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# The Outcome of Early Intervention in Children with Virtual Autism Spectrum Disorders on the Basis of ADOS

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Author`s Contribution

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**ABSTRACT**

**Objective:** To evaluate the effects of speech and behavior therapy on children with virtual autism based on the Autism Diagnostic Observation Schedule (ADOS).

**Methodology:** This prospective descriptive study was conducted in the Outpatient departments of Ali Medical Centre and KRL Hospital, Islamabad, from January 2020 to December 2022. A total of 30 children under 10 years old, with speech delays, spending more than 5 hours on screens per 24 hours, and diagnosed with autism, were enrolled. These children received early intervention in the form of speech and behavior therapies for one year, followed by reassessment. After one year of follow-up, significant improvements were observed in speech and behavior when screen time was reduced to 30 minutes or less.

**Results:** The mean age of the children in the study was 4.028 ± 1.99 years. The chief complaint at presentation was speech delay in 21 (70%) children. The distribution of behavior as measured by the Questionnaire for Autism in Toddlers (QABF) scale showed that the majority (10, 33.3%) of children presented with aggression. The ADOS assessments revealed that the majority of the children (14, 46.7%) had mild autism, followed by 9 (30%) with moderate autism. After receiving speech therapy for 10 months to 1 year, the repeated ADOS tests showed that among these children, 24 (80%) no longer exhibited behaviors indicative of autism, while 3 (10%) children had borderline autism, and 3 (10%) had mild autism.

**Conclusion:** Excessive screen time can lead to autism-like symptoms in young children, which are reversible through early intervention therapies. This effect is more pronounced in children under 5 years old.

**Keywords:** Autism, ADOS, Behavior Change, Speech Delay.

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## Introduction

The COVID-19 pandemic in 2020 not only brought about significant changes in our social lives worldwide but also had a notable impact on the social development of growing children. Particularly during the first five years of life, children require a nurturing environment. Since 2020, we have observed changes in the behavior of children in outpatient settings. There has been an increase in children displaying behavior problems, heightened attachment to screens, and increased anxiety related to school. Many parents have reported observing increased aggression in their children. Among the under-fives, communication issues have become more prevalent than other behavioral concerns.[1]

It has been noted that children with autism tend to experience worsening symptoms in socially deprived environments. Their rigid behaviors become reinforced, and their communication skills deteriorate. This observation gained more attention in 2018 and became widely accepted during the 2020 pandemic.[2] Many households faced financial hardships due to job cuts and also experienced social isolation. As a result, there has been an increase in the number of children with speech delays and other communication problems. A significant proportion of these children have scored high on the

Autism Diagnostic Observation Schedule (ADOS) and have been diagnosed with Autism. Many of them have been found to spend excessive amounts of time on screens.[3]

People with autism spectrum disorder (ASD) may experience difficulties ranging from mild to severe, with varying degrees of ability and handicap, as the word "spectrum" suggests. A person could be illiterate or possess a large vocabulary. He or she can be mentally challenged or have an IQ that is average or above. He may be socially awkward or socially outgoing, albeit in an odd, unusual way. He might have a strong interest in a certain toy or be extremely knowledgeable about it.[4]

The study of the prevalence and distribution of autism spectrum diseases is known as autism epidemiology. The median number of cases per 10000 individuals was estimated to be 62 in a 2012 evaluation of estimates of the prevalence of autism spectrum disorders.[5] Autism is expected to affect 1 in every 44 (8-year-old) children throughout the CDC (chronic disease center, US) surveillance sites on average in 2018. It is 4.2 times more common in boys (3.7%) than in girls (0.9%) and is claimed to affect people of all racial and ethnic backgrounds. According to data from South Asia, Pakistan may have 350,000 kids who have autism.

The standardized assessment of autism is called ADOS i.e. autism diagnostic observation schedule. It is a behavior test with relevant scores for communication, play, social interaction and restrictive behaviors. It has 4 modules that cover different ages and levels of speech.[7] Bastiaansen et al. found that over all it could correctly classified 74% of cases, with a sensitivity of 61% and specificity of 82%. Moreover, the developmental history is an essential part of the final diagnosis that is why in NHS. ADOS is administered by a panel of therapists with a child and adolescent psychiatrist who assesses the physical and psychological development as well.[8]

In most of the cases, the slow progression of speech and solitary play is quite evident in first few years of life but as we observed that the children who presented with speech delay and scored high on ADOS in 2020 had normal developmental milestones initially and seemed to regress, in the absence of other genetic disorders e.g. Fragile X or Rett's syndrome. Moreover, these children showed improvement with speech therapy significantly.[9]

Autism is an umbrella and the children can present from few to many symptoms at different development levels, however, we questioned that can developmental environment produce an "autism like" change in behavior? The term "virtual autism" was coined by Romanian psychologist Marius Teodor Zamfir in 2018 after his research revealed that toddlers aged 0 to 3 who spent more than four hours a day staring at screens suffered from "sensory-motor and socio-affective deprivation.[10]

While we attempted to gather statistics, it was challenging due to uncertainties related to the diagnosis methods in Pakistan. However, data from South Asia indicates that Pakistan may have 350,000 children with autism. It's important to note that this data doesn't account for children who have shown improvement with changes in their environment and early intervention.[11] This highlights the existence of a type of autism that develops due to excessive screen time, lack of social interaction, and a solitary upbringing environment, particularly in the first five years of life. This phenomenon can be referred to as "Virtual Autism." There is growing global awareness about this issue, but further research is required. Therefore, we conducted an observational prospective study to explore this aspect in more depth.

# Methodology

In this prospective descriptive study all the children fulfilling inclusion and exclusion criteria were selected, who visited the outpatients (child psychiatry clinic in Ali Medical Centre & KRL pediatric outpatient Islamabad and 7 senses child development Centre Wah Cant) during study period. We included children under 10 years of age, who presented with speech delay and behavioral problems, in the absence of any genetic disorder, from January 2020 to December 2022. Most of the children were under 5 and the main complaint was speech delay.

Initially we selected 38 children but 5 of them did not come for regular follow up, 1 moved to another city and 2 could not receive therapies due to family circumstances. So total study sample consisted of 30 children who completed the study. Some of these children babbled before age 1 but then stopped making any more progress. All of them were seen by pediatrician and no physical health problem was diagnosed. There was no hearing disorder except one child who had congenital unilateral hearing loss and had hearing aid.

They were assessed with detailed developmental history from the parents and objectively by ADOS. They were diagnosed with Autism of mild to moderate degree. Most of them showed lack of emotional expression, social smile and no response to name. Socially, there were supportive parents. Developmental history including social

circumstances were taken in depth. The children were treated by early intervention approach including speech and behavior therapy. 7 children could access ABA therapy i.e. Applied behavior analysis and 5 (7 to 10 years old) received occupational therapy along with the above. Parents were given written information and links were shared with them on post ADOS feedback appointment. There was no formal parenting session but mostly both parents attended the feedback session.

The children were supposed to be followed up 3 monthly but because of pandemic, the pattern remained chaotic. However, 22 children were seen within 6 months and rest of them i.e. 5 children around 1 year and 3 children came for follow up after 18 months. Demographic information, presenting complains, speech status on (SMART) scale and behavior status on (QABF) scale at presentation, were recorded. Autism Diagnostic Observation Schedule (ADOS) was used at presentation and results were noted. On follow up visit all the children were reassessed for current speech status and behavior status along with ADOS. All this information was recorded on a predesigned Performa.

All the collected information was entered and analyzed with SPSS v. 25. Descriptive statistics were used to calculate mean and standard deviation for quantitative data and frequency and percentages for qualitative data. All the results were presented in the form of tables.

# Results

The mean age of the children in the study was 4.028 ± 1.99 years. The chief complain at presentation was speech delay in 21 (70%) children followed by speech issues in 3 (10%) children. The speech scale (SMART) at presentation showed that 8 (26.7%) children had no clear words, 5 (16.7%) children could speck 3 clear words, 5 (16.7%), 5 clear words and 6 (20%) children were non fluent. The distribution of behavior at QABF scale showed that 10 (33.3%) children presented with aggression, 6 (20%) had a complain of plays alone and 4 (13.3%) children had no eye contacts and 4 (13.3%) had screen addiction at the time of presentation. The Autism Diagnostic Observation Schedule (ADOS) showed that majority of the children 14 (46.7%) presented with mild autism followed by 9 (30%) with moderate autism and 7 (23.3%) children presented with borderline autism as elaborate in table I.

After speech therapy of 10 months to 1 year the distribution of speech showed that majority of the children 12 (40%) were able to phrase speech, 8 (26.7%) were able to speak 50 clear words, followed by 3 (10%) children who were able to make sentences and 3 (10%) were able to speck fluently. The speech therapy of 10 months to 1 years improved the behavior significantly and it was noted that in a large section 19 (63.3%) of the children in the study got (50-74%) improvement followed by 9 (30%) children whose behavior improved (26-49%). The repeated ADOS test after 10 months to 1 years of speech therapy showed that among these children in study 24 (80%) showed result of ADOS as not on spectrum. Only 3 (10%) children had borderline autism and 3 (10%) had mild autism elaborated in table II.

**Table I: Distribution of demographic characteristics, Speech, behavior and ADOS at presentation.**

| **Characteristics** | **N** | **%** |
|---|---|---|
| **Age of the children** | | |
| Mean ± SD | 4.028 ± 1.99 | |
| **Presenting Complaints** | | |
| Speech Delay | 21 | 70.0 |
| Speech Issue | 3 | 10.0 |
| Does not hold Conversation | 2 | 6.7 |
| Stopped Speaking | 2 | 6.7 |
| Isolating | 2 | 6.7 |
| **Speech scale (SMART) at presentation** | | |
| No Clear Words | 8 | 26.7 |
| 3 Clear Words | 5 | 16.7 |
| 5 Clear Words | 5 | 16.7 |
| 10 Clear words | 5 | 16.7 |
| Non fluent | 6 | 20.0 |
| Short Phrases | 1 | 3.3 |
| **Behavior (QABF) at presentation** | | |
| Disruptive | 3 | 10.0 |
| Aggression | 10 | 33.3 |
| Plays Alone | 6 | 20.0 |
| No eye contacts | 4 | 13.3 |
| Screaming | 3 | 10.0 |
| Screen Addiction | 4 | 13.3 |
| **Autism Diagnostic Observation Schedule (ADOS)** | | |
| Borderline Autism | 7 | 23.3 |
| Mild Autism | 14 | 46.7 |
| Moderate Autism | 9 | 30.0 |
| **Total** | **30** | **100.0** |

After 1 year, significant improvement was seen in children who reduced screen time and received both therapies. 24/30(80%) completely outgrew the symptoms, showing social gestures, responding to their names and interacting with other children. It was interesting to find out that 21(70%) of children who outgrew were less than 5 years of age and only 7 (23%) children were 5 to 7 years of age.

# Discussion

In spite of the above, we made consistent efforts to follow up. We observed improvements in speech development after 3 months of early intervention, with noticeable changes in behavior towards more interactive play

emerging around 9 to 10 months. By the end of a year of early intervention, the majority of the children had developed phrase speech.

**Table II: Distribution of Speech, Behavior and ADOS after speech therapy.**

| Characteristics | N | % |
|---|---|---|
| **Speech after 10 months to 1 year of speech therapy** | | |
| 20 Clear Words | 2 | 6.7 |
| 30 Clear words | 2 | 6.7 |
| 50 Clear words | 8 | 26.7 |
| Phrase Speech | 12 | 40.0 |
| Spoke in Sentences | 3 | 10.0 |
| Fluent | 3 | 10.0 |
| **Improvement in Behavior after 10 months to 1 year of speech therapy** | | |
| < 25 % | 1 | 3.3 |
| 26-49% | 9 | 30.0 |
| 50-74% | 19 | 63.3 |
| > 75% | 1 | 3.3 |
| **Repeat ADOS after 10 months to 1 year of speech therapy** | | |
| Not on Spectrum | 24 | 80.0 |
| Borderline Autism | 3 | 10.0 |
| Mild Autism | 3 | 10.0 |
| **Total** | **30** | **100.0** |

Similar trends were observed in communities worldwide, as detailed in another study by Berard et al. in 2018.[12] They examined the effects of screen usage on a sample of 249 children and adolescents diagnosed with ASD, who were part of a regional ASD cohort in France during a specific COVID-19 lockdown period. The study revealed that 37.4% of the patients exceeded recommended screen time during the lockdown. Further analysis of various research conducted during the pandemic indicated that children who spent excessive time on screens had lower daily living abilities, as measured by the VABS-II. This aligns with previous findings linking excessive screen usage to adverse health outcomes in children and teenagers with ASD. As measured by the CBCL, children and teenagers with ASD who spent too much time on screens were notably more withdrawn. Additionally, it was reported that parents may also engage in excessive screen time.[13]

These findings are consistent with a descriptive online survey conducted in Canada in May 2020 by Must et al. [14], involving 3,000 participants, which compared screen time between young children with ASD and typically developing children. They found that even outside of lockdowns, ASD children had considerably higher screen hours, 2.5 hours per day versus 1.6 hours per day for typically developing children. The report also highlighted that families with children under the age of 18 at home experienced a decline in their mental health due to the pandemic. 44.3% of parents of children under 18 reported lower mental health compared to 35.6% of respondents without children under 18, illustrating a general decline in mental health symptoms among parents and its impact on their interaction with their children during the pandemic, leading to increased demand for mental health resources.[12,15]

A study reviewing the prevalence of excessive virtual environment use in children with ASD between 2012 and 2017 in two specialized rehabilitation centers in Romania introduced the term "virtual autism." This study assessed the Quality of Development/Interaction Quotient (QD/IQ) of 62 autistic children and tracked their therapy progress over time. It compared two groups of children between the ages of 0 and 3, one of which had previously consumed more than 4 hours per day of virtual environments.[16,17] The survey's findings indicated that children with ASD may exhibit behaviors and characteristics similar to typically developing children when they experience sensory-motor and socio-affective deprivation due to spending more than 4 hours per day in a virtual environment. [18]

However, it's important to note some limitations of this study. It was conducted on outpatients, and only children with supportive parents who could afford the therapies were included. Most of these children attended follow-ups and received therapies. Parents selected speech and behavior therapists in their local areas and provided feedback from the therapists, which included videos, verbal reports, or written comments. Conclusions were drawn after 10 to 12 months with repeat ADOS or clinical reviews.

# Conclusion

We have concluded that exposure to more than 2 hours of screen time for over 6 months during the first 3 years of life can lead to a regression in speech development and the emergence of autism-like symptoms, such as a lack of response to one's name and poor eye contact. Many of these symptoms were observed to be reversible by significantly reducing screen time, implementing early intervention therapies, and providing opportunities for interactive play. In this regard, our findings align with previous studies.

It's important to note that defining "excessive" screen time for adolescents is more complex and cannot be solely based on a specific number of hours. We are mindful of the fact that the COVID-19 pandemic necessitated a transition to virtual education and work systems, which may have led to increased screen time for this age group. This increased screen time should be viewed in the context

of the unique circumstances imposed by lockdowns and related constraints.

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