Autism and Attachment Disorder symptoms in the general population: prevalence, overlap and burden.

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Abstract

**Background:** Co-occurring mental health and neurodevelopmental problems are common in maltreated children, but overlap is rarely considered in population research or clinical practice where diagnoses tend to be considered separately. Overlapping health problems, i.e. “multi-morbidity” in adulthood is associated with increased service burden and costs, but this has not been investigated in childhood.

**Methods:** Using well validated parent-report questionnaires, we examined the overlap between Autism (AD) and Attachment Disorders (AD) in a representative general population sample of over 3,300 children aged 5-6 years of age. We investigated socio-demographic factors, service burden and costs in association with these problems when considered separately and when co-occurring.

**Results:** Nearly 2% of this population had symptoms suggestive of both ASD and AD. High symptom scores for ASD were associated with male gender, (younger) age of mother at birth and being in a single parent family, while high symptom scores for AD were associated with (younger) age of mother at birth, being in a single parent family and the number of accidents reported. Service use costs per likely case of both ASD and AD in the pre-school years were increased by £348.62 (95% CI 121.04 to 391.11) – nearly double the costs of ASD alone.

**Conclusions:** There is considerable overlap between symptoms of ASD and AD in the general population, indicating that multi-morbidity is already present in childhood and is associated with increased service use and costs even in the pre-school years.

**Keywords:** Autism Spectrum Disorder; Attachment Disorders; General population

**Abbreviations:** ASD=Autism Spectrum Disorder; AD =Attachment Disorder
Background

Children who have been abused and neglected are much more likely than their peers to have symptoms of neurodevelopmental problems such as Autism, ADHD and intellectual disabilities (Dinkler et al., 2017). In turn, children with neurodevelopmental disorders such as Autism, ADHD and Intellectual Disability, are at higher risk than their peers of experiencing maltreatment (McDonnell et al., 2019; Stern et al., 2018). The symptoms of these neurodevelopmental problems can increase parental stress (Miranda, Tárraga, Fernández, Colomer, & Pastor, 2015) and place children at risk of being maltreated.

We, and others, have investigated the causal links between neurodevelopmental problems and maltreatment. Our behavioural genetic findings suggest that maltreatment does not cause neurodevelopmental problems in abused and neglected children (Dinkler, et al., 2017) and longitudinal research has now shown that neurodevelopmental problems, including ADHD and Intellectual Disability, occur before maltreatment in the life cycle (Danese et al., 2016; Stern, et al., 2018). Together, these findings suggest that neurodevelopmental problems and maltreatment need to be considered together – and that neurodevelopmental problems might be important risk factors for child abuse and neglect.

However, children who have experienced maltreatment are also at risk of developing problems that directly arise from abuse and neglect. Two “trauma and stressor related disorders”, sometimes referred to as “Attachment Disorders” (AD)\(^1\), are described in DSM V: Disinhibited Social Engagement Disorder, characterised by indiscriminate behaviours and Reactive Attachment Disorder, characterised by failure to seek/accept comfort and emotionally withdrawn behaviours (American Psychiatric Association, 2013). ADs are serious disorders of social functioning associated with early childhood neglect (Gleason et al., 2011) that are thought to have a poor long-term prognosis if untreated (Rutter, 2000).

\(^1\) We are using the term “Attachment Disorder (AD)” to describe both Reactive Attachment Disorder and Disinhibited Social Engagement Disorder. In our previous UK-based research, we have found mixed clinical presentations of Inhibited and Disinhibited RAD to be very common, therefore we have not sought to separate these disorders for the purposes of this symptom-based study and use the term “AD” to refer to both.
Kreppner, & Sonuga-Barke, 2009). Both psychiatric classification systems (ICD-10 and DSM-V) state that the diagnosis should only be made if there is a history of serious early childhood maltreatment (American Psychiatric Association, 2013; World Health Organisation, 1993).

Traditionally, these “trauma and stressor related problems” (assumed caused by maltreatment) (Zeanah et al., 2016) and neurodevelopmental problems (which are highly heritable) (Taylor, Charman, & Ronald, 2015) have been regarded as entirely separate entities. Both the DSM and ICD classification systems recommend that, when assessing for Attachment Disorders, neurodevelopmental disorders such as Autism should be diagnoses of exclusion (American Psychiatric Association, 2013; WHO, 2010, 2016). Yet such exclusionary diagnostic systems are being increasingly challenged in child psychiatry since overlap in psychiatric syndromes is the rule (Gillberg, 2010; Minnis, 2013) and a full understanding of a child’s profile is essential for appropriate management and treatment planning (Hunt & Rodwell, 2018). In adult health, there is an increasing focus on the co-occurrence of health problems: “multi-morbidity”, the presence of two or more disorders, has been shown to place a particular burden on health and social care services (Barnett et al., 2012) and to be associated with adverse childhood experiences such as abuse and neglect (Anda et al., 2006). There has been little research on multi-morbidity in early childhood (Chau, Baumann, & Chau, 2013) especially in the context of abuse and neglect where it is most likely to occur (Dinkler, et al., 2017) and when the effects might be most modifiable (Kim & Cicchetti, 2010). We know nothing about any associated burden on individuals, their families or on health and other services. ASD is associated with high societal costs related to intense use of public services (Barrett et al., 2012; Knapp, Romeo, & Beecham, 2009) but only one study has previously examined service use and costs in relation to AD symptoms (Minnis, Everett, Pelosi, Dunn, & Knapp, 2006) and none have examined both disorders together.

Theoretically, there is no reason why neurodevelopmental problems such as ASD and trauma/stressor-related problems such as ADs could not occur together: a child with
heritable ASD could experience maltreatment in the same way as a child without and, in addition, children with inherent deficits in social communication may be more at risk of being maltreated if in a vulnerable family (Sullivan & Knutson, 2000). We have already shown, in clinic-based research, that ASD and AD can occur together in maltreated children (Kocovska et al., 2012), but the prevalence of co-occurring ASD and AD in the population is unknown. Co-occurrence of AD and ASD might place children at particularly high risk of current and future physical and mental illness as has been found when multi-morbidity occurs in adults (Barnett, et al., 2012).

The population prevalence of ASD is around 1.1% (Baird et al., 2006), although estimates vary between geographical locations (Parner et al., 2011). We established the prevalence of AD in a socio-economically deprived general population in Scotland and it was similar to the prevalence of ASDs at 1.4% (Minnis et al., 2013). In this study, we have the first opportunity to investigate whether overlap between ASD and AD is present in the general population at early school age and whether overlapping ASD and AD is associated with an increased burden to families and services.

Our research questions were the following:

- What is the prevalence of ASD and AD symptoms among six-year old Scottish children?
- What is the overlap between ASD and AD among six-year old Scottish children?
- What are the socio-demographic features associated with the two conditions?
- What are the healthcare burdens and costs associated with the two conditions?

**Methods**

**Ethics**

The initial sweep of data collection was subject to medical ethical review by the Scotland 'A' MREC committee (application reference: 04/M RE 1 0/59). Subsequent sweeps have
been reviewed via substantial amendments submitted to the same committee. The study has therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. At the outset of the study, participants were provided with study details before written, informed consent was collected. Participants are regularly provided with updated study information and consent for re-contact and ongoing participation is collected on a continuous basis at all sweeps of data collection.

**Sample**
The Growing Up in Scotland study (GUS) is a national sample including a birth cohort (n=4191; 80.3% of original cohort), born in 2004/2005. It includes face-to-face interviews with parents annually until age 5, then at stages of interest. In order to investigate the patterning and correlates of ASD and AD symptoms in the Scottish Population, screening questionnaires for these disorders were included in the sixth sweep of GUS (2010-11), when the children were approximately 6 years old.

The methodology for collecting data on questionnaires for ASD and AD, the Autism Spectrum Screening Questionnaire (ASSQ) and Relationship Problems Questionnaire (RPQ) (see below for details), was piloted with 96 children in GUS. The parental response-rate in the pilot was 74% and there were no major concerns regarding the questionnaires. Very minor modifications (not affecting meaning of core concepts) were made to the ASSQ for this Scottish population.

In the main-stage survey (data collected as part of the 2010/11 sweep of GUS), parents were sent copies of the ASSQ and RPQ (see below) with the “advance letter” that was sent out approximately one week prior to the home interview and were asked to complete them in advance. If the questionnaire had been completed, it was collected by the interviewer on the day of interview, or at a later home visit or by post if not
completed on the day. Completed questionnaires were transferred to the Robertson Centre for Biostatistics for data processing and analysis.

The GUS population was derived from Child Benefit records (at that time a universal benefit taken up by around 97% of eligible families). Stratified cluster sampling was used to derive a nationally representative sample. Child Benefit records indicate that amongst the eligible population, 6% of children were born to mothers aged under 20 and 18% lived in an area in the most deprived quintile of the Scottish Index of Multiple Deprivation (see below). After applying weights to adjust for non-response and sample selection, 8% of the GUS sample at sweep 6 had mothers aged under 20 at birth and 19% lived in an area in the most deprived quintile. As such, the GUS sample is considered to be representative of the study population from which it is drawn.

**Measures**

The ASSQ is a 27-item screening instrument for symptoms of autism spectrum disorders with versions for parents and teachers and three possible responses “no”, “somewhat” and “yes”. In this study, the parent version was used. Because it is completed by lay informants and items can be interpreted subjectively, it is not intended as a diagnostic measure, but simply as a measure that indicates which children require further assessment for ASD. It has been widely used and validated in general population research, including in the Barn i Bergen study – a longitudinal cohort study of 10,000 school-age Norwegian children (Posserud, Lundervold, & Gillberg, 2006) and in a diagnostic study focussing on Asperger's syndrome involving over 4,400 Finnish school children (Mattila et al., 2007). It has good test-retest and inter-rater reliability and the optimum cut-off point (giving the best balance of sensitivity versus specificity) has been determined at a score of 19 on the parent-rated ASSQ (Ehlers, Gillberg, & Wing, 1999). ASD high scorer status was therefore defined in this study as those children with a score on the ASSQ of 19 or above (Ehlers, et al., 1999).
The RPQ is a 10-item questionnaire, with versions for parents and teachers, for AD symptoms (Minnis et al., 2007). It has four possible responses (‘Not at all like my child’, ‘A bit like my child’, ‘Like my child’ and ‘Exactly like my child’) scored 0, 1, 2 and 3. In this study, the parent version was used. The RPQ was completed by over 13000 parents in a large general population twin sample, the Twins Early Development (TEDS) study (Minnis, et al., 2007). It was found to have good internal consistency (cronbach’s alpha 0.85). This work demonstrated that AD symptoms are present in the general population and are associated with harsh parenting. The RPQ has also been used in a population-based diagnostic study involving over 1600 children and the optimum cut-off point (giving the best balance of sensitivity versus specificity) has been determined at a score of 7 on either the parent or teacher-rated RPQ. AD high scorer status was therefore defined in this study as those children with a score on the RPQ of 7 or above (Minnis, et al., 2013).

In order to ensure that any symptomatic overlap between the ASSQ and RPQ was not simply due to overlap between the questionnaires, we performed factor analysis.

Deprivation in GUS was measured by Scottish Index of Multiple Deprivation (SIMD). SIMD ranks small postcode areas in quintiles according to deprivation from one (most deprived) to five (least deprived). The SIMD is derived from 38 indicators across 7 domains: income, employment, health, education, skills and training, housing, geographic access and crime (www.scotland.gov.uk/Topics/Statistics/SIMD/BackgroundMethodology).

Cost for service use was derived from the reported number of contacts with healthcare professionals over the 6 months preceding data collection. This information was collected at sweeps 2 to 4, when the child was approximately 2, 3 and 4 years old. Costs for each healthcare contact were taken from Unit Costs of Health and Social Care (PSSRU, 2018).
Statistical analysis

Confidence intervals for prevalence rates have been calculated using normal approximation. Socio-demographic variables have been summarised as number of children per category and percentage of these scoring positive, and their relation to caseness has been assessed through Exact Fisher tests.

For ASD, AD and ASD+AD, a multivariate logistic regression model predicting caseness was derived by backward selection from all predictors identified in the univariate analyses, excluding general health at sweep 6. In addition, analyses were repeated using weightings to account for study attrition. Details about the weights can be found in the GUS study data documentation (Bradshaw, Corbett, & Tipping, 2011). Since differences between the weighted and the unweighted analyses were small, we only present the unweighted results.

For predicting costs, values of the predictor variables at the same sweep as the cost data have been used, except for education where values at sweep 6 were used, assuming that the important education factor was maximal level of education achieved rather than education at the time of the sweep.

The shape of the relation between questionnaire scores and cost was assessed predicting cost from thin plate regression splines of the questionnaire scores (these aim to give a smooth fit of the data) (Wood, 2003).

Cost was modelled using generalised mixed models assuming a log link and Gamma variance. Models were constructed including ASSQ score or RPQ score or both scores, or both scores and their interaction. Similar models were constructed using likely caseness rather than questionnaire scores. Other variables were selected in forward stepwise variable selection from age of child at each sweep, child sex, age of mother at birth, household level of education at sweep 6, family type, combined household employment
and family type, number of adults in household, number of children in household, income, urban rural classification and SIMD.

Estimates for costs for healthcare contacts over the period from the age of 18 months to 4 years have been derived from the above model for caseness using the method of recycled prediction (Glick, Doshi, Sonnah, & Polsky, 2007). We predicted cost differences between

- children with likely ASD and other children (including children with likely AD)
- children with likely AD and other children (including children with likely ASD)
- children with likely ASD or likely AD or both and children without ASD and AD
- children with both likely ASD and likely AD and children without ASD and AD.

All results of regression analyses shown here have been carried out on unweighted data, assuming that the relationship of one variable with another should not be affected by attrition. Analyses were repeated using weights and differences were found to be small (available on request).

All analyses have been carried out in R version 3.0.1. (R Core Team (2013). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL http://www.R-project.org/.) Since this is an exploratory analysis, p-values have not been corrected for multiple testing and have to be considered as descriptive.

Results

Of the target sample of 4191, 3355 (80%) questionnaires were returned. For incomplete questionnaires, scores were pro-rated if at least 60% of the items had been completed. This resulted in 3349 (79.9% of the target sample) questionnaires that could be analysed. During data cleaning, 18 questionnaires (0.5% of the sufficiently completed ones) were removed because they had maximum scores in either ASSQ or RPQ and a
score of 0 in the other, which was assumed to be highly unlikely. The remaining 3331 questionnaires (79.5% of the target sample) were used for the analysis.

Of this final sample, 49.0% are girls and the mean age is 70.2 months (5.85 years), the age range is 69 to 72 months (5.75 to 6.00 years). Our factor analysis (results available on request) showed virtually no overlap between the ASSQ and RPQ. We have presented our results according to research questions:

- **What is the prevalence of ASD and AD symptoms among six-year old Scottish children?**

  Of the 3331 children with complete data, 139 (4.2%, 95% confidence interval 3.5%-4.9%) screened positive for ASD (i.e. had an ASSQ score of 19 or more). Using the metrics from the Finnish sample as a guide, in which 26% of screen-positive children had an actual ASD diagnosis (Mattila, et al., 2007), this might translate to approximately 36.1 cases of ASD in this population, or a prevalence of 1.1%.

  Of the 3331 children with complete data, 154 (4.6%, 95% confidence interval 3.9%-5.3%) screened positive for AD. Using the metrics from the Glasgow sample as a guide (Minnis, et al., 2013), in which 16.04% of screen-positive children had an actual AD diagnosis using gold standard diagnostic instruments, this might translate to approximately 24.7 cases of AD in this population, or a prevalence of 0.74%.

- **What is the overlap between ASD and AD among six-year old Scottish children?**

  Of the 3331 children with data available for both questionnaires 61 (1.8%) were high scorers for both ASD and AD. Of the AD high scorers, 39.6% were also ASD high scorers and of the ASD high scorers, 43.9% were also AD high scorers (see Figure below and Table 1-1, Web Appendix 1).

  *Insert Figure 1 about here*
• *What are the socio-demographic features associated with the two conditions?*

**ASD high scorers** (See Supplemental Tables 1 and 2, Web Appendix): In univariate analyses, no relevant associations were observed between prevalence of ASD high scoring and parental educational level, household income or level of deprivation. ASD symptoms were not associated with parental endorsement of smacking as a form of discipline.

The univariate analyses did show that ASD high scoring was more common in boys, lone parent families, families with younger mothers and families with more than 3 children. High ASD scorers were also reported to have poorer general health, and to have more accidents (see Supplemental Tables 1 and 2, Web Appendix).

In multivariate analyses (see Table below), ASD high scoring was associated with male gender, (younger) age of mother at birth and being in a single parent family but number of accidents was no longer a predictor.

*Insert Table about here*

**AD high scorers** (see Supplemental Tables 1 and 2, Web Appendix): In univariate analyses, no relevant associations were observed between prevalence of AD high scoring and parental educational level, household income or level of deprivation. AD symptoms were not associated with parental endorsement of smacking as a form of discipline.

The univariate analyses did show that prevalence of AD high scoring was associated with male gender, lone parenthood, more than 3 children and younger mother’s age at birth (see Supplemental Table 1, Web Appendix). There was also an association with poorer general health in the child and more accidents (see Supplemental Table 2, Web Appendix).
In multivariate analyses (see Table below), AD high scoring was not associated with gender, but was associated with (younger) age of mother at birth, number of accidents and being in a single parent family.

**High scorers for both ASD and AD** (see Supplemental Tables 1 and 2, Web Appendix): In univariate analyses, no relevant associations were observed between prevalence of high scoring for both disorders and parental educational level, household income, level of deprivation, number of adults or children in the household or lone parent status. Symptoms of both disorders were not associated with parental endorsement of smacking as a form of discipline.

The univariate analyses did show that prevalence of high scoring for both disorders was associated with male gender and younger mother’s age at birth. There was also an association with poorer general health and more accidents (see Supplemental Tables 1 and 2, Web Appendix).

In multivariate analyses (see Table below), high scoring for both disorders was associated with gender and (younger) age of mother at birth.

- **What are the healthcare burdens and costs associated with the two conditions?**

  Figure 2 shows the average number of healthcare professional visits in the six months preceding the sweep, by likely caseness and by type of healthcare professional, and the distribution of the costs associated with healthcare professional contacts, by sweep and likely caseness. Being a high scorer for both ASD and AD symptoms was associated with more contacts in the pre-school period with various health professionals including the Health Visitor, paediatrician, physiotherapist and speech and language therapist. Children with high scores for either/both disorders were, however, less likely to visit the dentist.
Regression models (Supplemental Table 3, Web Appendix) predicted costs of being a high scorer (likely caseness) for ASD or AD, i.e. either including ASSQ high scorers only, including RPQ high scorers only or including both. Likely caseness was associated with higher costs. The number of accidents, child age, being male and living in a more urban area increase costs. Using continuous questionnaire scores rather than likely caseness gives similar results.

The predicted increase in cost for healthcare contacts over the period from 18 months to four years of age per ASD case was £178.87 (95% CI 47.85 to 408.14). The predicted increase in cost per AD case was £228.76 (95% CI 87.14 to 443.83). The predicted increase in cost per case of ASD and AD occurring together is £348.62 (95% CI 8.59 to 661.11).

Figure 2 shows predicted costs by ASSQ and RPQ scores for a hypothetical male child aged 72 months, living in "Large urban" area, highest qualification in household is degree or equivalent, couple family with both working at least 16 hours, mother 30+ years at birth, with no history of accidents.

**Discussion**

Our findings have shown that neither ASD nor AD symptoms are rare in the Scottish population and that overlap between these two clusters of symptoms is fairly common. These findings fit well with other recent findings in child and adolescent mental health: that symptomatic overlap between the various child psychiatric disorders is common (Gillberg, 2010) and the common genetic aetiology that is now known to exist for a range of child neurodevelopmental disorders (Pettersson, Anckarsäter, Gillberg, & Lichtenstein, 2013; Thapar, Cooper, Eyre, & Langley, 2013).
Although this study focuses on symptoms and does not attempt to make diagnoses, our estimates of diagnostic prevalence may be useful in illuminating something about the nature of our population. Our estimate of likely ASD prevalence in the Scottish population of 6 year olds (1.1%) is in accordance with other UK datasets (Baird, et al., 2006). Our estimation of the likely prevalence of AD in this population of Scottish 6 year olds (0.74%) is approximately half of the prevalence of 1.4% estimated in a socio-economically deprived Scottish population sample (Minnis, et al., 2013). This is perhaps unsurprising as AD is thought to only exist if there has been a history of abuse and neglect: although the overwhelming majority of people living in poverty do not abuse or neglect their children, rates of child maltreatment are higher in areas of high socio-economic deprivation, possibly due to the stress associated with poverty (McSherry, 2004). However, this could perhaps be indicative of a methodological issue: although GUS is apparently representative of the general population, there may have been selective attrition of parents who were more likely to maltreat their children. This might suggest that the true prevalence of AD in GUS may be higher than our estimate suggests.

Some of the findings regarding ASD symptoms were unsurprising, e.g. the male preponderance and the lack of association with socio-demographic variables and parenting, but there were some surprising results including that ASSQ scores were higher in children living in lone parent families and who had mothers who were younger at their birth. Previous studies have not found associations with single parenthood (Montes & Halterman, 2007) and have found a higher prevalence of ASD in mothers who were older at the time of the baby’s birth: the seminal Kaiser Permanente study found a significant increase in ASD prevalence for every 10 year increase in maternal age, however this study investigated the prevalence of ASD diagnoses (from Kaiser Permanente clinical outpatient records) (Croen, Najjar, Fireman, & Grether, 2007). In the current study, we asked parents to report on symptoms of ASD and it is possible that younger mothers are less likely to seek services (and are hence less likely to get a
diagnosis) than older mothers. Apparent effects of young age of the mother or lone parenthood may not be direct but could be the result of other factors such as maternal psychopathology, smoking, drugs use, obstetric problems or poor medical assistance during pregnancy and it would be of interest to investigate these factors in future research.

Because AD is thought to be caused by maltreatment, and maltreatment is known to be more prevalent in more deprived communities where social stressors are greater (Sidebotham, Golding, & Team, 2001), it is perhaps unsurprising that children with high scores on the RPQ were more likely to come from lone parent families and to have mothers who were younger at the time of the child’s birth. It is, however, surprising that likely AD caseness was not associated with employment, parental education, income or Scottish Index of Multiple Deprivation score. This is a reminder that child maltreatment – and AD - can occur in all strata of society.

It is of note that, in this study, we did not find an association between AD high scoring and parental endorsement of smacking but this may be a measurement problem in that parents may have been reluctant to admit to smacking their children in a climate where legal sanctions may apply for such behaviour. In a previous large population (twin) study using the RPQ there was a significant association between AD symptoms and parental endorsement of using harsh parenting techniques - though the measure used for harsh parenting in that study was more detailed than that used in GUS (Minnis, et al., 2007). The association between AD high scoring and accidents leads us to speculate whether or not some of these injuries could have, in fact, been non-accidental, or that the higher frequency of accidents may have been related to the lack of supervision associated with neglect or because neglected children are less likely to ask for help.

The study is limited by the fact that we did not get data from 20.5% of the target population and may therefore have lost the most vulnerable families, hence
underestimating the true prevalence of AD symptoms as detailed above. This loss of the most vulnerable families may also have affected the social patterning of findings in ways it would be hard to predict. There may be other response biases within the data - e.g. we cannot know whether younger or older mothers may complete questionnaires differently. Although the RPQ has been validated against diagnosis in a Scottish population (Minnis, et al., 2013), the ASSQ has not so we would emphasise that our estimates for likely diagnosis would need to be further tested in a future study. Another limitation is the lack of diagnostic information: these data cannot tell us whether children with overlapping symptoms of ASD and AD really do have both disorders or whether this is simply due to the symptoms, as reported by parents, being similar. Our previous research has shown that discrimination between ASD and AD diagnosis is usually, but not always, possible in clinical practice (Davidson et al., 2015) and that co-occurrence of AD and ASD is also possible (Kocovska, et al., 2012). It will be important, in future research, to conduct full assessments of children who have high scores on both the ASSQ and RPQ within a population context to determine the prevalence of overlapping disorders.

Service use and costs of having both ASD and AD in childhood are already increased by the time we investigated them in the pre-school and early primary school years (additional cost per case of nearly £350). These costs seem modest compared to the enormous lifetime costs of Autism, recently estimated at approximately £1.23 million for someone with intellectual disability and approximately £0.80 million for someone with ASD without intellectual disability (Knapp, et al., 2009). This suggests that costs multiply as the years progress and underlines the importance of intervening early to ameliorate this accruing burden on individuals and society.

Our findings suggest logical targets for early intervention. For example, interventions such as Nurse Family Partnership that target young parents and focus on the parent-infant relationship might be particularly well placed to prevent trauma/stress-related
disorders emerging in infants/pre-schoolers with neurodevelopmental problems (Eckenrode et al., 2017). If proven successful, such early interventions might prevent increasing mental health burden accruing across the lifespan in these children.

**Conclusions**

Almost 2% of pre-school children in this Scottish general population cohort have symptoms of both ASD and AD, suggesting they have both neurodevelopmental and trauma/stressor-related problems. ASD nor AD symptoms are associated with younger maternal age and being in a single parent family and AD is also associated with the number of reported accidents. Already in the pre-school years, significantly increased service use and costs are associated with symptoms of both disorders, particularly when co-occurring.

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