

Autism spectrum disorders in young children: effect of changes in diagnostic practices

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Background It is unclear whether the increase in autism over the past two decades is a real increase or due to changes in diagnosis and ascertainment of autism spectrum disorders (ASDs), which include autism, Asperger syndrome and pervasive developmental disorder not otherwise specified (PDD-NOS). The aim of this study was to examine the trends in ASD over time in Western Australia (WA) and the possible effects and contribution of changes in diagnostic criteria, age at diagnosis, eligibility for service provision based on ASD diagnoses and changes in diagnostic practices.

Methods A population-based study was conducted among the cohort of children born in WA between 1983 and 1999 and diagnosed with ASD between the age of 2 and 8 years up to December 31, 2004. The trend in ASD diagnosis over the study period was assessed by investigating birth cohort and period effects, and examining whether these were modified by age of diagnosis. ASD diagnosis corresponding with changes in diagnostic criteria, funding and service provision over time were also investigated. A subgroup analysis of children aged ≤ 5 years was also conducted to examine trends in the incidence and age of diagnosis of ASD and intellectual disability (ID) and to investigate the role of changes in diagnostic practices.

Results The overall prevalence of ASD among children born between 1983 and 1999 and diagnosed by age 8 was 30 per 10 000 births with the prevalence of autism comprising 21 per 10 000 births. The prevalence of ASD increased by 11.9% per annum, from 8 cases per 10 000 births in 1983 to 46 cases per 10 000 births in 1999. The annual incidence of ASD, based on newly diagnosed ASD cases in each year from 1985 to 2002, increased over the study period. The increase in incidence of ASD appeared to coincide with changes in diagnostic criteria and availability of funding and services in WA, particularly for children aged < 5 years. The age-specific rates of autism and PDD-NOS increased over time and the median age of diagnosis for autism decreased from 4 to 3 years of age throughout the 1990s. For children aged ≤ 5 years the incidence of ASD diagnosis increased significantly from 1992, with an average annual increase of 22%. Similar findings were found for autism. In the corresponding years the incidence of diagnosis of severe ID fell by 10% per annum and mild–moderate ID increased by 3% per annum.

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Conclusions The rise in incidence of all types of ASDs by year of diagnosis appears to be related to changes in diagnostic and service provision practices in WA. In children aged ≤ 5 years, diagnosis of severe ID decreased, but mild–moderate ID increased during the study period. A true increase in ASD cannot be ruled out.

Keywords Autism, autism spectrum disorders, intellectual disability, prevalence

Introduction

There has been widespread concern over the last decade about the reported increases in the prevalence of autism spectrum disorders (ASDs), which include autism, Asperger syndrome and pervasive developmental disorder not otherwise specified (PDD-NOS), with prevalence estimates rising from 4 per 10 000 children¹ to $\geq 1\%$ ^{2,3}. Although the causal pathways to developing an ASD are unclear and the contribution of genetics and the environment are yet to be quantified, much speculation has occurred about the relation of societal trends to prevalence estimates. These include changes over time in diagnostic criteria, diagnostic practices, the availability of early intervention funding and clinical awareness.

The two current classification systems for diagnosing ASD, the Diagnostic and Statistical Manual (DSM) published by the American Psychological Association⁴ and the International Classification of Diseases (ICD) published by the World Health Organisation⁵ have undergone qualitative and categorical changes over time that may have affected ascertainment of ASD cases through broadening or narrowing of criteria. For example, the third edition of the DSM criteria⁶ specified age of onset as 'by 30 months', whereas the revised edition⁷ allowed 'anytime during infancy and childhood'. This single change broadened the scope in which a child could be considered for a diagnosis, and there is evidence of a high rate of false positives using these criteria, particularly for children with profound intellectual disability (ID).⁸ In the fourth edition⁴ the age of onset was stated as 'by 36 months', which potentially narrowed the diagnostic criteria. However, an editorial change in the same volume broadened the opportunity to diagnose under the PDD-NOS category.⁹ Many examples of the effects of using different criteria on the estimates of prevalence exist¹⁰ and it is therefore important to consider such changes when investigating temporal trends.

It is also important to consider the impact of diagnostic practices over time. ASD and ID share common descriptive elements and characteristics, and both disorders are thought to be heterogeneous in origin and could share biomedical influences. The reported proportion of children with ASD who also have ID varies widely, ranging between 26 and 68% of cases^{2,11–13},

depending on the ascertainment methods, age of cases and time period of data collection. It is possible that children who in the past would have received a diagnosis such as ID, if presenting with the same symptomatology in more recent times, would receive a diagnosis of ASD. There has been some evidence of simultaneous decreases in the population prevalence of ID with increases in ASD,^{14,15} but limitations in methods have restricted the interpretation of these data. To measure the influence of such a possibility on ASD prevalence, population models with adequate follow-up and consistent definitions over time are needed.

Other changes over time impacting on estimates are changes in diagnostic and intervention services. In Western Australia (WA), for example, the mechanisms by which children are diagnosed with ASD have changed considerably. In the 1970s, children with autism were referred to a child psychiatrist for diagnosis, and few services were available for those diagnosed. In recent years, centralized diagnostic services comprising a multidisciplinary diagnostic panel have focused on early identification and referral to intervention programs targeted at preschool-aged children.¹⁶

Using data from record-linked health databases in WA,¹⁷ we conducted a population-based cohort study of ASD to examine the changes over time in conjunction with known period influences (changes in diagnostic criteria, availability of services and change in diagnostic practices and services) and whether there has been a simultaneous decrease in ID.

Methods

Study population and data sources

The study population comprised all children liveborn in WA between January 1, 1983 and December 31, 1999 ($n=419\,917$). Cases were defined as children diagnosed with an ASD between the age of 2 and 8 years by December 31, 2004 ($n=982$). In WA, diagnosis of ASD is based on the DSM classification system and cases were identified from at least one of three databases (Figure 1): (i) the Disability Services Commission (DSC) of the WA database (1983–2004), the government agency and primary provider of funding and services for individuals with

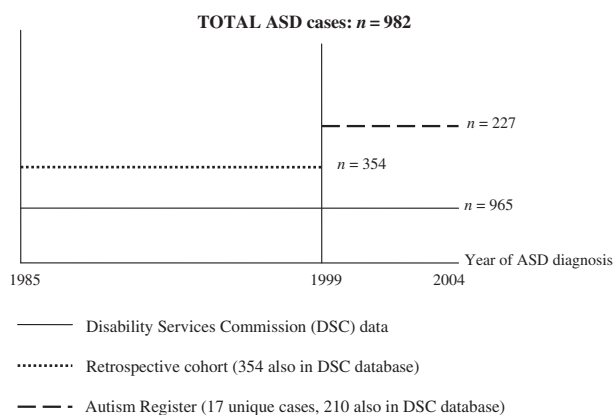


Figure 1 Source of registration and number of children aged ≤ 8 years diagnosed with ASD in WA during 1985–2004

a disability in WA, including ASD ($n = 965$);¹⁸ (ii) a retrospective dataset of all ASD cases born in WA between 1983 and 1995 and diagnosed by 1999 by individual case note review described below ($n = 354$);¹⁹ and (iii) the WA Register of ASD, a prospective data collection system including diagnostic information on new cases diagnosed in WA since 1999. Only Autism Register cases with parental permission for registering identifying data were included in this analysis ($n = 227$).²⁰

These data sources are not mutually exclusive (Figure 1). As the state-nominated provider of funding for services, most cases of ASD are registered with the DSC ($n = 965$; 98%), and this is the most comprehensive data source of ASD cases available for research. Data from the Autism Register provided a further 17 unique cases and, importantly, the Register and the retrospective cohort contain more detailed diagnostic information and complement the DSC data to enable validation of cases and data such as dates of diagnosis and registration.

The retrospective cohort was based on all possible cases of ASD diagnosed between January 1985 and December 1999 at one of the four main diagnostic centres and some private practice clinics responsible for diagnosis of ASD in WA at the time of sampling. Information on cases was ascertained by a comprehensive review of all case notes by a developmental paediatrician, initially in 1997–98 for cases diagnosed up to June 1997 and subsequently in 2000 to ascertain additional cases,¹⁹ using a standard data abstraction form. Cases diagnosed with an earlier version than the DSM-IV were reclassified according to the DSM-IV criteria.¹⁹

In 1999, a state-wide register to monitor new ASD cases diagnosed in WA was initiated and remains an ongoing and prospective data set.²¹ Clinicians actively diagnosing ASD cases receive data collection forms from the WA Autism Register to record diagnostic details and assessment information and submit the

completed forms to the Register.¹⁶ The Register is estimated to have $>90\%$ ascertainment of newly diagnosed cases. Data are available for data linkage purposes in only those cases where parental consent is obtained to have names included on the database ($\sim 40\%$).¹⁶

Changes in diagnostic criteria and practices, funding and service provision

Dates and timing of changes in diagnostic criteria, diagnostic practices, funding and service provision were obtained from a review of practices and through key informant interviews and examination of government reports. This was undertaken by a qualified and experienced qualitative researcher, who interviewed persons with extensive involvement or who played key roles in diagnosis and service provision for ASDs in WA since 1980. A total of nine informants (diagnosticians, services providers and policy makers) were interviewed. The interviewer used a schedule of questions for each interview to investigate responsibility for services; pathway to diagnosis; assessment and diagnostic practices; criteria for diagnosis; services to child and family; funding in WA and changes over time.

Trends in ID

Population-based data on ID diagnosed among all children born between 1983 and 1999 were also extracted. Children with ID ($IQ < 70$) were sourced from the IDEA (Intellectual Disability Exploring Answers) Database,¹⁸ which ascertains subjects from both the DSC and from state and non-government education services ($n = 5674$). In WA, IQ is determined using psychometric testing^{16,18} and all children are assessed by a psychologist or, for younger children, a developmental paediatrician, in order to meet the service provision criterion of $IQ < 70$. Children diagnosed with a clear biomedical condition resulting in ID (e.g. Down syndrome) ($n = 1009$)²² were excluded from the analysis. Of the remaining children with ID of unknown cause, 1508 were identified from the DSC and 3157 from education sources.

For most children identified from educational sources, ID was categorized only as mild–moderate (IQ ranging from 35–40 to < 70), so all subjects with either mild or moderate ID were grouped together. Children with $IQ < 35$ –40 were categorized as severe ID. Children with ID only and where the level of ID was unspecified were included in the mild–moderate group, as it was unlikely that those with severe ID would not be registered and identified as such by the DSC.²³ A child with ID and an ASD would be registered in the IDEA database with both an ID and ASD diagnosis. However, for cases with an ASD and where the individual was considered untestable for IQ, often in younger children or those

with limited compliance at the time of assessment (~40%), ID was not assumed.²¹

For the study, record linkage was conducted through the WA Data Linkage System²⁴ to combine individual-level data on all births in WA (identified from the statutory WA Midwives Notification System)²⁵ with ASD and ID data sources to identify unique cases of ASD and ID (wherever relevant), both born and diagnosed in WA. The resulting dataset was de-identified for the purpose of this study.

Age and year of diagnoses

Information on the exact age of diagnosis was available for 227 cases identified from the Autism Register. For the remaining 755 ASD cases, the year of registration with the DSC was used as a proxy measure for age of diagnosis. We compared the proxy measure with the age at diagnosis for the 227 cases from the Autism Register and found 86% of cases were registered with the DSC within a year of the age at diagnosis.

Cohort, period and age-related effects

From these data, we assessed the trend in ASD diagnosis over the study period by investigating cohort and period-related effects and whether these were modified by age of diagnosis.

Cohort effect

Prevalence by birth year of ASD and ASD subtypes (autism, Asperger syndrome and PDD-NOS) were examined. The numerator comprised children born between 1983 and 1999 and diagnosed with an ASD up to the age of 8 years between 1983 and 2004. Denominator data were obtained from the WA Midwives Notification System and consisted of all live births of ≥ 20 weeks' gestation born in WA from 1985 to 1999. Calculation of the prevalence by year of birth was based on the number of ASD cases born in the specific birth year divided by all live births in the WA population in that same year and expressed per 10 000 births.

Period effect

Annual incidence of ASD based on the year of diagnosis and changes in diagnosis and service provision over time were assessed. The numerator was based on all newly diagnosed cases of ASD in children aged <8 years in each year from 1985 to 2002. The denominators for this cohort were, therefore, restricted to all children at risk of diagnosis in each year during 1985–2002. For example, based on our study population of all births 1983–99, children diagnosed with an ASD in 1987 could only be aged 2–4 years and, thus only children in this age group would be considered 'at risk'. Any child diagnosed in 2001 could be aged between 2 and 8 years of age and children in this age group would be 'at risk'. Incidence of ASD by year of diagnosis was calculated using ASD cases diagnosed

in each year (1985–2002) divided by the annual mid-year population estimate of the corresponding denominator population in WA at risk in the relevant year and expressed per 10 000 child-years at risk. The population estimates were obtained from the Australian Bureau of Statistics (ABS).²⁶ Specific events and time periods related to the diagnosis of ASD and introduction and availability of services in WA were plotted on the trend graph of ASD by year of diagnosis. To examine the cohort and period effects in more detail, the age-specific prevalence by year of birth and annual incidence by year of diagnosis for children aged 2–3, 4–5 and 6–8 years were calculated and presented.

Trends in ID and ASD in preschool children

This was examined by extracting a subset of the original cohort. Since case ascertainment in this study only extended to 2004, this analysis was limited to children born from 1983 to 1999 and diagnosed with ASD ($n=777$) or ID ($n=988$) by 5 years of age. As a result, cases of ID from education sources were not included. We used this cohort to compare rates and year of diagnosis of ASD (with and without ID) with rates of ID (without ASD) in children ≤ 5 years of age. Age at diagnosis for children with ID was obtained using the proxy measure of year of registration from the DSC, which was available for all children in this group. For this analysis, the incidence and age-specific incidence rates of ASD and ID were calculated for each year of diagnosis from 1985 to 2002, using the appropriate ABS mid-year population denominators for children.

Trends in prevalence of all ASD by birth year and incidence by year of diagnosis were assessed using Poisson regression analysis to estimate the average percentage change per year and associated 95% confidence intervals (CIs). Where there was evidence of over-dispersion in the results with a deviance greater than 2, a negative binomial model was applied. All data were analysed using SAS, release 9.1 (SAS Institute, Cary, NC, USA).

The study protocol was approved by the ethics committee of the University of Western Australia and the Confidentiality of Health Information Committee for the Department of Health, WA.

Results

A total of 982 children born in 1983–99 were diagnosed with an ASD up to the age of 8 years by 2004 in WA with an overall prevalence of 23.4 cases per 10 000 births (95% CI 21.9–24.8) (Table 1). In 1983, 1.7 in every 10 000 children born in WA were diagnosed with an ASD by age 8 compared with 53.4 per 10 000 children born in 1997, representing a significant increase in the prevalence of 16.6% per

Table 1 Prevalence (95% CI) and trend in overall and type of ASD for children aged ≤8 years born during 1983–99 and diagnosed by 2004 in WA

Year of birth	Autism (n = 700)	Asperger syndrome (n = 40)	PDD-NOS (n = 199)	ASD (n = 982) ^a
Number of cases				
1983–87	29	4	8	56
1988–93	172	26	46	269
1994–99	499	10	145	657
Prevalence (per 10000 births)				
1983–87	2.5 (1.6–3.4)	0.3 (0–0.7)	0.7 (0.2–1.2)	4.8 (3.5–6.1)
1988–93	11.4 (9.7–13.1)	1.7 (1.1–2.4)	3.0 (2.2–3.9)	17.8 (15.7–19.9)
1994–99	32.8 (29.9–35.7)	0.7 (0.3–1.1)	9.5 (8.0–11.1)	43.2 (39.9–46.5)
Overall prevalence (per 10000 births)	16.7 (15.4–17.9)	1.0 (0.7–1.2)	4.7 (4.1–5.4)	23.4 (21.9–24.8)
Rate of change (% per annum)	20.8 (17.4–24.2)	3.8 (–4.2–11.8)	21.3 (16.0–26.7)	16.6 (14.1–19.1)
P-value	<0.01	0.35	<0.01	<0.01

^aInformation on type of ASD was not available for n = 43 cases.

annum (95% CI 14.1–19.1; *P* < 0.01). Of the total cases of ASD, 71% were classified with autism, 4% with Asperger syndrome, 20% with PDD-NOS and information on the type of ASD was not available for 4% of cases. The corresponding prevalence per 10000 births between 1983 and 1999 was 16.7 (95% CI 15.4–17.9) for autism, 1.0 (95% CI 0.7–1.2) for Asperger syndrome and 4.7 (95% CI 4.1–5.4) for PDD-NOS (Table 1). The total number of cases with autism rose by 20% per annum over the study period (95% CI 17.4–24.2), from five cases (2 per 10000 births) born in 1985 to 100 cases (40 per 10000 births) of autism diagnosed among children born in 1997.

Figure 2A highlights the sharp increase in all three age-specific prevalences for a diagnosis of autism in annual birth cohorts from the late 1980s onwards. The prevalence of autism was highest for children aged 4–5 years, who were born in the early 1990s, but was surpassed by the 2- to 3-year old age group for births in the mid-1990s. In 1999, almost 20 in every 10000 children were diagnosed with autism by the age of 3 years compared with 13 per 10000 children aged 4–5 years. Downward trends in the latter years for the 4- to 5-year and 6- to 8-year-old age groups may have been due to the decreasing age of diagnosis and/or lack of years available for follow-up to attain a diagnosis. The age-specific prevalence of PDD-NOS followed a similar pattern to that of autism (Figure 2B).

Figure 3 presents the rising trends in the incidence of ASD by year of diagnosis among children born during 1983–99 and diagnosed during 1985–2002 before the age of 8 years. In 1992, only 20 cases or 1 per 10000 children ≤8 years of age were diagnosed with an ASD. By 2002, the overall incidence of ASD had increased to approximately 140 new cases equivalent to almost 8 per 10000 children diagnosed in that year.

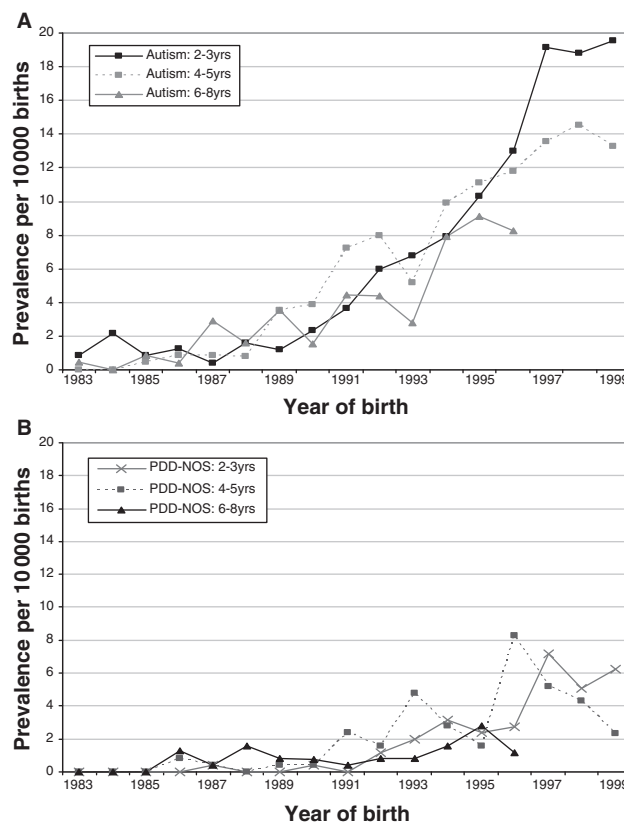


Figure 2 Trend in the prevalence of Autism (A) and PDD-NOS (B) in WA for children aged ≤8 years and born during 1983–99

Information on the timing of events related to ASD diagnosis and availability of services occurring in WA is also presented in Figure 3. In the 1980s, the incidence of ASD was relatively low and the trend reflects the increasing recognition of autism as a

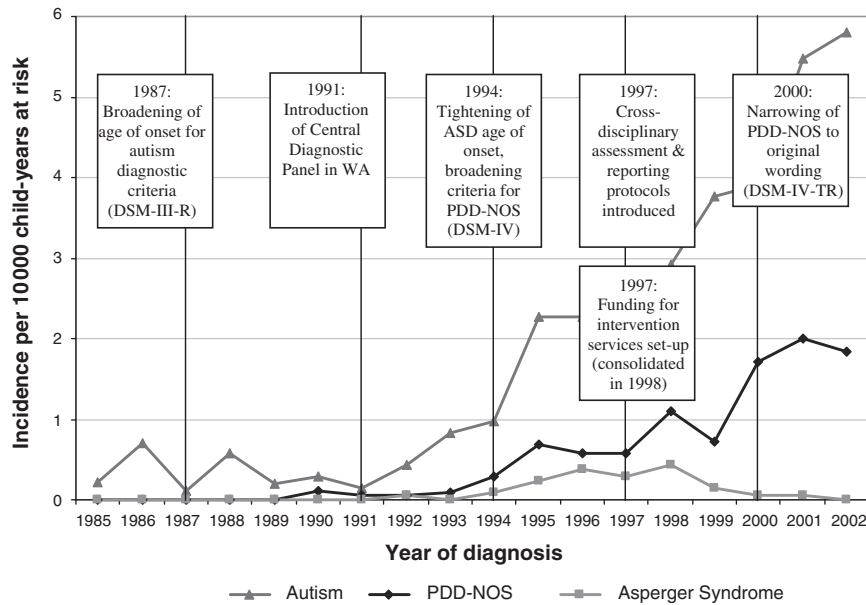


Figure 3 Incidence and significant events in the diagnosis of ASD between 1985 and 2002 among children ≤ 8 years of age in WA

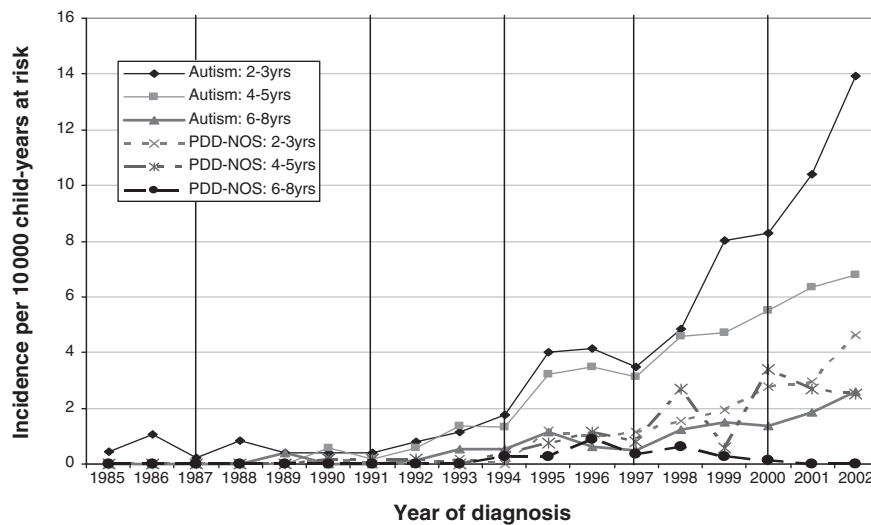


Figure 4 Age-specific rates of ASD diagnosed between 1985 and 2002 among children ≤ 8 years of age in WA

developmental disorder. During this time, assessment and clinical management of children was conducted by a developmental paediatrician supplemented with assessments by a clinical psychologist and speech pathologist and provided through both government and non-government agencies.¹⁶

From the late 1980s to the early 1990s, there was a parent-initiated drive towards more pro-active and intensive early intervention services, including the use of applied behavioural analysis.²⁷ In 1991, a multidisciplinary Central Diagnostic Panel was established to conduct the diagnostic assessment and determine eligibility of children for services,¹⁶ resulting in a marked increase in the annual incidence of autism.

In the early 1980s, the DSM-III criteria were applied as the primary diagnostic tool and then the DSM-III-R was used between the late 1980s and mid-1990s. In 1994, the DSM-IV criteria became the primary diagnostic tool and the diagnosis of Asperger syndrome was introduced. The rate of autism increased with sharp rises in 1995 and then again in 1997 following the formalization of the ASD assessment procedure with the introduction of cross-disciplinary assessment and protocols in WA. In the same year, the government-funded DSC was designated as the primary agency to distribute early intervention funding¹⁶ with the provision of funds only to families with preschool-aged (but not school-age) children, for

interventions by a service provider of their choice. This required all children diagnosed with an ASD to undergo a team assessment by a paediatrician or psychiatrist, a psychologist and a speech pathologist before being eligible for ASD-specific early intervention funding. Since 1997, the diagnosis of autism has continued to increase markedly and the DSM-IV criteria have been in continuous use including some evidence-based text revisions in definitions in 2000. This included a narrowing of criteria for PDD-NOS. Figure 3 highlights the fall in the incidence of Asperger syndrome after 1998. As Asperger syndrome is commonly diagnosed around the age of 7 or 8 years, most children in the cohort were not old enough to attain a diagnosis in the latter years of the study.

Figure 4 displays the age-specific annual incidence rates for autism and PDD-NOS from 1994 onwards. The trends for autism within each group were similar to the increases shown in Figure 3 for all ages combined. Nonetheless, the age of diagnosis of autism changed significantly over this period, as shown in Figure 5.

Figure 6 presents the trends in ASD and ID of unknown cause in preschool-aged children. When

analysis was restricted to children aged ≤ 5 years, the increase in all ASD occurred at a much faster rate than that for children ≤ 8 years of age. The overall incidence of ASD diagnosis increased by 21.8% (95% CI 19.1–24.5) per annum, from two cases per 10 000 in 1992 to 12 cases per 10 000 children with the age of ≤ 5 years in 2002 (data not shown). Over the same time period, there was a 2.9% (95% CI 1.2–4.5) annual increase in diagnosis of mild-moderate ID from 4.3 to 6.9 per 10 000 and a decrease in severe ID of 10.1% (95% CI 5.9–14.2) per annum from 1.3 to 0.2 per 10 000 children aged ≤ 5 years diagnosed between 1985 and 2002 (Figure 6). During the 1980s the incidence of severe ID was higher than that for ASD, but from 1992 onwards the incidence of severe ID declined and ASD diagnosis grew rapidly and overtook that of severe ID in 1992 and mild-moderate ID from 1998 onwards. Of the children with ASD, over half (56.2%) were also reported to have an ID (Figure 6). The overall incidence of ASD diagnosis associated with ID and ASD alone was 2.5 and 1.9 cases per 10 000 children aged ≤ 5 years, respectively. Prior to 1993 most children diagnosed with ASD also had a diagnosis of ID reported; however, from 1993 onwards diagnosis of ASD alone increased steadily, on average, by 23% per annum. ASD associated with ID also rose by slightly less at 16% per annum, but dropped sharply in 2002, possibly due to the trend in ASD diagnosis at younger ages (Figure 6).

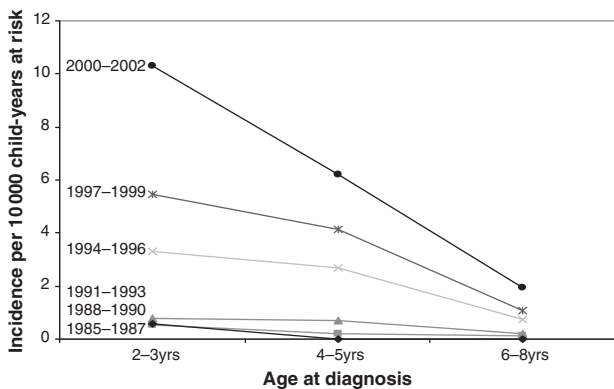


Figure 5 Age of diagnosis and incidence of autism for children ≤ 8 years of age in WA during 1985–2002

Discussion

Our findings demonstrate an increasing trend in the diagnosis of all ASD in children born in WA between 1983 and 1999 and diagnosed by 2004. Examination of the effects by birth cohort and by calendar year of diagnosis showed similar trends. However, the parallel and sharp increases at times of change in diagnostic criteria and introduction of funding for specific

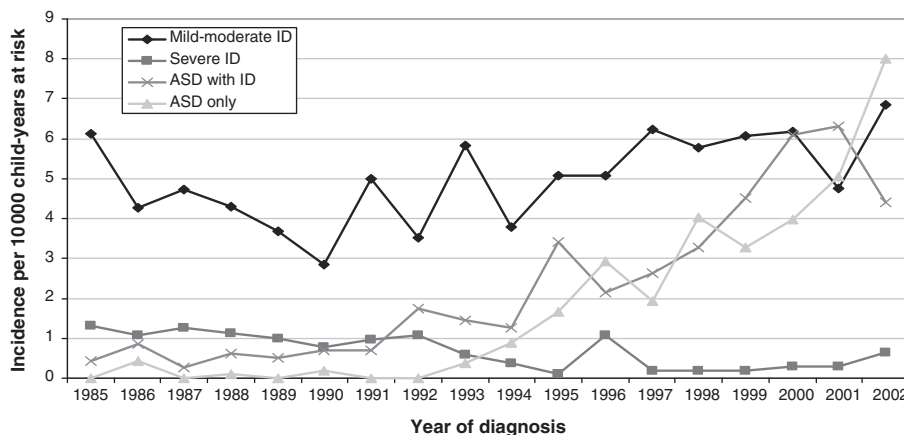


Figure 6 Incidence of ASD and ID (of unknown cause) in WA for children aged ≤ 5 years diagnosed during 1985–2002

ASD services (particularly after 2000) suggest that the period effects over calendar time were more influential than the birth cohort effects. Furthermore, the observed reduction in the age at diagnosis of autism and PDD-NOS and downward trends in rates for older children after 2000 seems likely to be due to the introduction of funding for services for younger children, but not for older children (>5 years) with ASD. It may also partly be due to the shift in the acceptance and recognition of ASD and the belief in the potential benefits of early intervention. For children aged ≤ 5 years, we found a small decrease in severe ID, which, in part, may be explained by a move away from the diagnosis of ID to the diagnosis of autism in this group of children. However, the decrease in severe ID was much smaller than the increase in ASD and hence, even if such a change in diagnostic practice did occur, it would not have accounted for much of the rise in ASD.

Strengths of the study include the multiple sources of case ascertainment, record linkage to all births in a defined geographical area and an ability to consider changes in diagnostic procedures, service provision and trends in ID in relation to trends in ASD. Although diagnostic criteria and official definitions changed over time, the same diagnostic process was applied in the assessment of all children at any given time. A further strength is the use of record linkage to investigate a complete cohort of preschool children aged ≤ 5 years. However, we acknowledge that diagnoses of both ASD and ID may occur well into school age, and mild ID (especially without other co-morbidities) often only becomes apparent once children start school and may explain the sharp drop in rates of ASD associated with ID in latter years. It will be important to continue this investigation as the cohort ages, to ascertain the extent of later diagnosis and its effect on lifetime prevalence of both ASD and ID, in order to assess to what extent the decreasing age at diagnosis may be accounting for the increase in ASD incidence.^{28,29}

Limitations of our study include the possibility of under-ascertainment of cases from the Autism Register because of lack of parental consent, and the need to use a proxy measure of age at diagnosis for a proportion of ASD cases and all cases of ID. This may have resulted in imprecise estimates of age at diagnosis. Also, the identification of ID in children with ASD is not easy, particularly as the presenting symptoms and characteristics of ASD and ID can overlap and especially when ASDs are being diagnosed at increasingly younger ages when many children cannot be tested for an ID. In the situations where information on ID level was missing we had to make the assumption that this was not present. Often, it is difficult to quantify the precise timing of changes in diagnostic criteria that came into effect within diagnostic practices, as these may also have been affected by drivers such as funding models, clinical uptake and

awareness, community support and delays in waiting times for assessments. However, our findings highlight that trends in ASD closely mirror the timing of events related to ASD diagnosis and availability of services and, particularly where the driver was related to funding, the effect on incidence of ASD appeared to be almost immediate.

Often period effects identified for diseases or health conditions are considered to reflect changes in diagnostic sensitivity and/or change in diagnostic criteria.³⁰ Our results are consistent with these hypotheses and with previous findings from the USA^{31,32} and Queensland, Australia,³³ and are in keeping with those postulated by Wazana *et al.*³⁴ Furthermore, the majority of children in WA are diagnosed with ASD at the age of <5 years and this is likely to be associated with the availability of funding for early intervention as well as being an accepted general standard of care. Although previous studies suggest that early intervention programs are beneficial for children with early autism, there is a lack of evidence on the comparative effectiveness of the few interventions that have been evaluated in methodologically rigorous trials.^{35,36}

Among children aged ≤ 5 years, the increase in the incidence of ASD diagnosis in our data was not completely offset by an equivalent decrease in the incidence of ID, as was shown among school-aged children in US special education.¹⁴ Independent influences, such as advances in neonatal technology, leading to improved survival of pre-term infants²⁵ with disability could have masked the effects of a diagnostic transfer or, conversely, improvements in survival without disability may account for all of the fall in severe ID. A further issue to be considered is that children with a borderline ID and an IQ of 71–75 (~2.8% of the population)³⁷ and who do not meet the DSC criteria for ID (IQ <70) may be more likely to be diagnosed with ASD in recent years. Such an effect would be difficult to quantify, but could explain some of the increase.

Our findings support a substantial increase in ASD diagnosis associated with diagnostic and service changes in WA over the last decade, although this is difficult to quantify and could be occurring in conjunction with a true increase in ASD. However, an important question is whether these children would have previously had an alternate diagnosis or no diagnosis at all. These data can really only tell the beginning of the story that we believe will be clarified and quantified by some further years of complete and consistent case ascertainment. It will also be valuable to examine more closely the socio-demographic, antenatal and perinatal characteristics of successive ASD cohorts, to investigate whether there are changing patterns in the characteristics of children with ASD and whether there may be any differences in the underlying aetiology of ASD over time.

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Conflict of interest: None declared.

KEY MESSAGES

- The prevalence of ASD by year of birth has increased in WA—a cohort effect.
- Sharp increases in ASD diagnoses occurred following changes in diagnostic criteria and introduction of funding for specific ASD services—a period effect.
- Median age of ASD diagnosis decreased from 4 to 3 years of age over the study period—an age effect.

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