

# Factors Associated with Age at Diagnosis of Autism Spectrum Disorder in Pediatric Patients at Sawanpracharak Hospital, Thailand

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## ABSTRACT

**Objective:** This study aimed to determine the average age at diagnosis and the characteristics associated with the age of children at the diagnosis of autism spectrum disorder (ASD) at Sawanpracharak Hospital.

**Materials and Methods:** A retrospective cross-sectional study was conducted from May 2023 to July 2023. Data were collected from the medical patient files of all children diagnosed with ASD between 2020 to 2022. Descriptive analysis was used to examine the characteristics of the children and their caregivers, and the children's age at diagnosis. Factors associated with the age at diagnosis were assessed by chi-square test analysis.

**Results:** In total, 100 patient records with complete information were collected. The average age at the diagnosis of ASD was  $4.57 \pm 1.61$  years old, with 60% of the patients diagnosed after four years of age. Social communication deficit symptoms, including non-response to name and lack of pointing out objects of interest, were significantly associated with an early ASD diagnosis ( $p$ -value = 0.023 and 0.002, respectively). Being a firstborn child and the presence of delayed development were found to delay the diagnosis of ASD meaning it occurred at a later age ( $p$ -value = 0.002 and 0.019, respectively). However, sex, the caregiver's education, and socioeconomic status were not related to the age at diagnosis.

**Conclusion:** Most children with ASD who received treatment at Sawanpracharak Hospital were diagnosed late. Being a firstborn child, poor response to name being called, lack of pointing out objects of interest, and delayed development were related to the age of the children at ASD diagnosis. Differences in diagnostic age based on sociodemographic and clinical characteristics indicate the need for coordinated measures for the early detection of ASD.

**Keywords:** Autism Spectrum Disorder; age of diagnosis; associated factors; delayed development; social communication deficit (Siriraj Med J 2023; 75: 778-783)

## INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that affects children's development, learning ability, and daily life activities. In addition, families caring for children with ASD face increased stress from the difficulty of caring for these children and the burden of the treatment costs, which can affect family relationships. The diagnostic criteria for ASD are based

on the Diagnostic Standards and Statistical Manual for Psychological Disorders, fifth edition (DSM-5), consisting of two core symptoms: social communication deficits and restrictive, repetitive behavior or interest.<sup>1</sup> Currently, the reported prevalence rate of ASD is as high as 1 in 36 children<sup>2</sup>, and the prevalence rate in boys is 2–3 times that of girls.<sup>3</sup> The cause of ASD is a combination of two factors: genetic and environmental factors.<sup>4,5</sup> The environmental

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factors that correlate with this disease include maternal exposure to certain drugs or chemicals, intrauterine infections, perinatal or postnatal complications, and advanced parental age.<sup>5</sup>

At present, there are many treatment modalities for children with ASD. However, the existing modalities are not a cure for this disease, but rather, current treatment methods are aimed at minimizing disabilities and minimizing children's dependence on others in society.<sup>6</sup> A study by Rogers and Vismara (2008) found that children with autism who received early treatment before age 3 had a better prognosis than those who received treatment after age 3.<sup>7</sup> The results of their study may be explained by the fact that children's brains develop rapidly and are highly adaptable before the age of 3. Early detection is crucial for early intervention in children with ASD. Therefore, the American Academy of Pediatrics (AAP) has issued recommendations for ASD screening in all children aged between 18 and 24 months old who attend health check-ups at a well-child clinic.<sup>6</sup>

In Thailand, there is no explicit recommendation for ASD screening. Previous studies have found that the average age at ASD diagnosis is between 3.9 and 5.7 years old<sup>8</sup>, considered a delayed diagnosis. The factors related to a delayed diagnosis include living in rural areas, impoverished families, and lower parental education.<sup>9,10</sup> In contrast, severely impaired language development and abnormal noticeable repetitive movement contribute to the early diagnosis of ASD.<sup>11</sup> However, in Thailand, no study has yet analyzed the average age at ASD diagnosis and the factors related to the age at ASD diagnosis. Thus, this study aimed to narrow this knowledge gap and use the obtained information to develop future ASD screening guidelines for Nakhon Sawan, Thailand.

## **MATERIALS AND METHODS**

### **Study design and population**

This was a hospital-based, descriptive retrospective cross-sectional study that was conducted from May 2023 to July 2023. All children who were diagnosed with ASD at Sawanpracharak Hospital between 2020 and 2022, according to DSM-5 criteria, were included in this study. In 2020, a developmental and behavioral pediatrician started work at Sawanpracharak Hospital and set up a complete patient record system; this was thus defined as the starting period for the data collection. A total of 100 ASD patient files with complete patient records were collected. The data collected included sex, birth order, age at diagnosis, comorbidity, family history of ASD, number of primary physicians whom the patients consulted before diagnosis, residence, symptoms that

caregivers notice before consulting physicians, and the primary caregiver's characteristics. Although Rogers and Vismara's study suggested that diagnosis after three years of age is late,<sup>7</sup> in our study, almost all the children were diagnosed with ASD after 3 years of age, so we decided to use the age of 4-years old to distinguish early diagnosis from late diagnosis.

The Institutional Review Board (IRB) of Sawanpracharak Hospital (COA. 38/2565) approved the study protocol.

### **Data analysis**

The coding in the case record forms was verified and entered into the computer system using Microsoft Excel. SPSS Statistics Program Version 26 (IBM Corp., Armonk, NY) was used for data processing and statistical analysis. The frequency, percentage of categorical data, and mean  $\pm$  standard deviation were used for the descriptive analysis. In order to investigate the factors related to the age at diagnosis, the chi-squared test or Fisher's exact test was used.

## **RESULTS**

In this study, a total of 100 complete patient records of pediatric patients diagnosed with ASD at Sawanpracharak Hospital between 2020 and 2022 were collected and analyzed. The average age of the children at ASD diagnosis was  $4.57 \pm 1.61$  years old. Most of the patients (88%) were boys and 61% were firstborn children. The most common comorbid conditions of these children were global developmental delay (60%) and ADHD (51%). At the same time, 9% had a positive family history of ASD. In addition, the majority of these children (84%) were diagnosed after consulting 1–2 primary physicians. Most of these children (73%) live outside the urban areas of Nakhon Sawan Province. When considering only the symptoms that caregivers observed before seeking medical consultation, the most common were hyperactivity (60%), lack of pointing out an object of interest (46%), and delayed development (39%) (Table 1).

Table 2 shows that almost all the primary caregivers (93%) were female, and almost half (44%) were between 30 and 39 years old. Most caregivers (81%) had an education level below a bachelor's degree. In addition, most of these children's families (82%) earned less than USD 886 a month.

Among all the children, 40 were diagnosed with ASD before the age of four, and were classified as an early diagnosis. In contrast, the other 60, who were diagnosed after age four, were classified as a late diagnosis. The frequency distribution of the age at diagnosis based on

**TABLE 1.** Demographic characteristics of children with ASD who received treatment and comparison of the patients' demographic characteristics between the "early age at diagnosis group" and "later age at diagnosis group."

Demographic characteristics	Descriptive results			P-value
	Total number (100)	Early age at diagnosis <4 years old (n=40)	Later age at diagnosis ≥4 years old (n=60)	
Sex				0.258
Boy	88 (88)	37 (92.5)	51 (85)	
Girl	12 (12)	3 (7.5)	9 (15)	
Birth order				0.002*
First born	61 (61)	15 (37.5)	41 (68.3)	
Not first born	39 (39)	25 (62.5)	19 (31.7)	
Comorbidity				
GDD	60 (60)	26 (65)	34 (56.7)	0.405
ADHD	51 (51)	19 (47.5)	32 (53.3)	0.568
Epilepsy	2 (2)	0 (0)	2 (3.3)	0.358
Positive family history of ASD	9 (9)	4 (10)	5 (8.3)	0.775
Number of primary physicians consulted before diagnosis				0.244 <sup>a</sup>
1–2	84 (84)	32 (80)	52 (86.7)	
3–4	14 (14)	8 (20)	6 (10)	
≥5	2 (2)	0 (0)	2 (3.3)	
Residence				0.713
Urban	27 (27)	10 (25)	17 (28.3)	
Rural	73 (73)	30 (75)	43 (71.7)	
Symptoms that caregivers observed before seeking medical consultation				
Poor eye contact	82 (82)	31 (77.5)	51 (85)	0.339
Poor peer relationship	63 (63)	23 (57.5)	40 (66.7)	0.352
Hyperactive	60 (60)	27 (67.5)	33 (55)	0.211
Lack of pointing out objects of interest	46 (46)	26 (65)	20 (33.3)	0.002*
Delay development	39 (39)	10 (25)	29 (48.3)	0.019*
No response to name	32 (32)	18 (45)	14 (23.3)	0.023*
Delay speech	29 (29)	8 (20)	21 (35)	0.105
Aggressive	16 (16)	5 (12.5)	11 (18.3)	0.436
Loss of language skills	15 (15)	5 (12.5)	10 (16.7)	0.568
Food selectivity	8 (8)	4 (10)	4 (6.7)	0.403 <sup>a</sup>
Sleep problem	7 (7)	3 (7.5)	4 (6.7)	0.585 <sup>a</sup>

**Abbreviations:** ASD = autism spectrum disorder, GDD = global developmental delay, ADHD = attention deficit/hyperactivity disorder. Data presented as number (percentage)

The comparison of differences was analyzed by chi-square test. <sup>a</sup>The associations were assessed using Fisher's exact test. \*Statistically significant at  $p$ -value < 0.05.

**TABLE 2.** Demographic characteristics of primary caregivers' children with ASD and comparison of the primary caregivers' demographic characteristics between the "early age at diagnosis group" and "later age at diagnosis group."

Demographic characteristics	Descriptive results			P-value
	Total number (100)	Early age at diagnosis <4 years old (n=40)	Later age at diagnosis ≥4 years old (n=60)	
Gender				0.699 <sup>a</sup>
Male	7 (7)	2 (5)	5 (8.3)	
Female	93 (93)	38 (95)	55 (91.7)	
Age				0.906
20–29 years	15 (15)	7 (17.5)	8 (13.3)	
30–39 years	44 (44)	16 (40)	28 (46.7)	
40–49 years	24 (24)	10 (25)	14 (23.3)	
≥ 50 years	17 (17)	7 (17.5)	10 (16.7)	
Education level				0.061
Below bachelor's degree	81 (81)	36 (90)	45 (75)	
Bachelor's degree and above	19 (19)	4 (10)	15 (25)	
Family monthly income (US dollars)				0.671
<886 <sup>+</sup>	82 (82)	32 (80)	50 (83.3)	
≥886 <sup>+</sup>	18 (18)	8 (20)	10 (16.7)	

Data presented as number (percentage).

The comparison of differences was analyzed by chi-square test. <sup>a</sup>The associations were assessed using Fisher's exact test. \*Statistically significant at  $p$ -value < 0.05.

<sup>+</sup>1 US dollar = 33.90 bahts

various variables is illustrated in Table 1&2 using chi-square or Fisher's exact test analysis. The symptoms observed by caregivers before the children received a medical consultation had a statistically significant association with the age at diagnosis. There was a substantial correlation between the earlier-diagnosed and the later-diagnosed age groups in having several symptoms, such as no response to name ( $p$ -value = 0.023) and lack of pointing out objects of interest ( $p$ -value = 0.002), with the earlier-diagnosed age group having a broader distribution (Table 1). On the other hand, delayed development was more common in the later-diagnosed age group ( $p$ -value = 0.019). In addition, being a firstborn child was associated with a late diagnosis of ASD ( $p$ -value = 0.002) (Table 1).

## DISCUSSION

Our result reveals that the mean age at diagnosis of ASD in pediatric patients consulted at Sawanpracharak Hospital was  $4.57 \pm 1.61$  years old. ASD typically shows its first signs at around 12 months of age. However,

diagnosis is only possible from the age of 18 months.<sup>12</sup> According to previous studies, the range for the average age of diagnosis is 2.7 to 7.2 years old.<sup>12,13</sup> Looking at the overall situation, the age at diagnosis in our population is no different from previous studies. However, recent studies have shown a trend toward early diagnosis before 3 years of age.<sup>14,15</sup> Therefore, this result is important information to remind our hospital to actively adjust its policies to facilitate the early detection of this condition.

Considering the factors that may be associated with the age at diagnosis, our study found that firstborn children were more likely to be diagnosed with ASD later than non-firstborn children. Our findings are inconsistent with previous studies that did not find an association between birth order and age at diagnosis.<sup>16,17</sup> This disparity may be explained by the nature of our population, whose caregivers have a low education level and are unaware of the child's expected age-appropriate development.<sup>18</sup> However, once these caregivers had experience of raising children, they began to notice the

development difference between the first child and the non-first child. Therefore, non-firstborn children would have autism-specific symptoms noticed earlier.

In our study, the main symptoms observed by caregivers before seeking medical consultation were related to an early diagnosis of ASD, including unresponsiveness to name and lack of pointing out objects of interest. These results are consistent with Loubersak's study (2023), which found that delayed social communication skills are associated with a younger ASD diagnosis.<sup>12</sup> Social communication skills, including nonverbal communication, are often the symptoms that concern parents and that they notice first. Children with these symptoms are often not interested in interacting with their parents properly or using age-appropriate communication. Furthermore, early communication skills, including pointing out objects of interest and responding to names, can be found before a child is 12 months old, and observed even before children have linguistic ability. Thus, children with these symptoms are often diagnosed early.

In contrast, previous studies have shown that children with developmental delays are diagnosed with ASD earlier than those without delayed development.<sup>12,16</sup> That our findings are inconsistent with those studies may be explained by the fact that developmental retardation can mask the specific symptoms of autism.<sup>19</sup> Moreover, before 2020, pediatric patients who came for consultation at Sawanpracharak Hospital were examined by general pediatricians who may not have been skilled in diagnosing ASD. Thus, this reason may have led to a delay in diagnosing this group of children.

In addition, our study did not find differences in sex, caregiver's education, socioeconomic status, and distance to access treatment between the early- and late-diagnosed ASD groups. This finding is similar to Loubersak's study (2023).<sup>12</sup> These data indicate that the educational level or economic status of the caregiver is not a factor related to gaining the knowledge to observe the symptoms and characteristics of ASD. Therefore, educating caregivers to observe ASD symptoms is crucial for early diagnosis. In addition, nowadays, transportation is more convenient, so even children in remote areas far from the hospital should not have problems accessing treatment.

Our study is the first research study in Thailand to explore the factors associated with the age at diagnosis of ASD. A key benefit of finding the related factors is that they can inform the development of an intervention that can minimize the problem of the delayed diagnosis of ASD in Nakhon Sawan Province. Moreover, the average age at diagnosis data in this study may also support

developing a proactive ASD screening policy for Thailand. The American Academy of Pediatrics (AAP) has issued recommendations since 2020 for standardized ASD screening in all children aged 18 to 24 months old who come to be vaccinated in well-child visits.<sup>6</sup> However, in Thailand, this important recommendation has not yet been implemented.

There are some limitations of this study to be noted, including this study involved a retrospective design, which means it omitted some data that may have affected the recruitment population in our study. The generalizability of our study results is also limited since our population was collected from a single-center site and involved relatively small numbers of patients. A multicenter prospective study design with a larger population should be considered in a future study.

## CONCLUSION

At Sawanpracharak Hospital, more than half of the children with ASD had a delayed diagnosis. Children with delayed social communication skills, including non-response to name and lack of pointing out objects of interest, were more likely to be diagnosed early. In contrast, firstborn children and children with delayed development tended to be diagnosed later.

## Conflict of interest

All authors declare no conflict of interest.

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