotional disturbance in young people with intellectual disability and maternal mental health. *Research in Developmental Disabilities, 32*(3), 1194-1204.
- Hastings, R. P., Daley, D., Burns, C., & Beck, A. (2006). Maternal distress and expressed emotion: Cross-sectional and longitudinal relationships with behavior problems of children with intellectual disabilities. *American Journal on Mental Retardation, 111*(1), 48-61.
- Hauser-Cram, P., & Woodman, A. C. (2016). Trajectories of internalizing and externalizing behavior problems in children with developmental disabilities. *Journal of Abnormal Child Psychology, 44*(4), 811-821.
- Jess, M., Totsika, V., & Hastings, R. P. (in press). Maternal stress and the functions of positivity in mothers of children with intellectual disability. *Journal of Child and Family Studies*.

- Kearney, D. S., & Healy, O. (2011). Investigating the relationship between challenging behavior, co-morbid psychopathology and social skills in adults with moderate to severe intellectual disabilities in Ireland. *Research in Developmental Disabilities, 32*(5), 1556-1563.
- Kessler, R. C., Andrews, G., Colpe, L. J., Hiripi, E., Mroczek, D. K., Normand, S. L., ... & Zaslavsky, A. M. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological Medicine, 32*(6), 959-976.
- Kessler, R. C., Barker, P. R., Colpe, L. J., Epstein, J. F., Gfroerer, J. C., Hiripi, E., ... & Zaslavsky, A. M. (2003). Screening for serious mental illness in the general population. *Archives of General Psychiatry, 60*(2), 184-189.
- Maulik, P. K., Mascarenhas, M. N., Mathers, C. D., Dua, T., & Saxena, S. (2011). Prevalence of intellectual disability: a meta-analysis of population-based studies. *Research in Developmental Disabilities, 32*(2), 419-436.
- Minnes, P., Perry, A., & Weiss, J. A. (2015). Predictors of distress and well-being in parents of young children with developmental delays and disabilities: the importance of parent perceptions. *Journal of Intellectual Disability Research, 59*(6), 551-560.
- Neece, C. L., Green, S. A., & Baker, B. L. (2012). Parenting stress and child behavior problems: A transactional relationship across time. *American Journal on Intellectual and Developmental Disabilities, 117*(1), 48-66.
- Payne, R.A., Abel, G.A. (2012). UK indices of multiple deprivation – a way to make comparisons across constituent countries easier. *Health Statistics Quarterly, 53*, 1–16.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage.
- Russell, G., Golding, J., Norwich, B., Emond, A., Ford, T., & Steer, C. (2012). Social and behavioural outcomes in children diagnosed with autism spectrum disorders: A longitudinal cohort study. *Journal of Child Psychology and Psychiatry, 53*(7), 735-744.
- Rodas, N. V., Chavira, D. A., & Baker, B. L. (2017). Emotion socialization and internalizing behavior problems in diverse youth: A bidirectional relationship across childhood. *Research in developmental disabilities, 62*, 15-25.
- Silver, R. B., Measelle, J. R., Armstrong, J. M., & Essex, M. J. (2005). Trajectories of classroom externalizing behavior: Contributions of child characteristics, family characteristics, and the teacher–child relationship during the school transition. *Journal of School Psychology, 43*(1), 39-60.

Stump, K. N., Ratliff, J. M., Wu, Y. P., & Hawley, P. H. (2009). Theories of social competence from the top-down to the bottom-up: A case for considering foundational human needs. In J. L. Matson (Ed.), *Social Behavior and Skills in Children* (pp.23–37). New York, NY: Springer.

Totsika, V., Hastings, R. P., Emerson, E., Hatton C. (2018). *Early years parenting mediates early adversity effects on problem behaviours in intellectual disability*. Manuscript submitted for publication.

Totsika, V., Hastings, R. P., Emerson, E., Lancaster, G. A., & Berridge, D. M. (2011). A population-based investigation of behavioural and emotional problems and maternal mental health: Associations with autism spectrum disorder and intellectual disability. *Journal of Child Psychology and Psychiatry*, 52(1), 91-99.

Totsika, V., Hastings, R. P., Emerson, E., Lancaster, G. A., Berridge, D. M., & Vagenas, D. (2013). Is there a bidirectional relationship between maternal well-being and child behavior problems in autism spectrum disorders? Longitudinal analysis of a population-defined sample of young children. *Autism Research*, 6(3), 201-211.

Totsika, V., Hastings, R. P., Emerson, E., Berridge, D. M., & Lancaster, G. A. (2015). Prosocial skills in young children with autism, and their mothers' psychological well-being: Longitudinal relationships. *Research in Autism Spectrum Disorders*, 13, 25-31.

Twisk, J., de Boer, M., de Vente, W., & Heymans, M. (2013). Multiple imputation of missing values was not necessary before performing a longitudinal mixed-model analysis. *Journal of Clinical Epidemiology*, 66(9), 1022-1028.

Tzavidis, N., Salvati, N., Schmid, T., Flouri, E., & Midouhas, E. (2016). Longitudinal analysis of the strengths and difficulties questionnaire scores of the Millennium Cohort Study children in England using M-quantile random-effects regression. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, 179(2), 427-452.

World Health Organisation (2018). *ICD-11 for Mortality and Morbidity Statistics*. Retrieved from : <https://icd.who.int/browse11/1-m/en#/http%3a%2f%2fid.who.int%2fid%2fentity%2f605267007>

Tables and Figures

TRAJECTORIES OF BEHAVIOURAL PROBLEMS IN CHILDREN WITH ID

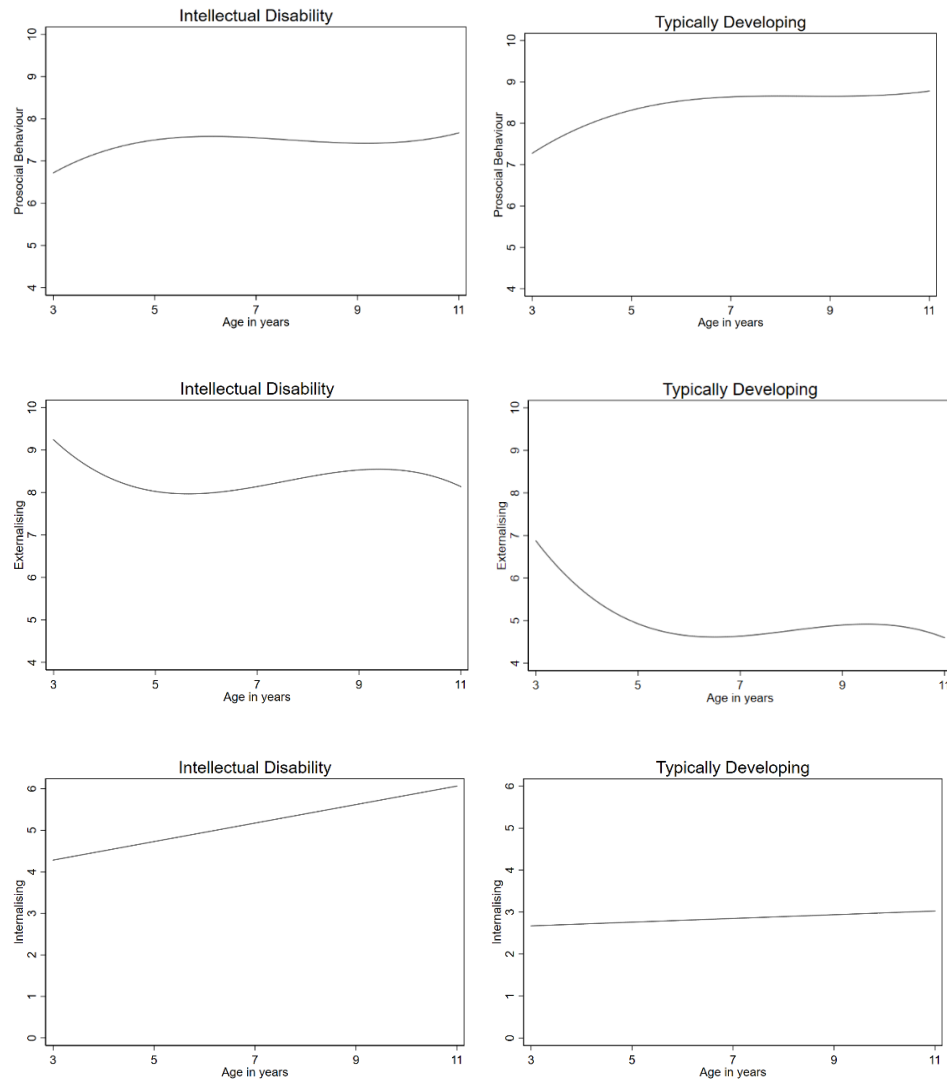


Figure 1. Age-related trajectories of prosocial, externalising, and internalising behaviour problems in both children with intellectual disabilities and typically developing children.

TRAJECTORIES OF BEHAVIOURAL PROBLEMS IN CHILDREN WITH ID

Table 1

Means and Standard Deviations for Time-Varying Predictors and Outcomes at Each Wave of Measurement

Variable	Time 1 (child age ≈ 3)		Time 2 (child age ≈ 5)		Time 3 (child age ≈ 7)		Time 4 (child age ≈ 11)	
	M	SD	M	SD	M	SD	M	SD
Children with ID								
<i>Outcome</i>								
Prosocial behaviours	6.86	2.25	7.62	2.12	7.46	2.32	7.76	2.27
Internalising behaviours	4.48	3.09	4.58	3.35	5.23	3.66	6.27	4.07
Externalising behaviours	9.22	4.11	7.86	4.17	8.45	4.00	8.07	3.96
<i>Within-person predictor</i>								
Maternal Life Satisfaction	7.51	2.02	6.95	2.42	6.85	2.22	7.03	2.33
Maternal Distress	4.72	5.34	5.34	5.50	5.07	5.41	6.32	5.65
TD Children								
<i>Outcome</i>								
Prosocial behaviours	7.38	1.86	8.41	1.64	8.62	1.60	8.82	1.52
Internalising behaviours	2.87	2.50	2.49	2.48	2.69	2.74	3.14	3.09
Externalising behaviours	6.66	3.79	4.73	3.36	4.65	3.53	4.39	3.52
<i>Within-person predictor</i>								
Maternal Life Satisfaction	7.80	1.75	7.40	1.96	7.43	1.87	8.27	2.21
Maternal Distress	3.24	3.71	3.12	3.78	3.08	3.79	3.97	4.34

Notes. * $p < .05$.

TRAJECTORIES OF BEHAVIOURAL PROBLEMS IN CHILDREN WITH ID

Table 2

Multilevel Models of Between-Person Associations of ID status and Within-Person Associations of Maternal Stressors with Child Behavioural Trajectories

Variable	Prosocial behaviours		Internalising behaviours		Externalising behaviours	
	Coefficient	SE	Coefficient	SE	Coefficient	SE
Initial status intercept at age 3 (random)	7.135*	.395	5.116*	.556	10.075*	.813
ID status	-.442*	.193	.794*	.227	.518	.364
Linear rate of change age slope (random)	.925*	.030	-.032*	.010	-1.723*	.051
ID status	.273	.194	.207*	.068	1.262*	.336
Quadratic rate of change age slope	-.196*	.011			.397*	.020
ID status	-.118	.068			-.271*	.118
Cubic rate of change age slope	.013*	.001			-.028*	.002
ID status	.008	.006			.017	.011
Maternal distress fixed slope	-.039*	.031	.086*	.007	.096*	.009
ID status	.022	.026	.067	.038	-.015	.046
Maternal life satisfaction fixed slope	-.012	.009	.018	.012	-.012	.015
ID status	.085	.046	.320*	.067	-.043	.083
<i>Variance components</i>						
Intercept	2.040*	.063	3.012*	.054	7.979*	.219
Linear age slope	.082*	.005	.161*	.009	.283*	.014
Slope-intercept covariance	-.262*	.014	-.242*	.025	-.760*	.045

TRAJECTORIES OF BEHAVIOURAL PROBLEMS IN CHILDREN WITH ID

Level-1 effect	1.459*	.026	3.012*	.054	4.056*	.075
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Notes. * $p < .05$. ID status coded 1 = child with ID, 0 = child without ID. All analyses adjusted for baseline covariates, child autism co-diagnosis, family deprivation, mean maternal distress and maternal life satisfaction.

