

Investigation of Screen Time and Symptom Severity in Children with Autistic Spectrum Disorder

Otistik Spektrum Bozukluğu Olan Çocuklarda Ekran Süresi ve Belirti Şiddetinin Araştırılması

Kevser Nalbant¹ , Semih Erden² 

¹Hacettepe University, Medical Faculty, Department of Child and Adolescent Psychiatry, Ankara, Türkiye

²Necmettin Erbakan University, Meram Medical Faculty, Department of Child and Adolescent Psychiatry, Konya, Türkiye

ORCID ID: K.N. 0000-0003-4261-1013; S.E. 0000-0002-7723-9584

Citation/Atf: Nalbant K, Erden S. Investigation of screen time and symptom severity in children with autistic spectrum disorder. Çocuk Dergisi - Journal of Child 2022;22(1):48-57. <https://doi.org/10.26650/jchild.2022.946883>

ABSTRACT

Objective: Screen-based media (e.g. television, computer, cell phone, tablet) has become an increasingly important part of our life. Children with autism spectrum disorder (ASD) are known to be interested in limited subjects and highly attracted to screens. The purpose of this study is to investigate the time of screen use in newly diagnosed children with ASD and the association between screen time and symptom severity of ASD.

Methods: The symptom severity of ASD was determined using the Childhood Autism Rating Scale. Information concerning socio-demographic characteristics, clinical data, and frequency and duration of children's screen exposure since birth were collected during clinical interviews from the primary caregivers. Linear regression analysis was performed to examine the associated factors on symptom severity of ASD.

Results: In our study, it was found that children with ASD use screens at an earlier age and for a longer period of time when compared to the recommendations of the American Academy of Pediatrics. Also, our results indicated that longer daily screen time and longer periods of no interaction during screen time <24 months, >1 h / day were associated with the symptom severity of ASD.

Discussion: This study suggests that longer daily screen time in early childhood might increase the symptom severity of ASD. These results support that appropriate guidance and education for parents on how to optimize the benefits and potential harms of screen use may be a substantial preventive mental and public health service to support the socio-emotional development for early childhood.

Keywords: Autism, Children, Screen time, Socioemotional development

Öz

Amaç: Ekran tabanlı medya (ör. televizyon, bilgisayar, cep telefonu, tablet), giderek hayatımızın önemli bir parçası haline gelmiştir. Otizm spektrum bozukluğu (OSB) olan çocukların sınırlı ilgi alanları olduğu ve ekranlardan oldukça etkilendikleri bilinmektedir. Bu çalışmanın amacı, yeni tanı almış OSB'li çocuklarda ekrana maruz kalma süresi ile OSB'nin semptom şiddeti arasındaki ilişkiyi araştırmaktır.

Yöntem: OSB'nin belirti şiddeti Çocukluk Otizmi Derecelendirme Ölçeği kullanılarak belirlenmiştir. Çocukların sosyo-demografik özellikleri, klinik verileri ve ekran maruz kalma sıklıkları ve süreleri ile ilgili bilgiler, birincil bakım verenlerinden klinik görüşme esnasında toplanmıştır. OSB semptom şiddeti ile ilişkili faktörleri incelemek için lineer regresyon analizi yapılmıştır.

Bulgular: Çalışmamızda OSB'li çocukların Amerikan Pediatri Akademisi önerilerine göre daha erken yaşta ve daha uzun süre ekran başında kaldıkları bulunmuştur. Ayrıca sonuçlar, günlük ekran süresinin artmasının, ekran süresi boyunca etkileşim olmadan <24 ay, > 1 saat / gün ekran başında kalmanın OSB semptom şiddeti ile ilişkili olduğunu göstermiştir.

Tartışma: Bu çalışma, erken çocukluk döneminde daha uzun günlük ekran süresinin OSB'nin semptom şiddetini artırabileceğini düşündürmüştür. Bu sonuçlar, ebeveynler için ekran kullanımının yararlarının ve potansiyel zararlarının nasıl optimize edileceğine dair uygun rehberlik ve eğitimin, erken çocukluk döneminde sosyo-duygusal gelişimi desteklemek için önemli bir koruyucu zihinsel ve halk sağlığı hizmeti olabileceğini desteklemektedir.

Anahtar Kelimeler: Otizm, Çocuklar, Ekran süresi, Sosyo-duygusal gelişim

Corresponding Author/Sorumlu Yazar: Kevser Nalbant E-mail: drkevser@yahoo.com

Submitted/Başvuru: 02.06.2021 • **Accepted/Kabul:** 04.04.2022



This work is licensed under Creative Commons Attribution-NonCommercial 4.0 International License

INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that starts early in life and is characterized by limitations in social interaction and communication, limited interests, and repetitive behaviors (1). In recent years, the prevalence of ASD has been reported to have steadily increased, reaching up to 2.5% (2). While this increase can be associated with factors such as enhanced diagnostic criteria, increased social awareness and recognition regarding ASD, and improved screening programs, studies show that there is a real increase in the prevalence of ASD (3).

Many genetic and environmental factors have been investigated in the etiopathogenesis of ASD. Studies suggest that the interaction of multifactorial factors involving genetics, environment, and gene-environment interaction plays a role in the etiology of ASD (4, 5), and that the role of environmental factors is about 50% (6, 7). Compared with other mammals, the human brain continues to develop rapidly after birth, which increases the impact of environmental factors on brain development (8). Therefore, it is important to reveal the role of environmental factors in ASD, because many environmental factors can be reconfigured or changed.

One of the environmental factors that may be associated with ASD is the duration of screen exposure of individuals during early childhood, which is critical for the development of socio-emotional skills (9). Socio-emotional skills are defined as the ability of an individual to recognize, manage, and express emotions, to cope with problems, to establish satisfactory relationships with others, and to actively explore and learn about the environment (10). These skills continue to evolve and mature throughout life with social stimuli, such as the relationship first established with the caregiver, and then the mutual interaction and communication established with others. However, children who spend more time on screens are reported to have reduced social interactions with caregivers and peers (11).

Screen-based media (e.g. television, computer, cell phone, tablet) has become an increasingly important part of our daily life. Screens, if used appropriately, provide many benefits such as access to information, education, communication and socialization (12-14). Despite the value of screens, studies in this area have reported that prolonged times spent in front of a screen, especially for children under the age of 3 years, negatively affect children's linguistic, cognitive, behavioral, and socio-emotional skills (15-19). For this reason, the American Academy of Pediatrics (AAP) recommends that children aged under 18 months should not spend time in front of a screens, and for children aged between 2 and 5 years, the time they spend in front of a screens should be limited to programs for children up to one hour per day, and that parents should watch these programs together with their children and explain what they see (20). Unfortunately, nowadays, children in early childhood spend a much longer time in front of screens, contrary to these suggestions (17, 21, 22). One study reported that 68%

of children aged under two years spend more than 2 hours in front of a screen on average (23). Another study showed that 31% of children were found to spend at least 4 hours in front of a screen on weekdays and, 71.7% on weekends (24).

The parallel increase in the prevalence of ASD and the use of screens has raised questions about a potential relationship between screen time and ASD, and various explanations have been made on this subject. Heffler and Oestreicher claimed that screen-based media exposure in early childhood might be a possible cause of ASD, suggesting that exposure to screens for long periods in early childhood, when the neuroplasticity of the human brain is at its highest, negatively affects the development of social cognition pathways through a competition between the non-social audio-visual pathways and social cognition pathways of the brain (9), and stated that the regression in developmental abnormalities in some children with ASD and marked improvement through early intensive interventions were evidence of the neuroplasticity of children's brains, which allows them to adapt to environmental stimuli (9, 25, 26). Moreover, it is known that children with ASD are interested in limited subjects (27), and are highly attracted to screens (28, 29). It has been suggested that this explains the tendency of children with ASD toward screen-based media activities rather than social interaction (30, 31). In addition, parents of children with ASD use screen time to calm their children, alleviate the difficulties of their care, and/or because they think it has a positive effect on their child's development (32). However, a recent systematic review in this area emphasized that the direction of the possible relationship between ASD and screen time had yet to be clarified due to the lack of adequate research on this subject (32).

According to our knowledge in the literature, very few studies have been conducted in this area on children with ASD in early childhood (33). Early childhood is considered to be the most critical period in the development or exacerbation of many psychiatric diseases and developmental disorders. Also, this period is the primary in respect of preventive mental health (1). Given the literature, it is clear that further studies are needed to elucidate the potential relationship between ASD and screen time. Therefore, we thought that the effects of screen time on children with ASD in early childhood should be investigated.

The aim of this study was to investigate the time spent in front of screen-based media before diagnosis by children who were newly diagnosed as having ASD and to reveal whether there was a relationship between screen exposure time and ASD severity. In addition, these data were compared with the detailed socio-demographic characteristics and clinical information of the participants. Furthermore, investigating the time spent in front of screen-based media prior to a diagnosis of ASD will help us understand the extent of parents' attitudes toward their children in terms of screens. We believe that the exposure of children with ASD in early childhood to screens for a long time exacerbate the difficulties they experienced in this regard. We predicted that the screen exposure time in children diagnosed as having ASD would be longer than the

period recommended by the AAP and that the severity of ASD would increase with increased screen time.

METHODS

Sample

This study was conducted at Necmettin Erbakan University, Meram Medical Faculty, Department of Child and Adolescent Psychiatry between July 2019 and March 2020. Our study group consisted of 187 children who were newly diagnosed as having ASD and admitted to the outpatient clinic of our institution. The study was conducted with patients who were newly diagnosed with ASD. The diagnosis of ASD was made following semi-structured clinical interviews between the child and an adolescent psychiatrist based on the ASD section of the Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version/Diagnostic and Statistical Manual of Mental Disorders, 5th (K-SADS-PL/DSM-5) (34). All parents who had children with ASD in the study volunteered to participate at no cost. Patients who were previously diagnosed as having ASD were not included in the study because the parents of children with ASD being followed up were more likely to inaccurately recall the times spent in front of a screen prior to diagnosis due to the effect of the time passed. In addition, children with severe mental, physical, neurologic, and chronic diseases (hearing problems, epilepsy, cerebral palsy, diabetes mellitus, hypertension etc.) were excluded from the study.

Instruments

Sociodemographic and clinical information form

The form developed by the researchers questioned the socio-demographic data of the children included in the study, as well as parental age, education, family structure, income level, primary caregiver, family members, and family support (the participation of other family members in the child's care), prenatal, perinatal, postnatal history, developmental history, and the time spent in front of a screen-based media per day were detailed. Various questions about screen time were asked to parents. The total screen time was recorded in the clinical data sheet as 'hours'.

Hollingshead-Redlich Scale

The Hollingshead-Redlich Scale is used to determine the socioeconomic-sociocultural level of families (35). The scale is based on the occupational and educational status of the mother and father and is a general scale that reflects the highest level reached in a certain period.

The Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version/Diagnostic and Statistical Manual of Mental Disorders, 5th (K-SADS-PL/DSM-5)

The K-SADS-PL is a semi-structured clinical interview for determining the present and lifetime psychopathologies of children and adolescents (36). A reliability and validity study of K-SADS-PL/DSM-5 for the Turkish population was conducted by Ünal et al. (34).

Childhood Autism Rating Scale (CARS)

CARS (37) is a semi-structured assessment tool composed of 15 items. It is rated by clinicians according to the information obtained from child observations and family interviews. Items on the scale are as follows: interpersonal relationships, imitation, emotional response, body use, object use, adaptation to change, visual response, listening response, taste and smell responses, use of touch, fear/nervousness, verbal communication, nonverbal communication, activity level, level of intellectual response, and general impressions. A reliability and validity study of CARS for the Turkish population (38). A score of 15–29 points indicates the child does not have autism, 30–36.5 points indicates mild-to-moderate autism, and 37–60 points indicate severe autism. According to the CARS total score, the children with ASD were divided into two groups: children with mild-to-moderate ASD and children with severe ASD.

Application

The socio-demographic data of the primary caregivers who agreed to participate in the study, children's history and background information, their medical history, and clinical data about the disease were collected during clinical interviews via the sociodemographic and clinical information form developed by the child and adolescent psychiatrist. The Sociodemographic Data Form and the CARS were filled out during the clinical psychiatric evaluation with the child and adolescent psychiatrist. The evaluation of each participant took about 2 hours. After obtaining the approval for the study of our institution, the parents were informed in detail about the research, and their written informed consents were obtained.

Data evaluation and statistical analysis

Statistical analysis of the data was performed using the Statistical Package for the Social Sciences (SPSS) version 23.0. Skewness and Kurtosis statistics were used to evaluate the normality of distribution of the data. The Student's t-test was used to evaluate quantitative data. The Chi-square (χ^2) test or Fisher's exact Chi-square test was used for intergroup comparisons of quantitative data. Pearson's correlation test was used to investigate the relationship between two measured values in the groups. A linear regression model was used to identify the variables predicting the symptom severity of ASD. $p < 0.05$ was accepted as the level of statistical significance in all analyses.

RESULTS

Socio-demographic and clinical characteristics of the individuals with ASD

Our sample consisted of 187 children with newly diagnosed ASD. After the CARS evaluation, the patients were divided into two groups - those with mild-to-moderate autism symptoms ($n=128$) (68.4%), and those with severe autism symptoms ($n=59$) (31.6%). There was no statistically significant difference between the two groups in terms of age, age of the parents, duration of maternal and paternal education, family structure, and socioeconomic levels (Table 1). In addition, there was no statistically significant difference between the two groups in

Table 1: Sociodemographic and clinical characteristics of the children with ASD

	Mild-to-moderate	Severe	Statistics	p
Symptom severity of ASD	128 (68.4)	59 (31.6)		
Age (months)	40.2±18.4	34.5±12.6	t: 2.47	0.01
Age at which symptoms are first noticed	33.1±14.9	27.5±9.1	t: 3.20	0.002
Sex				
Female	16 (12.5)	8 (13.6)	χ^2 :0.84	0.50
Male	112 (85.5)	51 (86.4)		
Mother's age	32.6±5.3	33.2±5.9	t: -0.52	0.60
Mother's education, years	9.8±3.8	9.0±3.1	t: 1.48	0.14
Father's age	35.6±5.7	37.5±7.5	t: -1.63	0.10
Father's education, years	10.8±3.9	10.4±3.6	t: 0.85	0.39
Number of siblings	2.03±0.9	2.1±0.9	t: -0.58	0.55
Presence of ASD in siblings	6 (4.7)	3 (5.1)	χ^2 :0.90	0.58
Family structure				
Nuclear	110 (85.9)	48 (81.4)	χ^2 : 3.73	0.08
Extended	14 (10.9)	11 (18.6)		
Divorced	4 (3.1)	-		
SEL				
High	22 (17.2)	5 (10.2)	χ^2 : 1.77	0.41
Moderate	48 (37.5)	22 (37.3)		
Low	58 (45.3)	31 (52.5)		
Problem during the pregnancy				
Yes	20 (15.6)	12 (20.3)	χ^2 : 0.63	0.27
No	108 (84.4)	47 (79.7)		
Time of birth				
Premature (<37 weeks)	10 (9.3)	4 (3.7)	χ^2 : 0.38	0.82
Mature (37-42 weeks)	68 (63.0)	25 (23.1)		
Postmature (>42weeks)	1 (0.9)	-		
Type of birth				
Caesarean section	76 (59.4)	35 (59.3)	χ^2 : 0.00	1.00
Spontaneous vaginal birth	52 (40.6)	24 (40.7)		
Problem during the birth				
Yes	14 (10.9)	11 (18.6)	χ^2 : 0.33	0.86
No	114 (89.1)	48 (81.4)		
Incubator care-history				
Yes	20 (15.6)	14 (23.7)	χ^2 : 1.78	0.22
No	108 (84.4)	45 (76.3)		
First 2 years caregiver				
Mother	106 (82.8)	51 (86.4)	χ^2 : 3.14	0.20
Grandmother	18 (14.1)	4 (6.8)		
Babysitter	4 (3.1)	4 (6.8)		
Delay of speech in the first degree relative				
Yes	66 (51.6)	37 (62.7)	χ^2 : 2.02	0.10
No	62 (48.4)	22 (37.3)		
Age of starting to walk (months)	15.4±5.8	14.5±4.2	t: 0.97	0.23
Age of first meaningful word (months)	21.8±9.4	26.4±8.0	t: -3.20	0.001
CARS score	32.1±2.3	44.2±7.9	t:11.2	< 0.000
ASD severity	128 (68.4)	59 (31.6)		
Age (months)	40.2±18.4	34.5±12.6	t: 2.47	0.01
Age at which symptoms are first noticed	33.1±14.9	27.5±9.1	t: 3.20	0.002
Sex				
Female	16 (12.5)	8 (13.6)	χ^2 :0.84	0.50
Male	112 (85.5)	51 (86.4)		

Table 1: Sociodemographic and clinical characteristics of the children with ASD (continued)

	Mild-to-moderate	Severe	Statistics	p
Mother's age	32.6±5.3	33.2±5.9	t: -0.52	0.60
Mother's education, years	9.8±3.8	9.0±3.1	t: 1.48	0.14
Father's age	35.6±5.7	37.5±7.5	t: -1.63	0.10
Father's education, years	10.8±3.9	10.4±3.6	t: 0.85	0.39
Number of siblings	2.03±0.9	2.1±0.9	t: -0.58	0.55
Presence of autism in siblings	6 (4.7)	3 (5.1)	χ^2 :0.90	0.58
Family structure				
Nuclear	110 (85.9)	48 (81.4)		
Extended	14 (10.9)	11 (18.6)	χ^2 : 3.73	0.08
Divorced	4 (3.1)	-		
SEL				
High	22 (17.2)	5 (10.2)		
Moderate	48 (37.5)	22 (37.3)	χ^2 : 1.77	0.41
Low	58 (45.3)	31 (52.5)		
Problem during the pregnancy				
Yes	20 (15.6)	12 (20.3)	χ^2 : 0.63	0.27
No	108 (84.4)	47 (79.7)		
Time of birth				
Premature (<37 weeks)	10 (9.3)	4 (3.7)		
Mature (37-42 weeks)	68 (63.0)	25 (23.1)	χ^2 : 0.38	0.82
Postmature (>42 weeks)	1 (0.9)	-		
Type of birth				
Caesarean section	76 (59.4)	35 (59.3)	χ^2 : 0.00	1.00
Spontaneous vaginal birth	52 (40.6)	24 (40.7)		
Problem during the birth				
Yes	14 (10.9)	11 (18.6)	χ^2 : 0.33	0.86
No	114 (89.1)	48 (81.4)		
Incubator care-history				
Yes	20 (15.6)	14 (23.7)	χ^2 : 1.78	0.22
No	108 (84.4)	45 (76.3)		
First 2 years caregiver				
Mother	106 (82.8)	51 (86.4)		
Grandmother	18 (14.1)	4 (6.8)	χ^2 : 3.14	0.20
Babysitter	4 (3.1)	4 (6.8)		
Delay of speech in the first degree relative				
Yes	66 (51.6)	37 (62.7)	χ^2 : 2.02	0.10
No	62 (48.4)	22 (37.3)		
Age of starting to walk (months)	15.4±5.8	14.5±4.2	t: 0.97	0.23
Age at which the child can say the first meaningful word (months)	21.8±9.4	26.4 ±8.0	t: -3.20	0.001
CARS score	32.1±2.3	44.2±7.9	t:11.2	<0.000

ASD: Autism spectrum disorder, SEL: Socioeconomic level, CARS: Childhood Autism Rating Scale

terms of problems during pregnancy (e.g. a maternal follow-up disease that required medication, bleeding, gestational diabetes, preeclampsia), time of birth (preterm, term, post-term), problems during birth (e.g. prolonged labor, forceps-vacuum requirement, hypoxia symptoms), and incubator care-history of postpartum hospitalization. The group with mild-to-moderate autism symptoms was seen to walk later than the group with severe symptoms but the difference between them was not statistically significant. The group with mild to moderate autism symptoms said their first meaningful

word at a statistically significantly earlier age than the group with severe symptoms (Table 1).

Screen-based media viewing time characteristics of the individuals with ASD

There was no statistically significant difference between the two groups in terms of onset of screen-based media viewing, no interaction during screen-based media viewing <24 months, >1 h/day and no interaction during screen-based media viewing >2 h/day. In terms of screen-based media viewing time/day (h), it was found that children with ASD with mild-to-moderate

Table 2. Screen time characteristics of the children with ASD

	Mild-to-moderate	Severe	Statistics	p
Onset of screens (months)	10.0 (3.4)	9.3 (2.9)	t: 1.40	0.16
No interaction during screen time <24 months, >1 h/day	85 (66.4)	45 (76.3)	χ^2 : 1.84	0.17
No interaction during screen time >2 h/day	133 (83.3)	55 (93.2)	χ^2 : 1.07	0.29
Screen time / day (h)	4.8±1.6	6.4±1.9	t: 5.63	<0.000

ASD: Autism spectrum disorders, CARS: Childhood Autism Rating Scale

Table 3: Correlation between the CARS, Onset of screens (months) and screen time/day in the all participants

	CARS score	Onset of screens (months)	Screen time/day
CARS score	1		
Onset of screens (months)	-262**	1	
Screen time/day	-592**	-160	1

Pearson Correlation Analysis, **: p<0.000, CARS: Childhood Autism Rating Scale

symptoms spent an average of 4.8 hours and children with severe symptoms spent an average of 6.4 hours in front of screen-based media (Table 2). However, it was found that both groups began to watch screens at earlier age than the AAP recommendations. Regarding the frequency of screen time, both groups appeared to spend significantly more time than the AAP recommendations.

Correlations between CARS total scores and screen-based media viewing time

In the groups with mild-to-moderate and severe autism symptoms, statistically significant positive and mild correlations were found between CARS scores and the onset of screen

usage (Table 3). In the groups with mild-to-moderate and severe autism symptoms, statistically significant positive and moderate correlations were found between CARS scores and screen times (Table 4).

When the correlations between the CARS items scores and screen time in the children with ASD were evaluated, the CARS verbal communication ($r=0.437$, $p=0.01$), nonverbal communication ($r=0.423$, $p=0.02$), activity level ($r=0.402$, $p=0.01$), level of intellectual response ($r=0.574$, $p=0.002$), and general impressions ($r=0.424$, $p=0.02$) items scores were found positively and moderately correlated with screen time.

Associated factors with symptom severity of ASD

Linear regression analysis was performed to examine the impact of the associated factors investigated in our study on ASD symptom severity (CARS scores). The screen time/day, the onset of screen usage (months), the no interaction during screen time <24 months, >1 h/day, the age of the first meaningful word (months) and the father's age which have correlation coefficients higher than 0.5 and no multicollinearity between them were taken as variables (Table 5). With this

Table 4: Correlation between the CARS score and Screen time/day

	r	p
Symptoms of mild-to-moderate ASD	0.428	<0.000
Symptoms of severe ASD	0.589	<0.000

Pearson Correlation Analysis, CARS: Childhood Autism Rating Scale, ASD: Autism spectrum disorders

Table 5: Associated factors with symptom severity of ASD

Associated factors model	B	t	p	95%Confidence Interval
1				
Screen time	2.32	9.51	<0.000	1.83 / 2.80
2				
Screen time	2.20	9.12	<0.000	1.73 / 2.68
No interaction during screen time <24 months, >1 h	-0.41	-2.84	0.005	-0.68 / -0.12
3				
Screen time	2.02	8.31	<0.000	1.54 / 2.50
No interaction during screen time <24 months, >1 h	-0.48	-3.42	0.001	-0.76 / -0.20
Age of first meaningful word (months)	1.16	3.14	0.002	0.06 / 0.26

Linear regression analysis /Stepwise, ASD: Autism spectrum disorder, h:hour

model, all the assumptions of linear regression analysis were met, and the model explained 41.7% of the variance of ASD symptom severity (R Square: 0.417, $p < 0.000$). In the stepwise regression analysis, in model 1, the screen time predicted 35.1% of the variance of ASD symptom severity (R Square: 0.351, $p < 0.000$), and in model 2, the screen time + the no interaction during screen time <24 months, >1 h/day predicted 38.2% (R Square: 0.382, $p < 0.000$), in model 3, the effect of screen time + the no interaction during screen time <24 months, >1 h/day + the age of first meaningful word (months) on ASD symptom severity associated 41.7% (R Square: 0.417, $p < 0.000$) (Table 5).

DISCUSSION

The main purpose of this study was to investigate the time patterns of screen usage prior to diagnosis for children who were newly diagnosed with ASD and to reveal whether there was a correlation between these screen times and ASD severity. It was found that children with ASD use the screen at an earlier age and for a longer period of time, in comparison to the recommendations of the AAP. Our results indicated that longer daily screen time, longer periods of no interaction during screen time <24 months, >1 h/day and the age of the first meaningful word were associated with the symptom severity of ASD. While it is known that spending time in front of screens for long periods in early childhood negatively affects children's cognitive, behavioral, and socio-emotional development (15-18), there is a limited number of studies investigating the screen time of children with ASD in early childhood (33).

In this study, it was found that both groups began to watch screens earlier (mild-to-moderate symptoms group of ASD: 10 months, severe symptoms group of ASD: 9.3 months) than the AAP recommendations. Regarding the screen time, both groups appeared to spend significantly more time in front of a screen than the AAP recommendations. Given that the average age of the children in our group was about 3 years, it is possible that spending such a long time (mild-to-moderate ASD group: 4.8 h/day, severe ASD group: 6.4 h/day) in front of a screen may significantly hinder opportunities for brain development, for example, social skills learned with mutual interaction in early childhood. The fact that a child becomes passive in front of the screen and has to be content only with what they see and hear, the rapid changes in the subjects and events shown compared with real-life speed, and the presence of abstract concepts that they cannot make sense of according to their level of development makes it difficult for that child to select and evaluate what they perceive. These results suggest that parents should be more informed that screen usage should be structured because of the negative effects of prolonged screen exposure on children's development (12-14). The physical and emotional environment of children who have not yet developed the ability to distinguish what is right and wrong, must be regulated by their parents and configured in accordance with

their age and development. In future studies, it is important to develop intervention programs for parents to investigate the cause of this attitude and change it.

In our study, the results indicated that longer daily screen time, longer periods of no interaction during screen time <24 months, >1 h/day, and the age of the first meaningful word were associated with the symptom severity of ASD. Also, it was found that the severity of ASD increased as the total screen time of children with ASD increased per day, and CARS verbal communication, nonverbal communication, activity level, level of intellectual response, and general impressions items scores were found to be correlated with screen time. In a recent review of studies investigating ASD and screen time, it was reported that children with ASD spent more time in front of a screen at earlier ages than typically developing children and children in other clinical groups (32). In a study investigating the association between exposure to screen time in early life and the presence of autistic-like behaviors in preschool children, it was demonstrated that younger initial age, longer daily screen time, and longer cumulative years of screen exposure since birth were associated with the presence of autistic-like behaviors. In addition, it was emphasized that the first three years after birth may be a sensitive period for children when exposure to the screen increases the risk of experiencing autistic-like behaviors (39). The most important difference of our study from previous studies is the early childhood screen time investigation of children diagnosed with ASD.

In this study, we found that the group with severe symptoms had a longer screen exposure time than the group with mild-to-moderate symptoms, and that the relationship between screen time and ASD symptom severity was greater in the group with severe symptoms. These results could be indicative of the increased severity of ASD due to long-duration screen time, or it could be due to the screen preferences of the parents of children with severe symptoms. In order to clarify this connection, longitudinal studies are needed in which screen time from birth is recorded and monitored.

In the comparison of mild-to-moderate and severe symptom groups in terms of sociodemographic characteristics and clinical information, we found that the average age of the group with only mild-to-moderate symptoms was higher than that of the group with severe symptoms. This may be due to the late detection of ASD symptoms in children with lesser symptom severity. It is reported that early diagnosis and intervention in the treatment of ASD is more likely to improve the symptoms of ASD (25, 26). For this reason, we need to develop early assessment and intervention programs for children at risk in order to avoid severe problems later in life, and to identify young children at risk for socio-emotional developmental problems at an early stage.

The strengths of our study are that screen exposure time was questioned during diagnosis, the ASD group was divided

into symptom severity groups using CARS, the correlations between these variables were investigated, and only newly diagnosed children with ASD were included in order to create a homogeneous group. The investigation of screen time during diagnosis is of importance because it minimizes difficulties with retrospective recall. The cross-sectional nature of the study and the lack of typically developing controls and/or other clinical disease groups for comparison is one significant limitation of our study. For this reason, a cause-effect relationship cannot be established. Population-based studies with long-term follow-up in those with ASD and typically developing controls are needed. Another significant limitation of this study includes the assessment of screen-based media, with investigators obtaining screen time via parent-reports. It should not be ruled out that this assessment method could be influenced by parents' defensive attitudes, responsiveness biases, and difficulties due to retrospective recall of information. Moreover, we only investigated the screen-based media 'time' dimension. Investigation of the 'content' and 'function' dimensions of media usage in future studies will provide a multi-dimensional evaluation. In addition, planning screen time logs or phone application-based screen-time tracking, starting from birth, will contribute to our understanding of the early-stage effects of screen time on child development.

Finally, the findings of this study have important clinical implications. In our study, screen time and symptom severity of ASD were found to be significantly correlated. Considering the relationship between early diagnosis and comprehensive developmental and behavioral intervention programs in ASD and better outcomes of ASD treatment (40), the importance of clarifying environmental risks and protective factors in ASD comes to the fore. Increasing social interaction and communication can help activate neural structures and pathways that involve social cognition due to the plasticity of the human brain (10). Considering that individuals with a long screen time in studies conducted in the typically developing children and teens have more difficulties in areas such as reading facial cues (41), empathy and social cognition (42), the importance of early childhood becomes particularly evident. Therefore, more research is needed in this field to more deeply understand the causes of ASD along with ways to activate effective neural pathways.

Also, our study results suggest that parents should be more informed about the potential harmful effects of early and excessive exposure to screen-based media. Short and long-term effects of the long-time screen exposure in children with ASD should be further studied to better provide suitable anticipatory guidance for parents of children with ASD, especially the subjects in terms of how to optimize advantages and potential harms from the screen. Nevertheless, based on the current literature, our findings seem to hold relevant contributions for the development of intervention programs in early childhood to target social interaction and communication skills. Moreover, planning training that will improve the quality of parent-child interaction instead of spending time in front of

the screen from an early age may be an important preventive mental and public health service that will support children's socio-emotional development.

Ethics Committee Approval: This study was approved by the ethics committee of Necmettin Erbakan University Meram Faculty of Medicine (26.06.2021 - 14567952-050/1070).

Informed Consent: Written consent was obtained from the participants.

Peer Review: Externally peer-reviewed.

Author Contributions: Conception/Design of Study- K.N., S.E.; Data Acquisition- S.E.; Data Analysis/Interpretation- K.N., S.E.; Drafting Manuscript- K.N., S.E.; Critical Revision of Manuscript- S.E.; Final Approval and Accountability- K.N., S.E.

Conflict of Interest: Authors declared no conflict of interest.

Financial Disclosure: Authors declared no financial support.

Etik Komite Onayı: Necmettin Erbakan Üniversitesi Meram Tıp Fakültesi Etik Kurulu'ndan onay alınmıştır (26.06.2021 - 14567952-050/1070).

Bilgilendirilmiş Onam: Katılımcılardan bilgilendirilmiş onam alınmıştır.

Hakem Değerlendirmesi: Dış bağımsız.

Yazar Katkıları: Çalışma Konsepti/Tasarım- K.N., S.E.; Veri Toplama- S.E.; Veri Analizi/Yorumlama- K.N., S.E.; Yazı Taslağı- K.N., S.E.; İçerigin Eleştirel İncelemesi- S.E.; Son Onay ve Sorumluluk- K.N., S.E.

Çıkar Çatışması: Yazarlar çıkar çatışması beyan etmemişlerdir.

Finansal Destek: Yazarlar finansal destek beyan etmemişlerdir.

REFERENCES

1. Association AP. Diagnostic and statistical manual of mental disorders (DSM-5®). American Psychiatric Pub; 2013.
2. Lyall K, Croen L, Daniels J, Fallin MD, Ladd-Acosta C, Lee BK, Park BY, Snyder NW, Schendel D, Volk H. The changing epidemiology of autism spectrum disorders. *Annual review of public health* 2017;38:81-102.
3. Hertz-Picciotto I, Delwiche L. The rise in autism and the role of age at diagnosis. *Epidemiology (Cambridge, Mass)* 2009;20:84.
4. Tordjman S, Somogyi E, Coulon N, Kermarrec S, Cohen D, Bronsard G, Bonnot O, Weismann-Arcache C, Botbol M, Lauth B. Gene x Environment interactions in autism spectrum disorders: role of epigenetic mechanisms. *Frontiers in psychiatry* 2014;5:53.
5. Stamou M, Streifel KM, Goines PE, Lein PJ. Neuronal connectivity as a convergent target of gene x environment interactions that confer risk for Autism Spectrum Disorders. *Neurotoxicol Teratol* 2013;36:3-16.
6. Hallmayer J, Cleveland S, Torres A, Phillips J, Cohen B, Torigoe T, Miller J, Fedele A, Collins J, Smith K, Lotspeich L, Croen LA, Ozonoff S, Lajonchere C, Grether JK, Risch N. Genetic heritability and shared environmental factors among twin pairs with autism. *Arch Gen Psychiatry* 2011;68:1095-1102.

7. Sandin S, Lichtenstein P, Kuja-Halkola R, Larsson H, Hultman CM, Reichenberg A. The familial risk of autism. *JAMA* 2014;311:1770-1777.
8. Johnson MH. Functional brain development in humans. *Nat Rev Neurosci* 2001;2:475-483.
9. Heffler KF, Oestreicher LM. Causation model of autism: Audiovisual brain specialization in infancy competes with social brain networks. *Med Hypotheses* 2016;91:114-122.
10. Pontoppidan M, Niss NK, Pejtersen JH, Julian MM, Vaever MS. Parent report measures of infant and toddler social-emotional development: a systematic review. *Fam Pract* 2017;34:127-137.
11. Gerhold M, Laucht M, Texdorf C, Schmidt MH, Esser G. Early mother-infant interaction as a precursor to childhood social withdrawal. *Child Psychiatry Hum Dev* 2002;32:277-293.
12. Westby C. Screen Time and Children with Autism Spectrum Disorder. *Folia Phoniatri Logop* 2020:1-8.
13. Charlton CT, Kellems RO, Black B, Bussey HC, Ferguson R, Goncalves B, Jensen M, Vallejo S. Effectiveness of avatar-delivered instruction on social initiations by children with autism spectrum disorder. *Research in Autism Spectrum Disorders* 2020;71:101494.
14. Valencia K, Rusu C, Quiñones D, Jamet E. The impact of technology on people with autism spectrum disorder: a systematic literature review. *Sensors* 2019;19:4485.
15. Radesky JS, Silverstein M, Zuckerman B, Christakis DA. Infant self-regulation and early childhood media exposure. *Pediatrics* 2014;133:e1172-1178.
16. Chonchaiya W, Sirachairat C, Vijakkhana N, Wilaisakditipakorn T, Pruksananonda C. Elevated background TV exposure over time increases behavioural scores of 18-month-old toddlers. *Acta Paediatr* 2015;104:1039-1046.
17. Zimmerman FJ, Christakis DA, Meltzoff AN. Television and DVD/video viewing in children younger than 2 years. *Arch Pediatr Adolesc Med* 2007;161:473-479.
18. Chonchaiya W, Pruksananonda C. Television viewing associates with delayed language development. *Acta Paediatr* 2008;97:977-982.
19. Cerniglia L, Cimino S, Ammaniti M. What are the effects of screen time on emotion regulation and academic achievements? A three-wave longitudinal study on children from 4 to 8 years of age. *Journal of Early Childhood Research* 2020:1476718X20969846.
20. American Academy of Pediatrics. Handheld Screen Time Linked with Speech Delays in Young Children. 2017 Retrieved from <https://www.healthychildren.org/English/news/Pages/Handheld-Screen-Time-Linked-with-Speech-Delays-in-Young-Children.aspx>
21. Kabali HK, Irigoyen MM, Nunez-Davis R, Budacki JG, Mohanty SH, Leister KP, Bonner RL. Exposure and use of mobile media devices by young children. *Pediatrics* 2015;136:1044-1050.
22. Christakis DA. The effects of infant media usage: what do we know and what should we learn? *Acta Paediatr* 2009;98:8-16.
23. Rideout VJ, Vandewater EA, Wartella EA. Zero to six: Electronic media in the lives of infants, toddlers and preschoolers. 2003.
24. Tuncer AM, Yalcin SS. Multimedia and children in Turkey. *Turk J Pediatr* 1999;41(Suppl):27-34.
25. McEachin JJ, Smith T, Lovaas OI. Long-term outcome for children with autism who received early intensive behavioral treatment. *Am J Ment Retard* 1993;97:359-372; discussion 373-391.
26. Sallows GO, Graupner TD. Intensive behavioral treatment for children with autism: four-year outcome and predictors. *Am J Ment Retard* 2005;110:417-438.
27. Volkmar FR, Paul R, Klin A, Cohen DJ. Handbook of autism and pervasive developmental disorders, diagnosis, development, neurobiology, and behavior. John Wiley & Sons; 2005.
28. Mazurek MO, Wenstrup C. Television, video game and social media use among children with ASD and typically developing siblings. *J Autism Dev Disord* 2013;43:1258-1271.
29. Engelhardt CR, Mazurek MO. Video game access, parental rules, and problem behavior: a study of boys with autism spectrum disorder. *Autism* 2014;18:529-537.
30. Mazurek MO, Wenstrup C. Television, video game and social media use among children with ASD and typically developing siblings. *Journal of autism and developmental disorders* 2013;43:1258-1271.
31. Nally B, Houlton B, Ralph S. Researches in brief: The management of television and video by parents of children with autism. *Autism* 2000;4:331-337.
32. Slobodin O, Heffler KF, Davidovitch M. Screen Media and Autism Spectrum Disorder: A Systematic Literature Review. *J Dev Behav Pediatr* 2019;40:303-311.
33. Chonchaiya W, Nuntnarumit P, Pruksananonda C. Comparison of television viewing between children with autism spectrum disorder and controls. *Acta Paediatrica* 2011;100:1033-1037.
34. Unal F, Oktem F, Cetin Cuhadaroglu F, Cengel Kultur SE, Akdemir D, Foto Ozdemir D, Cak HT, Unal D, Tiras K, Aslan C, Kalayci BM, Aydos BS, Kutuk F, Tasyurek E, Karaokur R, Karabucak B, Karakok B, Karaer Y, Artik A. [Reliability and Validity of the Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version, DSM-5 November 2016-Turkish Adaptation (K-SADS-PL-DSM-5-T)]. *Turk Psikiyatri Derg* 2019;30:42-50.
35. Andreasen NC, Flaum M, Arndt S. The Comprehensive Assessment of Symptoms and History (CASH): an instrument for assessing diagnosis and psychopathology. *Archives of general psychiatry* 1992;49:615-623.
36. Kaufman J, Birmaher B, Axelson D, Perepletchikova F, Brent D, Ryan N. Schedule for Affective Disorders and Schizophrenia for School-Aged Children: Present and Lifetime Version (K-SADS-PL) DSM-5 November 2016 Working draft. New Haven, Yale University. Child and Adolescent Research and Education 2016.
37. Schopler E, Reichler RJ, DeVellis RF, Daly K. Toward objective classification of childhood autism: Childhood Autism Rating Scale (CARS). *Journal of autism and developmental disorders* 1980.
38. İncekaş Gassaloğlu S, Baykara B, Avcil S, Demiral Y. Validity and Reliability Analysis of Turkish Version of Childhood Autism Rating Scale. *Turkish Journal of Psychiatry* 2016;27.
39. Chen JY, Strodl E, Wu CA, Huang LH, Yin XN, Wen GM, Sun DL, Xian DX, Chen YJ, Yang GY, Chen WQ. Screen time and autistic-like behaviors among preschool children in China. *Psychol Health Med* 2020:1-14.
40. Dawson G, Rogers S, Munson J, Smith M, Winter J, Greenon J, Donaldson A, Varley J. Randomized, controlled trial of an intervention for toddlers with autism: the Early Start Denver Model. *Pediatrics* 2010;125:e17-23.

41. Uhls YT, Michikyan M, Morris J, Garcia D, Small GW, Zgourou E, Greenfield PM. Five days at outdoor education camp without screens improves preteen skills with nonverbal emotion cues. *Computers in Human Behavior* 2014;39:387-392.
42. Pea R, Nass C, Meheula L, Rance M, Kumar A, Bamford H, Nass M, Simha A, Stillerman B, Yang S. Media use, face-to-face communication, media multitasking, and social well-being among 8-to 12-year-old girls. *Developmental psychology* 2012;48:327.