Tidsskriftet Tidsskrift for Den norske legeforening

Autism spectrum disorder in preschool children in Sør-Trøndelag 2016–19

ORIGINAL ARTICLE

KRISTIN BROBAKKEN EIG

NTNU, Norwegian University of Science and Technology
She has contributed to data collection, literature searches, statistical analyses and the main work with the manuscript.
Kristin Brobakken Eig, medical student
The author has completed the ICMJE form and declares no conflicts of interest.

MARIA BRANDKVIST

Child and Adolescent Habilitation Services
St Olav's Hospital, Trondheim University Hospital
She has contributed to the design, content and reworking of the manuscript.
Maria Brandkvist, PhD, senior consultant
The author has completed the ICMJE form and declares no conflicts of interest.

STIAN LYDERSEN

Regional Centre for Child and Youth Mental Health and Child Welfare
NTNU, Norwegian University of Science and Technology
He has contributed to the statistical analyses.
Stian Lydersen, professor in medical statistics
The author has completed the ICMJE form and declares no conflicts of interest.

ANNE LISE HØYLAND

anne.lise.hoyland@ntnu.no
Child and Adolescent Habilitation Services
St Olav's Hospital, Trondheim University Hospital
and

Regional Centre for Child and Youth Mental Health and Child Welfare
NTNU, Norwegian University of Science and Technology
She has contributed to the concept and design of the study, and data interpretation.
Anne Lise Høyland, PhD, senior consultant and associate professor
The author has completed the ICMJE form and declares no conflicts of interest.

BACKGROUND
Autism spectrum disorder (ASD) is an umbrella term covering a range of conditions characterised by challenges with social interaction, restricted interests and repetitive behaviours. The prevalence of ASD has increased significantly in recent years, and there is a clinical impression of a preponderance of cases among young children whose mothers were not born in Norway.

MATERIAL AND METHOD
The study included 142 children aged 2 to 6 years who were diagnosed with autism in the county of Sør-Trøndelag, Norway in the period 2016–2019. The following information was collected: age at onset of symptoms and diagnosis, primary diagnosis, ADOS-2 (Autism Diagnostic Observation Schedule) scores, whether the child was born in Norway and the mother's country of birth.

RESULTS
Children of mothers born outside of Norway had a 7.7 times higher risk of being diagnosed with autism than children of Norwegian-born mothers, with an annual incidence of 0.74 % and 0.10 % respectively. These children were diagnosed earlier, at an average age (standard deviation) of 41.9 (11.8) and 51.8 (18.1) months respectively (95 % CI 4.7 to 15.2); a p-value of <0.001 for the difference. They also had a higher ADOS score, with an average (standard deviation) of 19.0 (6.2) and 15.3 (7.1) respectively.

INTERPRETATION
The preponderance of autism diagnoses may be an indication that the mothers' country of origin has an impact on the development of the condition. This has implications for adaptions to the assessment and follow-up of this patient group.

Main findings

The incidence of autism spectrum disorder was higher among children of migrant mothers than children of Norwegian-born mothers.

Children of migrant mothers were younger at the time of diagnosis and had more severe symptoms than children of Norwegian-born mothers.

Clinical impressions suggest an overrepresentation of autism spectrum disorder (ASD) among young children of migrant mothers and that the severity of ASD is greater in this group. This impression is supported by an official Norwegian report from 2020, where data from the Norwegian Patient Registry suggests an increased risk of autism in young children with a minority background (1).

'Autism spectrum disorder' is an umbrella term used to describe a range of disorders with early abnormalities in reciprocal social interactions and patterns of communication, as well as repetitive sensory-motor behaviours and limited interests (2).

With an estimated global prevalence of 7–8 per 1 000 (3) and 7–12 per 1 000 in Norway (4), ASD is no longer considered a rare condition. The prevalence is increasing both globally (5, 6) and in Norway (4), and varies by geographic region (6) and ethnicity (7). Several European studies have found an increased prevalence of ASD among children of migrant mothers (8–11) and that migration, particularly from low-income countries, is associated with more severe symptoms (9, 12–15). Some studies have shown that children with a lower socioeconomic status or with a different mother tongue are often diagnosed later than other children (16). This could be related to how language and cultural background impact on the ability of diagnostic instruments to identify difficulties in these children. However, an Australian study (12) found earlier diagnosis among children of migrant mothers from low-income countries.

The aim of our study was to examine whether there was an association between the migration background of the mothers and the incidence as well as severity of ASD among preschool children in Sør-Trøndelag from 2016 to 2019. We sought answers to the following research questions: Does the incidence of ASD among children of migrant mothers differ from that of children of Norwegian mothers? Does the severity of symptoms or age at diagnosis differ between the two groups?

Materials and methods

We conducted a retrospective review of hospital records for all children aged 2–6 years diagnosed with ASD at the Child and Adolescent Habilitation Services (HABU) and the Clinic for Child and Adolescent Psychiatry (BUP), St Olav's Hospital in the period 2016–19. Most children are evaluated for ASD at their local hospital. Sør-Trøndelag, the catchment area for St Olav's Hospital, was therefore chosen as the geographic location of the study. We included the ICD-10 diagnostic codes F84.0 Childhood autism, F84.1 Atypical autism, F84.5 Asperger syndrome and F84.9 Pervasive developmental disorder, unspecified.

A total of 198 children in the relevant age group were registered with a diagnosis within the autism spectrum: 192 at HABU and 6 at BUP. Of these, 44 were excluded because they were diagnosed before 2016. It was considered likely that obtaining informed consent would cause selection bias. We were therefore granted exemption from this requirement by the Regional Committee for Medical and Health Research Ethics (REK Midt 153304) on the grounds that the integrity of the participants would be safeguarded since the data would only be analysed at group level. Information about the study was sent by post to the parents of relevant candidates (n = 154), with the option to decline participation. Ten of the candidates contacted chose to opt out and two letters were returned due to unknown addresses. The ASD diagnosis is based on a combination of clinical observation, medical history and clinical instruments such as the *Autism Diagnostic Observation Schedule, 2nd ed.* (ADOS-2) (17). The latter involves a semi-structured play or interview session to assess the child's social functioning, communication and behaviour. A higher ADOS score indicates more severe symptoms (18). The following information was retrieved from the children's hospital records: age at symptom onset defined as the parents' first concern, age of diagnosis, main diagnosis, ADOS score and whether the child was born in Norway. We also registered the mother's country of origin. Mothers with Norway as their country of origin were referred to as Norwegian-born mothers, while mothers with a different country of origin were referred to as migrant mothers. Details of the mothers' country of origin were often incomplete as this information was retrieved from the children's hospital records. In one case, the child's name and the language spoken at home were used to indicate that the mother's country of origin was not Norway.

The time of symptom onset was often recorded imprecisely in the child's records. We therefore chose to define this in six-month intervals where the numerical variable used in statistical analyses was defined as the midpoint of this interval.

Data on the population of Sør-Trøndelag was obtained from Statistics Norway (19, 20), see Table 1. The groups were compared with Pearson's chi-squared test for categorical variables and Welch's t-test for scalar variables. Welch's t-test does not assume equal variance (21). Incidence is calculated as the number of diagnosed children divided by the number of children in Sør-Trøndelag in the relevant age group and time period. We reported 95 % confidence intervals (CIs) when relevant, used two-tailed tests, and set a significance level of 5 %.

Table 1

Incidence of ASD in children aged 2–6 years in SørTrøndelag. Population figures are from ssb.no (19, 20).

	2016	2017	2018	2019	Total
Number of newly diagnosed children	31	32	40	39	142
Total population of children aged 2–6 years	19 014	19 024	19 074	19 041	76 153

		2016	2017	2018	2019	Total
Children of Norwegian-born mothers	No. of newly diagnosed	14	14	17	18	63
	Population	16 666	16 456	16 244	16 096	65 462
	Incidence (%)	0.08	0.09	0.10	0.11	0.10
Children of migrant mothers	No. of newly diagnosed	17	18	23	21	79
	Population	2 348	2 568	2 830	2 945	10 691
	Incidence (%)	0.72	0.70	0.81	0.71	0.74
Relationship between incidence for children of migrant mothers and Norwegian-born mothers		8.6	8.2	7.7	6.4	7.7

The analyses were performed using SPSS 27, with the exception of incidence analyses, which were performed in Stata 16.

Results

The study included 142 children in Sør-Trøndelag diagnosed with ASD in the period 2016–19 (Table 1). Parents of 80 of the children (56 %) reported their first concern about symptoms between 12–24 months of age (Figure 1). The difference in age at symptom onset between children of migrant mothers and children of Norwegian-born mothers was not statistically significant.

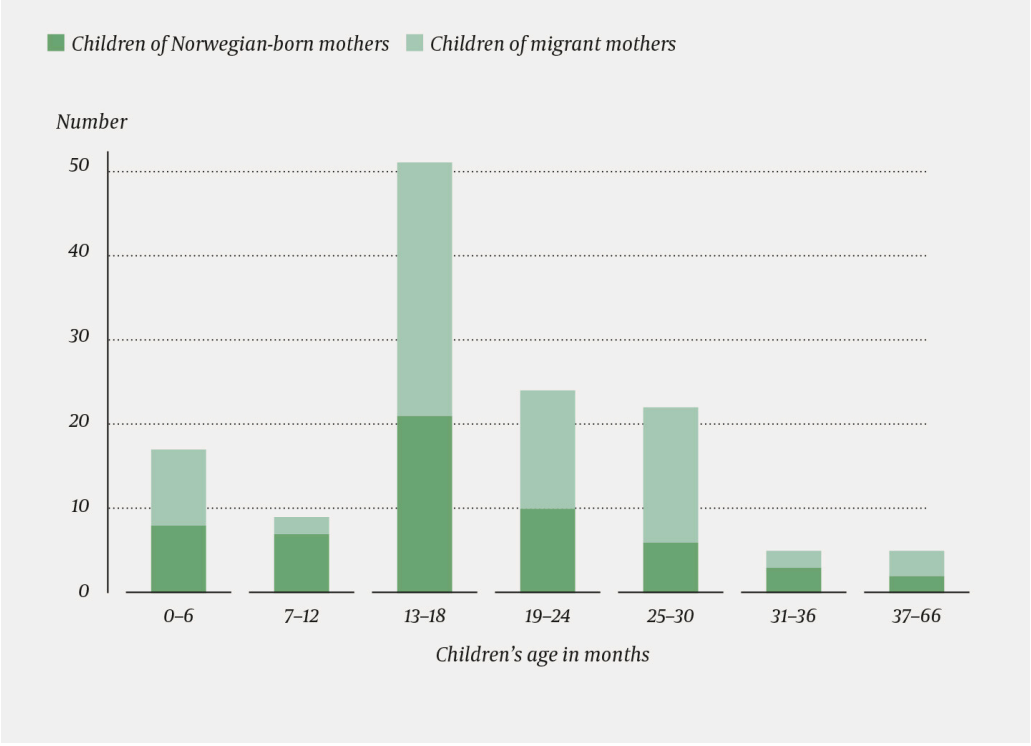

Figure 1 Age at symptoms onset in preschool children with autism spectrum disorder in Sør-Trøndelag 2016–19 divided into six-month intervals (n = 133). The difference in

reported symptom onset between the two groups is not statistically significant.

Of the 142 children included, 128 (90 %) were born in Norway. Sixty-three children (44 %) have a Norwegian-born mother and 79 (56 %) children have a migrant mother. The mothers come from 28 countries (Figure 2). Twenty-two per cent of these countries are in Africa, predominantly Eritrea and Somalia. The incidence of ASD in the time period was 0.74 % per year for children of migrant mothers and 0.10 % for children of Norwegian-born mothers. This means that the risk of being diagnosed with ASD was 7.7 times higher (95 % CI 5.4 to 10.9, p <0.001) for children of migrant mothers compared with children of Norwegian-born mothers (Table 1).

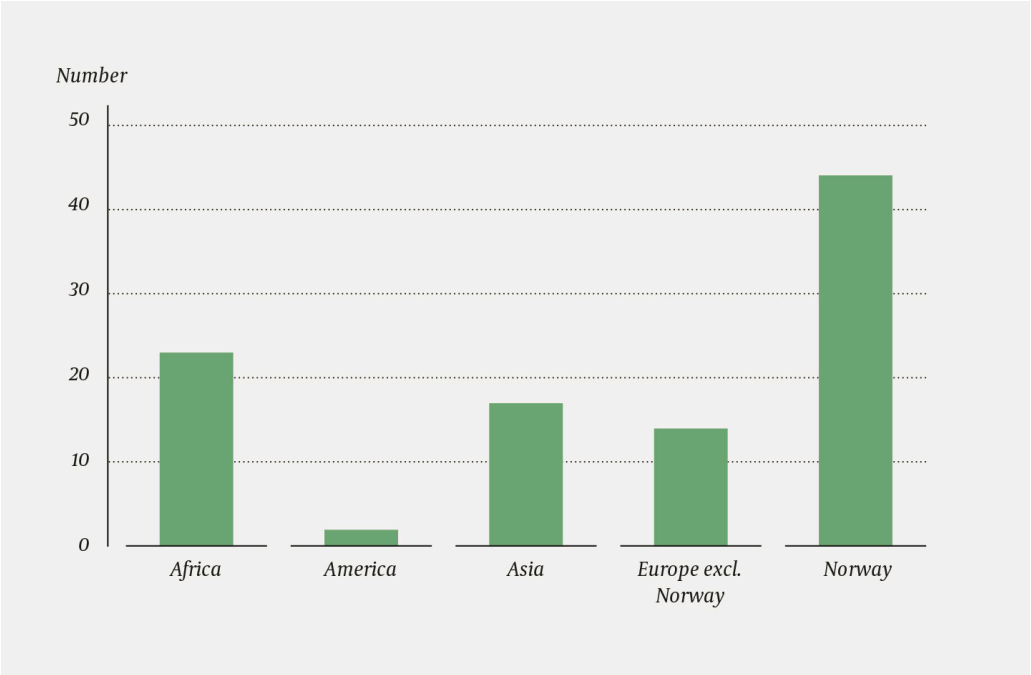

Figure 2 Country of origin for mothers of preschool children diagnosed with ASD in Sør-Trøndelag 2016–19 (N = 142).

The mean age at diagnosis for children of migrant mothers was 41.9 (standard deviation (SD) 11.8) months compared to 51.8 (18.1) months for children of Norwegian-born mothers. The difference was 9.9 (95 % CI 4.7 to 15.2, p <0.001) months between the two groups.

Children of migrant mothers had higher ADOS scores than children of Norwegian-born mothers, with mean scores of 19.0 (6.2) and 15.3 (7.1) respectively. The difference was 3.7 (95 % CI −6.1 to −1.3, p = 0.002). See Table 2 for the distribution of diagnostic codes. The differences between the diagnostic codes were statistically significant (Pearson's chi-squared test with 2 degrees of freedom, p = 0.003).

Table 2

Distribution of ICD-10 diagnostic codes in children of Norwegian-born mothers and children of migrant mothers (N = 142). Diagnostic codes: F84.0 = Childhood autism, F84.1 = Atypical autism, F84.5 = Asperger syndrome, F84.9 = Pervasive developmental disorder, unspecified.

		F84.0/F84.1	F84.5	F84.9	Total
Was the mother born in Norway? Number (%)	Yes	19 (30)	5 (8)	39 (62)	63 (100)
	No	42 (53)	0 (0)	37 (47)	79 (100)
Total (%)		60 (42)	5 (4)	76 (54)	142 (100)

Discussion

Our findings suggest that the mother's migration background is associated with an increased risk of ASD in preschool children, as well as more severe symptoms and a younger age at diagnosis. The findings suggest that the mother's migration background may influence the development of ASD. Our findings also imply a need to tailor the investigation to this patient group and highlight the need to clarify information and facilitate supportive services.

One of the strengths of our study is that we have identified all children diagnosed within the autism spectrum at St Olav's Hospital in the given age group and time period. Only 8 % of those invited to participate declined or had moved, and therefore could not be included. The Norwegian health service and the close cooperation between the health services and educational institutions (the Educational and Psychological Counselling Service/kindergartens) help ensure that children with a suspected neurodevelopmental disorder are identified and referred, regardless of socioeconomic status or family background. Hence, our dataset is unique and is hardly affected by selection bias.

Limitations to our study include limited information on the mother's country of origin as this was acquired through the child's hospital records. It was also difficult to acquire reliable information on language skills and cognitive function due to the child's young age and difficulties with social interaction associated with this disorder. We therefore have limited information on how many of the children also had a concurrent intellectual disability. We also have limited information on the child's socioeconomic status and we lack genetic information.

Previous studies support our findings of an increased risk for ASD in children of migrant mothers (9–11, 22). Several studies investigate the prevalence of ASD in this group (23, 24) while we investigated the incidence. Nevertheless, we do not expect this to affect results as our study population is of a young age. Several genetic variants can predispose a child to ASD (25). However, studies have shown that environmental factors both before and after birth also play a role (16, 26). Further research is therefore needed on how these can contribute to the risk of developing autism (16).

Medical records showed that 67 children (86 % of the group with a migrant background) had two parents with a migrant background. However, not all medical records included information on the fathers' country of birth. Only one

child had a Norwegian-born mother and a foreign father. A Swedish study (10) found that the mother's migration background increased the risk for ASD independent of the migration background of the father. A Finnish study (11) found no increased risk of ASD among children where only the father had a migrant background.

We found a higher mean ADOS score in children of migrant mothers compared with children of Norwegian-born mothers. This group was also younger at the time of diagnosis. A plausible explanation could be that these children were identified and examined at an earlier age because they had more severe symptoms. An Australian study (12) found that children of mothers who migrated from low-income countries were younger at the time of diagnosis and had an increased risk of intellectual disability. Our findings may indicate greater severity of the disorder in children of migrant mothers. The association between higher ADOS scores and early age of diagnosis was shown in both groups. This indicates that young children with clear signs of developmental disorder are identified and evaluated early, regardless of the mother's country of origin. However, we cannot rule out the possibility that some of the variance in ADOS scores found in this study could be attributed to reduced validity of the ADOS scoring as a diagnostic tool when the child and healthcare professional do not speak the same language or share the same cultural background.

Children of migrant mothers were overrepresented among preschool children with ASD, which may be an indication that migration in this age group has aetiological significance. A review of patient records of children diagnosed with ASD in a geographical region of the United States in the period 2004–14 (27) found that children with verbal language skills and comorbidities such as ADHD were often diagnosed at an older age. The study also found that children raised by migrant mothers in multilingual homes were younger at age of diagnosis than children of mothers without a migrant background.

Symptoms of Asperger syndrome become increasingly apparent in older children, while delayed language development often contributes to early referral (28). Our dataset has few children with Asperger syndrome as only preschool children were included. Several studies have shown a reduced risk of Asperger syndrome (10, 29) and of high-functioning autism (14) in children of migrant mothers. This supports the hypothesis that there is a distinction between ASDs in these two age groups, and they should therefore be studied separately. In most studies, inclusion criteria are based on the child's year of birth (11, 15, 23, 24, 29) or when the child was examined (13, 22, 23). Comparing individuals with ASD diagnosed at different times could reveal important information with regard to aetiological factors.

A qualitative study from England of parents with a Somali background who have children with autism (30) highlighted the importance of having a cultural understanding of this disorder. This study illustrates the need to improve the families' understanding of ASD, to provide families with support and to encourage them to seek help at an early stage. It is likely that the challenges described in the study are generalisable to our patients.

The large proportion of children with ASD of migrant mothers in Sør-Trøndelag (56 % of the study population) underlines the importance of adapting the evaluations and follow-up to children and families with a different native tongue and cultural background. Such measures include interpreting services and the translation of information to the child's mother tongue.

Conclusion and implications

This study supports the clinical impression that ASD is overrepresented among children of migrant mothers. The incidence of ASD was 7.7 times higher in children of migrant mothers than children of Norwegian-born mothers. Our findings also suggest that children with ASD of migrant mothers are younger at the time of diagnosis and have more severe symptoms.

This reinforces the need for further studies on the role of maternal migration in the development of ASD. Healthcare professionals should be aware of how a different mother tongue and cultural background impacts the evaluation and follow-up of children with ASD and their families. The rapidly increasing number of children diagnosed with ASD and concurrent overrepresentation of families with a migration background puts further pressure on evaluation and follow-up resources.

This article has been peer-reviewed.

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Publisert: 23 March 2022. Tidsskr Nor Legeforen. DOI: 10.4045/tidsskr.21.0673
Received 23.9.2021, first revision submitted 23.12.2021, accepted 28.1.2022.