

# A Survey on Early Screen Exposure during Infancy and Autism

I. Mahmood

**Abstract**—This survey was conducted to explore the hypothesis that excessive screen exposure combined with a subsequent decrease in parent-child interaction during infancy might be associated with autism. The main questions being asked are: Were children with autism exposed to long hours of screen time during the first 2 years of life? And what was the reason(s) for exposure at such an early age? Other variables were also addressed in this survey. An Arabic questionnaire was administered online (June 2019) via a Facebook page, relatively well-known in Arab countries. 1725 parents of children diagnosed with autism participated in this survey. Results show that 80.9% of children surveyed who were diagnosed with autism had been exposed to screens for long periods of time during the first 2 years of life. It can be inferred from the results of this survey that over-exposure to screens disrupt the parent-child interaction which is shown to be associated with ASD. The results of this survey highlight the harmful effects of screen exposure during infancy and the importance of parent-child interaction during the critical period of brain development. This paper attempts to further explore the connection between parent-child interaction and ASD, as well as serve as a call for further research and investigation of the relation between screens and parent-child interactions during infancy and Autism.

**Keywords**—Attachment disorder, autism, screen exposure, virtual autism.

## I. INTRODUCTION

**A**UTISM spectrum disorder (ASD) begins early in life and is characterized by deficits in social interaction, communication, and restricted and repetitive patterns of behavior [1]. Audiovisual stimulus (AV) refers to smartphones, tablets, television, video games, computers, and any type of screens.

*A. Satellite TV, Children's Television Channels, AV Stimulation, and Autism*

Many believe that the rise in autism cases correlates with the increased opportunities of very young children to watch TV and the increased popularity in children's TV programming, DVDs, VCRs, and video/computer games [2].

During the 1990s, Arabic satellite television broadcasting emerged, and it became the most powerful of all media instruments in Arab society. The pioneers of specialized Arabic children's channels were American companies involved in the children's television business. In 1996, Nickelodeon Arabia was first launched, followed by Disney Channel Middle East in 1997. In 2000, SpaceToon TV was launched as the first Arabic-owned children's television

channel [3].

The first Arabic autism center was established in the Kingdom of Saudi Arabia in 1992 [4]. More autism centers began to open in other Arabic countries due to the increased demand for such services, which was especially prominent towards the end of the 1990s. Following this trend, it has been noted that the interest in ASD has increased in Arab society, especially in Saudi Arabia and Egypt. This is evident through the increase in research on ASD over recent years. Though the interest has increased, research on ASD in Arabic countries is still at its infancy and requires stronger support for it to be productive [5].

In 2002, a report from Saudi Arabia stated that there were 42,500 confirmed cases of autism with many remaining undiagnosed [6] whereas in 2010, a study published on the prevalence of autism in the Sultanate of Oman stated that the overall prevalence of ASD in children aged 0–14 years old was 1.4 cases per 10,000 children, but noted that the low prevalence was most likely due to under-reporting and under-diagnosing [7]. Following in suit, in 2014, a systematic review of the prevalence of Autism in Arab Gulf countries reported that the prevalence of ASD in Bahrain was 4.3 cases per 10,000 children, while in UAE (with the use of a random sample of 3-year-old UAE nationals) it was 29 cases per 10,000 children [8].

It was suggested that screen viewing during infancy is a dose-related environmental exposure factor that is contributing to the rise of autism in the last 25 years [9]. Excessive exposure to an AV (such as TV) in combination with lack of opportunities to socialize with peers, as well as inadequate interactive relationships with family during the developmental years of childhood, which includes speech development, were all found to be related to the development of autism [10].

### *B. Screen and Autism*

Many studies have reported a correlation between screen consumption and autism [11]-[19]. A recent study conducted by Heffler and her colleagues from Drexel University in Philadelphia found that TV and/or video viewing at 12 months old was heavily associated with a greater display of ASD-like symptoms at 2 years of age [12]. This conclusion was also reached and confirmed by another study conducted in Indonesia [13].

A comparative study conducted by Cahid from Bezmialem University School of Medicine in Istanbul, Turkey, on the television viewing habits of children with ASD versus children who had no diagnosis, concluded that the sample of children with ASD had the highest percentage of children who consumed TV before the age of 12 months [14].

Israa Mahmood is Independent Researcher, Canada (e-mail: israhadi@hotmail.com).

Chonchaiya from the Department of Pediatrics in Chulalongkorn University, Bangkok, Thailand, concluded in an article published in 2011 that there are earlier onset and higher frequency of television viewing in children with autism compared to neurotypical children [15].

Zamfir, a clinical psychologist from Spiru Haret University (Bucharest), found that excessive consumption of virtual environments between 0 and 3 years old, cumulative with a genetic predisposition, can produce a neuro-cognitive structure typically for children with ASD. This was dubbed virtual autism [16].

In 2012, a study was conducted in Qatar using a control group of children with no diagnosis and a group of children with autism. These authors concluded that the children in the autism group spent more time on TV prior to 3 years old compared to the control group [17].

#### *C. Screen - Children's Health and Development*

Childhood is a time of significant development in the brain's anatomical structure and connectivity [18]. Brain plasticity during the first 2 years of life is particularly sensitive to the social-affective environment [19].

Rapid brain development occurs during infancy, more specifically, during the first year of life. The total brain volume at 2–4 weeks is approximately 36% of the adult volume, and by the first year, it reaches 72% of adult volume [20].

The use of screens might have harmful effects on the health and development of children [21]-[30]. In 2004, a study by the department of pediatrics at the University of Washington concluded that the more TV watched by infants aged 1-3, the more likely they were to develop problems with attention [31]. It has been suggested by other studies that increased screen time in children is associated with negative health outcomes, for example, impairment in language development, decreased cognitive ability, autism-like symptoms, such as short attention span, and hyperactivity [32], [33].

A study in China on pre-school children concluded that the more exposure to screen time in combination with shorter sleep duration at night, the more likely they were to develop behavioral problems [34].

A recent study obtained brain scans of children aged 3 to 5 years found that children who consumed more than the recommended 1 h of screen time during the day had less development in their brain's white matter, which is an area that is key in the development of literacy, language, and cognitive skills [35].

#### *D. Parents' Attitude toward Screen*

Screen viewing now begins in infancy with new research finding that the prevalence of screen viewing in children aged under 2 years 'is high and appears to increase steadily across age groups', with TVs and mobile devices being the most commonly used [36]. Tomopoulos and his colleagues reported that screen viewing began in children as young as 6 months old [26].

In the US, media usage in children aged 2-4 years old

increased from 39% to 80% between 2011 and 2013 [37]. A recent study in the UK noted that 51% of children aged 6 to 11 months old consumed touch-screen media every day [38].

There is a correlation between parental attitudes towards screens and the amount of screen exposure children receive. It has been reported by parents that the TV is viewed as a peacemaker in the household, and safe activity for their children while they are busy getting ready for the day, doing household chores, or preparing dinner [39].

A positive correlation has been found between screen time for children under 3 years of age, and the parental belief that the child enjoys TV [40], [41], the parental belief of the educational value of TV [40], [42] and the decreased duration of infant crying [43], in addition to shorter breastfeeding times [44].

#### *E. Screen and Parental Sensitivity (Attachment Theory)*

Parental sensitivity is the key to secure child-parent attachment relationships. Ainsworth defined parental sensitivity as the ability to perceive and interpret the child's signals accurately and respond to these signals in an adequate, prompt manner [45].

Secure children have experienced that their parents usually perceive and understand their distress, and that their needs are adequately met. Insecurely attached children tend to have less positive and supportive experience with their parents. Secure attachment is not only important for children's current well-being, but also for their later development [46].

Winnicott, a pediatrician and psychoanalyst, also described the importance of maternal caregiving behavior. Winnicott specifically described "holding" the child, both physically and within the mind, as an essential component of maternal care that serves to facilitate the development of early emotional capacities [47].

A study conducted by the Department of Pediatrics in Tohoku University concluded that attachment disorder and early exposure to media causes autism-like symptoms [48]. Audiovisual screen experiences take up time that could be used for social interaction; also, it cannot replace the quality of in-person social interaction [49], [50].

Parent-infant interactions are critical for child development. Children who spent  $\geq 3$  hours per day viewing screens had a language delay, short attention span, hyperactivity, and it negatively affects parent-child interaction during the exposure [51]. Lack of parental sensitivity has been shown to increase the possibility of developing psychopathology later in the child's life [52].

Screen exposure in early childhood, including background TV exposure, decreases the quantity and quality of interactions between parents and children, which has been shown to impact the development of the child [53]-[59].

#### *F. Other Variables in the Survey*

A comparative study on the prevalence of ASD links it according to feeding habits of infants at the time of birth (if they were breastfed, bottle-fed breast milk, or bottle-fed formula) concluded that there is an association between ASD

and formula-fed children or those who were weaned off breastfeeding early. It was also revealed that increased duration of child breastfeeding decreased the prevalence of ASD [60].

II. SURVEY RESULT

This survey was undertaken to determine whether excessive screen exposure and lack of parent-child interaction in infancy could be associated with Autism disorder. In addition to that, some other variables were addressed in this survey.

An Arabic-language questionnaire was administered online via a relatively well-known autism community Facebook page in Arab countries. The survey was conducted in June 2019. Responses were received from 1725 parents of children that have been diagnosed with autism. Parents answered the questions of the survey using multiple choice answers and were also provided with the option to write custom answers if they felt that the standard answers provided were not sufficient or did not describe them accurately.

Seven questions were addressed:

- 1- Was your child exposed to any type of screen for long hours during the first 2 years of life (TV, iPad, Mobile, etc.)? If yes, what was the reason?
- 2- When did you notice that your child had a problem?
- 3- Was the mother suffering from general health, psychological or social problems during the first 2 years of the child's life?
- 4- Did the mother breastfeed the baby for the first 2 years?
- 5- Was the mother working or studying during the first 2 years of the child's life?
- 6- Who cared for the child during the first 2 years of their life?
- 7- Was the mother or father taking psychotropic drugs?

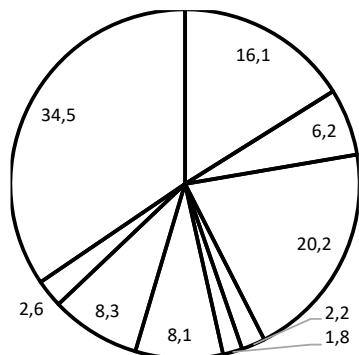


Fig. 1 Percentage breakdown of answers to the main question of whether the children are exposed to long hours of screen time during the first 2 years of life. Also shows the percentage breakdown for reasons (cited by parents) why the children of survey participants were subjected to screens for long hours during the first 2 years of life. 16.1% No, while 80.9% answered Yes

The results indicated that 80.9% of the children diagnosed with autism had been exposed to long hours of screen time during the first 2 years of their life.

The main reasons cited by the parents were to keep the

child occupied, avoid having them cry or move around too much, keeping them entertained and safe, or simply because the mother or caregiver was preoccupied [Fig. 1].

More than one-third (34.5%) of the parents thought that their children enjoyed their time watching TV. One-fifth (20.2%) were trying to keep them quiet, not moving around, and crying too much. Some (8.3%) got exposed to screens for long hours because mothers or caregivers were preoccupied with their other children and other responsibilities (babysitter). Some (8.1%) mentioned that the guardian that took care of children in the absence of the caregiver (housekeeper, grandparents, father) was keeping the child occupied by using TV to keep him or her quiet and safe (babysitter). Some (6.2%) believed that their children were learning from TV and Ipad and they would grow up smart because of this.

4% kept their child occupied with screens either because the child was physically ill or the mother was ill, and she could not take care of the child. Few mothers (2.6%) mentioned different reasons for early long hours of the screen including: older siblings who babysat the child were watching TV for long hours, and therefore the child got the same exposure; the mother was busy studying; because of war/country issues, families stayed at home all the time to be safe, and the TV was the only joy; the TV was on all day at home (background TV), and the baby was present; blind children enjoyed listening to the TV sound.

A. Other Variables Included in the Survey

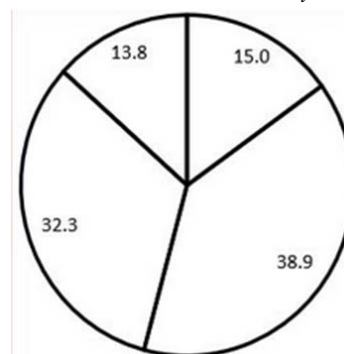


Fig. 2 The percentage breakdown of parents' responses to the question "when did you notice your child had difficulties?". 13.8% Before 1 year of age.38.9% Before 2 years of age. 32.3% After 2 years of age. 15.0% After 3 years of age

Among the mothers, 37.7% noticed their child had a problem before 2 years of age, 32.9% noticed the problem after 2 years of age, 15.1% noticed the problem after 3 years of age, and only 14.2% noticed their child had problems at an early age (less than 1 year of age) [Fig. 2].

Among the respondents, 35.8% of the mothers were suffering from health, psychological, or social problems during the first 2 years of the child's life [Fig. 3].

35.6% of mothers breastfed their babies for less than 1 year, and 20.7% for 1 year, 14.8% of mothers never breastfed their child, while only 28.9% completed 2 years of breastfeeding [Fig. 4].

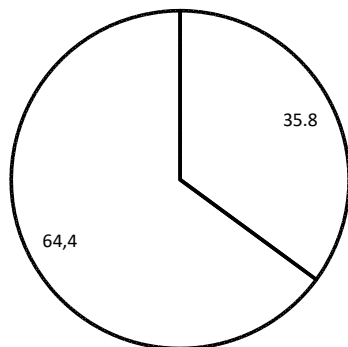


Fig. 3 The percentage of responses to the question of “Was the child’s mother suffering from health, psychological, or social problems during the first two years of the child’s life?”. 35.8% Yes. 64.4% No

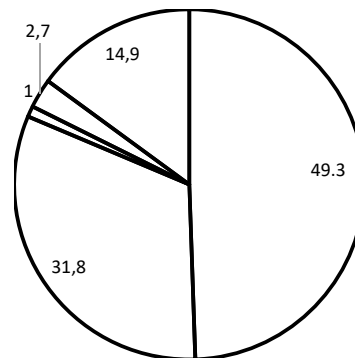


Fig. 6 Percentage breakdown of responses by parents to the question of “Who cared for the child during the first two years of life?”. 49.3% Mother and Father. 31.8% Mother only. 1% Father only. 2.7% Other (mother is absent). 14.9% Mother with others (Grandparents, Nanny, Nursery, Other relatives)

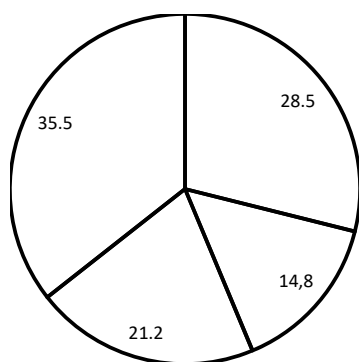


Fig. 4 Percentage breakdown of responses to the question of whether the mother completed breastfeeding and how long breastfeeding of the child lasted. 28.5% Yes. 14.8% Never been breast fed. 35.5% Less than one year. 21.2% One year only

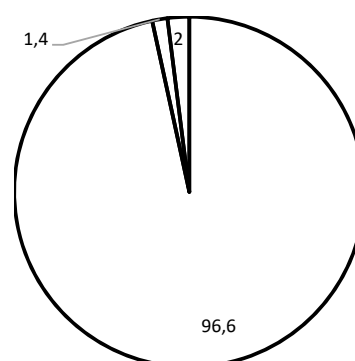


Fig. 7 Percentage breakdown of responses by parents to the question of whether either parent was taking psychotropic drugs. 96.6% No. 1.4 Yes, Mother. 2% Yes, Father

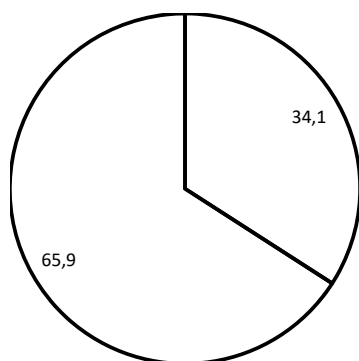


Fig. 5 Percentage breakdown of responses by parents to the question of whether the mother was busy with work or studies during the first 2 years of her child’s life. 34.1% Yes. 65.9% No

35% percent of mothers were working or studying during the first 2 years of their child’s life [Fig. 5].

Around half (49.3%) answered that both parents were responsible for taking care of the child, 31.8% answer that only the mother took responsibility, and 14.9% answered that guardians other than parents (Grandparents, Nanny, Nursery, Other relatives) took care of the child [Fig. 6].

Only 3.4% answered yes to the question of whether either mother or father was taking psychotropic drugs. It is also important to address the context in which this question was asked, as this was addressed to audiences from Arab countries, where mental illnesses are viewed as taboo [Fig. 7].

### III. DISCUSSION

Our findings indicate that 80.9% of the children diagnosed with autism have been exposed to long hours of screen time during the first 2 years of their life. This is evidence supporting the hypothesis that exposing infants and toddlers to long hours on screens is associated with autism disorder/ autism-like symptoms. This is consistent with the findings of many research papers from multiple countries on this topic [9]-[17].

#### A. The Trap

Screen consumption for children in Arab societies began when it entered the mainstream media, after its prevalence increased in the West. At the beginning of the 1990s, satellite channels became more accessible to the masses, which was around the same time, cases of autism began to appear in children.

In 1991, the Middle East Broadcasting Channel, also known as MBC, was established by Saudi Arabia, making it the first privately owned Arabic satellite TV station. Its target audience was primarily the pan-Arab audience, and its launch paved the way for more satellite launches in the 1990s [61], [62]. However, the boom in children's Arabic TV programming took place in the mid-2000s when broadcasting companies began marketing to children as consumers to advertise children's toys, candy, cereal, and more. By the end of 2000, there were more than 20 Arabic television channels with a target audience of pre-school children and older [63].

A strong advertising campaign by broadcasting companies, as well as TV program creators marketing their shows and channels towards parents, claimed that they have the potential for educational value by introducing social values, and teaching academic and cognitive knowledge. Advertisers capitalized on families' desire to promote their children's cognitive development by presenting and citing non-specific brain research to convince them to buy their products (DVDs, T programs, apps) [64].

We believe that parents were deceived by these broadcasting/program companies into thinking that there is no real harm to screen exposure from a young age, resulting in the overexposure of infants to audiovisual stimulation in hopes of educational benefits as well as providing pleasure for their children [65]. When mothers were asked about the beliefs of TV and video consumption by infants and toddlers, most reported positive beliefs [66], illustrating the lack of hesitation by parents in exposing their children to screens.

In addition to false information on the effects of screens, the nature of life has changed progressively. Parents were busy with the demands of their jobs, or were engaging in overconsumption of screens and technological devices, such that they must find a way to occupy their child's time. This is in addition to the fact that during the first 2 years, children begin to move and explore their surroundings, expose themselves to risks, and have tantrums [67], [68]. Therefore, screens would be used to preoccupy them. One of the reasons cited by the parents who participated in the survey was that they used the TV as a way to occupy their child's attention in order to have them be less mobile around the house in order to ensure that they will be safe at all times without worrying about them.

Beyens and Eggermont's findings in 2014 [69] coincide with the results of our survey, where parents indicated that their children were exposed to screens during the first 2 years of life as they were using screens to occupy their child while they or other caregivers were preoccupied. In addition to that, the survey revealed that infants would receive the same amount of screen exposure as their older sibling that is consuming TV while babysitting them.

Parents have fallen so deep into the trap of screens to the point where it is hard to stop consuming them even if they had believed in the negative effects associated with screen consumption in the early years. This is illustrated in a study done by Cingel and Krcmar that concluded that although parents have reservations on the effects of TV on their young

ones, they found it hard to refrain from using media as it was an integral part of their child-rearing routine [70].

#### *B. The Phenomenon of "unintentionally emotionally absent parents!"*

It has been suggested by attachment theorists that the quality of parent-child interaction is an important aspect of healthy development. Usually, a newborn baby would be the center of attention for the entire family. As such, those surrounding the baby would be the most influential and engaging in the environment [71].

A paper by Delmolino and Harris concluded that infants grow and learn through emotional interactions with the people in their environment and their surroundings [72]. The quality of parent-child interaction, as well as the child's experiences with their environment during the first 3 years of life, contribute greatly to the growth of the brain, including social and emotional growth, intellectual functioning, and language use [73].

Our survey revealed that 80.9% of the children diagnosed with autism had been exposed to long hours of screen time during the first 2 years of their life. Many studies have confirmed that screen exposure decreases the time available in the day for social interaction with the parents, thereby decreasing the quality of parent-child interaction [53]-[59].

In 2019, a study from Chulalongkorn University's Faculty of Medicine determined that positive mother-child interactions were associated with low screen consumption by children in early childhood [74], and we believe that this is the case with the 80.9% of the children diagnosed with autism, as mentioned above.

By looking at the reasons mentioned in this survey for screen exposure during infancy, it could be deduced that there was a lack of social communication with the infant during hours of screen exposure and attachment to screens disrupts the parent-child interaction. A decision was made to name this phenomenon, "unintentionally emotionally absent parent(s)".

The resulting phenomenon experienced by these children and their parents is an attachment disorder that occurs "unintentionally". A study in Tohoku University's Department of Pediatrics revealed that attachment disorders and media exposure are linked, causing Autism-like symptoms [48].

When toddlers and infants spend hours at screens, it deprives them of the time to experience their world and have continuous communication with their caregiver, leaving them with only the experience of sounds and images emanating from the screen which do not engage in social communication with the child and is, therefore, of no use to the child's development. The child's senses of touch and smell are not engaged, and there is no direct eye contact occurring when sitting in front of a screen. This fact was further proven through research conducted by ophthalmologist Heffler from Drexel University College of Medicine, where she stated that the attention of the vulnerable infant is taken away from social interactions and instead put to focus on electric toys, TV, and other media screens [9].

### C. Sensory Dysregulation

Sensory dysregulation during the early progression of ASD has an impact on social functioning, and this was concluded in a 2017 study describing the multiple mechanisms in which sensory dysregulation in ASD could trigger a cascade leading to social deficits throughout development [75]. We believe that sitting in front of screens for long hours during the first 2 years of life is one of the leading causes of sensory dysregulation. Studies also show that environmental enhancement results in increased dendritic branching in cortical neurons, among many other neurobiological changes [76], [77]. This was shown through a study displaying the overstimulation of newborn mice, which lead to deficits in cognitive performance and the behavioral difference compared to the negative control. This suggests that an excess of non-normative stimulation during critical times in the development of the brain demonstrates harmful effects on the subsequent neurocognitive function [78].

It is possible that an imbalance of age-appropriate sensory input in infants and toddlers in combination with lack of communication with caregivers leads to hindrance in brain development during a critical stage and that this is the main reason for autism.

### D. Other Variables in the Survey

Our results show that there was a significant association between autism and breastfeeding, which is compatible with the findings of research conducted by Shafai and his colleagues, where they reported a strong correlation between ASD in children who were fed with formula from birth or weaned off breast milk early. Data from Shafai et al. revealed that increasing the duration of breastfeeding resulted in a decrease in the prevalence of ASD [60]. Only 28.8% of mothers that participated in our survey have completed 2 years of breastfeeding for their child, while 56.7% of mothers breastfeed their children for less than a year, and 14.9% never breastfed their child. Kangaroo bonding/attachment is affected.

There was no significant correlation found in our study between children with autism and if their mothers were working, studying, or their parents' general and mental health. About 34.1% of mothers were working/studying during the first two years of their child's life, and only 35.8% of mothers in the survey suffered from physiological, psychological, or social problems during the first two years of the child's life, and only 3.4% of them answered yes to the question of whether the mother or father were taking psychotropic drugs during the first 2 years of the child's life.

## IV. CONCLUSION AND RECOMMENDATION

The result of this survey indicates that the majority of children diagnosed with autism in Arab countries have been exposed to long hours of screen time during the first two years of their life. This is consistent with the findings of many research papers from multiple countries on the same topic. The exposure to screens was not only an imbalance of age-appropriate sensory input that leads to hindrance in brain

development during this critical stage, but also the excessive screen time disrupts the parent-child interaction leading to an attachment disorder. Therefore, it can be inferred from these results that excessive screen exposure and the subsequent decrease in parent-child interaction might be associated with ASD.

## V. RECOMMENDATION

Based on our findings, we recommend providing education to parents on the importance of parent-child interactions and brain development during the early years of child development, as well as the dangers of screen exposure on child development during this critical stage. This education should be part of programs offered by maternity and childhood care centers and should be distributed in the form of leaflets given to mothers during their periodic visits to gynecologists, pediatricians, and/or maternity and child care centers. Also, pediatricians and family physicians play a huge role in preventative healthcare, and should help warn mothers of the dangers of excessive screen exposure at a young age. How much and when this screen exposure occurred in early childhood should be one of the questions posed to parents during routine physicals of the child or in the event of the appearance of early signs of ASD in children.

## REFERENCES

- [1] AP Association (2013). Diagnostic and Statistical Manual of Mental Disorders. doi:10.1176/appi.books.9780890425596
- [2] Waldman, M., Nicholson, S., & Adilov, N. (2006). Does television cause autism? *SSRN Electronic Journal*. doi:10.2139/ssrn.989648
- [3] Dishing Democracy ~ Handbook: Satellite Television in the Arab World. (2008, December 04). Retrieved June 10, 2020, from <https://www.pbs.org/wnet/wideangle/uncategorized/dishing-democracy-handbook-satellite-television-in-the-arab-world/1843/>
- [4] ElShajari, S. (2018, March 27). فيديو: كلمة الأميرة فهدة بنت سعود في افتتاح مبنى التوحيد الجديد. Retrieved June 10, 2020, from [https://derwaza.news/Home/Details/5aba2b488c42539ee41562c7\\_2](https://derwaza.news/Home/Details/5aba2b488c42539ee41562c7_2)
- [5] Hussein, H., & Taha, G. R. (2013). Autism spectrum disorders. *Middle East Current Psychiatry*, 20(3), 106-116. doi:10.1097/01.xme.0000430433.49160.a4
- [6] Eapen, V., Mabrouk, A. A., Zoubeidi, T., & Yunis, F. (2007). Prevalence of pervasive developmental disorders in pre-school children in the UAE. *Journal of Tropical Pediatrics*, 53(3), 202-205. doi:10.1093/tropej/fml091
- [7] Al-Farsi, Y. M., Al-Sharbati, M. M., Al-Farsi, O. A., Al-Shafae, M. S., Brooks, D. R., & Waly, M. I. (2010). Brief Report: Prevalence of autistic spectrum disorders in the Sultanate of Oman. *Journal of Autism and Developmental Disorders*, 41(6), 821-825. doi:10.1007/s10803-010-1094-8
- [8] Sahlia, H.O.; Al-Nasser, L.A.; Taher, L.S.; Al-Khathaami, A.M.; El-Metwally, A.A. Systemic review of the epidemiology of autism in Arab Gulf countries. *Neurosciences* 2014, 19, 291.
- [9] Causation model of autism: Audiovisual brain ... (n.d.). Retrieved June 13, 2020, from <https://www.sciencedirect.com/science/article/pii/S0306987715002388>
- [10] Jahan, A., Parvin, S. R., & Bugum, D. (2015). Familial, social and environmental risk factors in autism: A case-control study. *Bangladesh Medical Research Council Bulletin*, 40(3), 113-117. doi:10.3329/bmrcb.v40i3.25233
- [11] Slobodin, O., Heffler, K. F., & Davidovitch, M. (2019). Screen media and autism spectrum disorder. *Journal of Developmental & Behavioral Pediatrics, Publish Ahead of Print*. doi:10.1097/dbp.0000000000000654
- [12] Heffler, K. F., Sienko, D. M., Subedi, K., Mccann, K. A., & Bennett, D. S. (2020). Association of early-life social and digital media experiences with development of autism spectrum disorder-like symptoms. *JAMA Pediatrics*, 174(7), 690. doi:10.1001/jamapediatrics.2020.0230

- [13] Early electronic screen exposure and autistic-like symptoms. (n.d.). Retrieved June 13, 2020, from <https://www.ncbi.nlm.nih.gov/pubmed/29552452>
- [14] Orengul, A. C., & Gormez, V. (2017). Television viewing habits in a pre-school age clinical population with autism spectrum disorders and other clinical groups. *Bezmialem Science*. doi:10.14235/bs.2017.1423
- [15] Chonchaiya, W., Nuntnarumit, P., & Pruksananonda, C. (2011). Comparison of television viewing between children with autism spectrum disorder and controls. *Acta Paediatrica*, 100(7), 1033-1037. doi:10.1111/j.1651-2227.2011.02166.x
- [16] Zamfir, Marius. (2018). The consumption of virtual environment more than 4 hours/day, in the children between 0-3 years old, can cause a syndrome similar with the autism spectrum disorder. *Journal of Literary Studies*.
- [17] Kheir, N. M., Ghoneim, O. M., Sandridge, A. L., Hayder, S. A., Al-Ismaail, M. S., & Al-Rawi, F. (2012). Concerns and considerations among caregivers of a child with autism in Qatar. *BMC Research Notes*, 5(1). doi:10.1186/1756-0500-5-290
- [18] Rapoport, J. L., & Gogtay, N. (2007). Brain neuroplasticity in healthy, hyperactive and psychotic children: Insights from neuroimaging. *Neuropsychopharmacology*, 33(1), 181-197. doi:10.1038/sj.npp.1301553
- [19] Schore, A. N. (2001). Effects of a secure attachment relationship on right brain development, affect regulation, and infant mental health. *Infant Mental Health Journal*, 22(1-2), 7-66. doi:10.1002/1097-0355(200101/04)22:13.0.co;2-n
- [20] Knickmeyer, R. C., Gouttard, S., Kang, C., Evans, D., Wilber, K., Smith, J. K., . . . Gilmore, J. H. (2008). A Structural MRI study of human brain development from birth to 2 years. *Journal of Neuroscience*, 28(47), 12176-12182. doi:10.1523/jneurosci.3479-08.2008.
- [21] Cheung, C. H., Bedford, R., Urabain, I. R., Karmiloff-Smith, A., & Smith, T. J. (2017). Daily touch-screen use in infants and toddlers is associated with reduced sleep and delayed sleep onset. *Scientific Reports*, 7(1). doi:10.1038/srep46104
- [22] Barr, R., Lauricella, A., Zack, E., & Calvert, S. L. (2010). Infant and early childhood exposure to adult-directed and child-directed television programming: Relations with cognitive skills at age four. *Merrill-Palmer Quarterly*, 56(1), 21-48. doi:10.1353/mpq.0.0038
- [23] Figueiro MG, Wood B, Plitnick B, Rea MS. The impact of light from computer monitors on melatonin levels in college students. *Neuro Endocrinol Lett*. 2011;32(2):158-163.
- [24] Pagani LS, Fitzpatrick C, Barnett TA, Dubow E. Prospective associations between early childhood television exposure and academic, psychosocial, and physical well-being by middle childhood. *Arch Pediatr Adolesc Med*. 2010;164(5):425-431. doi:10.1001/archpediatrics.2010.50
- [25] Thompson, D. A. (2005). The association between television viewing and irregular sleep schedules among children less than 3 years of age. *Pediatrics*, 116(4), 851-856. doi:10.1542/peds.2004-2788
- [26] Tomopoulos, S., Dreyer, B. P., Berkule, S., Fierman, A. H., Brockmeyer, C., & Mendelsohn, A. L. (2010). Infant media exposure and toddler development. *Archives of Pediatrics & Adolescent Medicine*, 164(12). doi:10.1001/archpediatrics.2010.235
- [27] Tomopoulos, S., Dreyer, B. P., Valdez, P., Flynn, V., Foley, G., Berkule, S. B., & Mendelsohn, A. L. (2007). Media content and externalizing behaviors in Latino toddlers. *Ambulatory Pediatrics*, 7(3), 232-238. doi:10.1016/j.ambp.2007.02.004
- [28] Vandewater, E. A., Bickham, D. S., Lee, J. H., Cummings, H. M., Wartella, E. A., & Rideout, V. J. (2005). When the television is always on. *American Behavioral Scientist*, 48(5), 562-577. doi:10.1177/0002764204271496
- [29] Zimmerman, F. J., & Christakis, D. A. (2005). Children's television viewing and cognitive outcomes. *Archives of Pediatrics & Adolescent Medicine*, 159(7), 619. doi:10.1001/archpedi.159.7.619
- [30] Zimmerman, F. J., Christakis, D. A., & Meltzoff, A. N. (2007). Television and DVD/Video viewing in children younger than 2 years. *Archives of Pediatrics & Adolescent Medicine*, 161(5), 473. doi:10.1001/archpedi.161.5.473
- [31] Christakis, D. A., Zimmerman, F. J., Diguseppe, D. L., & McCarty, C. A. (2004). Early television exposure and subsequent attentional problems in children. *Pediatrics*, 113(4), 708-713. doi:10.1542/peds.113.4.708
- [32] Chonchaiya, W., & Pruksananonda, C. (2008). Television viewing associates with delayed language development. *Acta Paediatrica*, 97(7), 977-982. doi:10.1111/j.1651-2227.2008.00831.x
- [33] Hermawati, D., Rahmadi, F. A., Sumekar, T. A., & Winarni, T. I. (2018). Early electronic screen exposure and autistic-like symptoms. *Intractable & Rare Diseases Research*, 7(1), 69-71. doi:10.5582/irdr.2018.01007
- [34] Wu, X., Tao, S., Rutayisire, E., Chen, Y., Huang, K., & Tao, F. (2016). The relationship between screen time, nighttime sleep duration, and behavioural problems in pre-school children in China. *European Child & Adolescent Psychiatry*, 26(5), 541-548. doi:10.1007/s00787-016-0912-8
- [35] Hutton, J. S., Dudley, J., Horowitz-Kraus, T., Dewitt, T., & Holland, S. K. (2020). Associations between screen-based media use and brain white matter integrity in preschool-aged children. *JAMA Pediatrics*, 174(1). doi:10.1001/jamapediatrics.2019.3869
- [36] Goh, S. N., Teh, L. H., Tay, W. R., Anantharaman, S., Dam, R. M., Tan, C. S., . . . Müller-Riemenschneider, F. (2016). Sociodemographic, home environment and parental influences on total and device-specific screen viewing in children aged 2 years and below: An observational study. *BMJ Open*, 6(1). doi:10.1136/bmjopen-2015-009113
- [37] Common Sense Media. Zero to Eight: Children's Media Use in America 2013: A Common Sense Research Study. [www.commonsensemedia.org/research/zero-to-eight-childrens-media-use-in-america-2013](http://www.commonsensemedia.org/research/zero-to-eight-childrens-media-use-in-america-2013) (Accessed April 11, 2017).
- [38] Cheung CHM, Vota W; LSE Department of Media and Communications. What Are the Effects of Touchscreens on Toddler Development? <http://blogs.lse.ac.uk/parenting4digitalfuture/2016/12/28/what-are-the-effects-of-touchscreens-on-toddler-development/> (Accessed April 11, 2017).
- [39] Hamel, E., & Rideout, V. (2006, May 24). The Media Family: Electronic Media in the Lives of Infants, Toddlers, Preschoolers, and Their Parents. Retrieved June 20, 2020, from <https://www.issuelab.org/resource/the-media-family-electronic-media-in-the-lives-of-infants-toddlers-preschoolers-and-their-parents.html>
- [40] Dalzell, V. P., Msall, M. E., & High, P. C. (2000). Parental attitudes of television and videocassette viewing of children aged birth to 36 months. *Journal of Developmental & Behavioral Pediatrics*, 21(5), 390. doi:10.1097/00004703-200010000-00035
- [41] Masur, E. F., & Flynn, V. (2008). Infant and mother-infant play and the presence of the television. *Journal of Applied Developmental Psychology*, 29(1), 76-83. doi:10.1016/j.appdev.2007.10.001
- [42] Vandewater, E. A., Rideout, V. J., Wartella, E. A., Huang, X., Lee, J. H., & Shim, M. (2007). Digital childhood: electronic media and technology use among infants, toddlers, and preschoolers. *Pediatrics*, 119(5). doi:10.1542/peds.2006-1804
- [43] Maternal characteristics and perception of temperament associated with infant TV exposure. (2013). *Pediatrics*, 131(2), X20-X20. doi:10.1542/peds.2012-1224d
- [44] Schmidt, M. E., Rich, M., Rifas-Shiman, S. L., Oken, E., & Taveras, E. M. (2009). Television Viewing in Infancy and Child Cognition at 3 Years of Age in a US Cohort. *Pediatrics*, 123(3). doi:10.1542/peds.2008-3221
- [45] Lamb, M. E. (1980). Patterns of attachment: A psychological study of the strange situation. Mary D. Salter Ainsworth, Mary C. Blehar, Everett Waters, and Sally Wall. Hillsdale, N.J., Erlbaum, 1978 (distributor, Halsted (Wiley), New York). xviii, 392 pages, \$24.95. *Infant Mental Health Journal*, 1(1), 68-70. doi:10.1002/1097-0355(198021)1:13.0.co;2-3
- [46] Steele, H., & Steele, M. (2018). *Handbook of attachment-based interventions*. New York, NY: The Guilford Press.
- [47] Winnicott, D. W. (2019). *Thinking about Children*. S.I.: Routledge.
- [48] Numata-Uematsu, Y., Yokoyama, H., Sato, H., Endo, W., Uematsu, M., Nara, C., & Kure, S. (2018). Attachment Disorder and Early Media Exposure: Neurobehavioral symptoms mimicking autism spectrum disorder. *The Journal of Medical Investigation*, 65(3.4), 280-282. doi:10.2152/jmi.65.280
- [49] Kirkorian, H. L., Pempek, T. A., Murphy, L. A., Schmidt, M. E., & Anderson, D. R. (2009). the impact of background television on parent-child interaction. *Child Development*, 80(5), 1350-1359. doi:10.1111/j.1467-8624.2009.01337.x
- [50] Courage, M. L., Murphy, A. N., Goulding, S., & Setliff, A. E. (2010). When the television is on: The impact of infant-directed video on 6- and 18-month-olds' attention during toy play and on parent-infant interaction. *Infant Behavior and Development*, 33(2), 176-188. doi:10.1016/j.infbeh.2009.12.012

- [51] Byeon, H., & Hong, S. (2015). Relationship between television viewing and language delay in toddlers: Evidence from a Korea national cross-sectional survey. *Plos One*, 10(3). doi:10.1371/journal.pone.0120663
- [52] Cabrera, N. J., Fagan, J., Wight, V., & Schadler, C. (2011). Influence of mother, father, and child risk on parenting and children's cognitive and social behaviors. *Child Development*, 82(6), 1985-2005. doi:10.1111/j.1467-8624.2011.01667.x
- [53] Christakis, D. A., Gilkerson, J., Richards, J. A., Zimmerman, F. J., Garrison, M. M., Xu, D., . . . Yapanel, U. (2009). Audible television and decreased adult words, infant vocalizations, and conversational turns. *Archives of Pediatrics & Adolescent Medicine*, 163(6), 554. doi:10.1001/archpediatrics.2009.61
- [54] Mendelsohn, A. L., Berkule, S. B., Tomopoulos, S., Tamis-LeMonda, C. S., Huberman, H. S., Alvir, J., & Dreyer, B. P. (2008). Infant television and video exposure associated with limited parent-child verbal interactions in low socioeconomic status households. *Archives of Pediatrics & Adolescent Medicine*, 162(5), 411. doi:10.1001/archpedi.162.5.411
- [55] Tanimura, M., Okuma, K., & Kyoshima, K. (2007). Television viewing, reduced parental utterance, and delayed speech development in infants and young children. *Archives of Pediatrics & Adolescent Medicine*, 161(6), 618. doi:10.1001/archpedi.161.6.618-b
- [56] Tomopoulos S, Valdez PT, Dreyer BP, et al. Is exposure to media intended for pre-school children associated with less parent-child shared reading aloud and teaching activities? *Ambul Pediatr*. 2007;7(1):18-24.
- [57] Mendelsohn AL, Dreyer BP, Brockmeyer CA, Berkule-Silberman SB, Huberman HS, Tomopoulos S: Randomized controlled trial of primary care pediatric parenting programs: effect on reduced media exposure on infants, mediated through enhanced parent-child interaction. *Arch Pediatr Adolesc Med*. 2011, 165 (1): 42-48. doi:10.1001/archpediatrics.2010.266.
- [58] Zhao, J., Zhang, Y., Jiang, F., Ip, P., Ho, F. K., Zhang, Y., & Huang, H. (2018). Excessive screen time and psychosocial well-being: The mediating role of body mass index, sleep duration, and parent-child interaction. *The Journal of Pediatrics*, 202. doi:10.1016/j.jpeds.2018.06.029
- [59] Courage, M. L., & Howe, M. L. (2010). To watch or not to watch: Infants and toddlers in a brave new electronic world. *Developmental Review*, 30(2), 101-115. <https://doi.org/10.1016/j.dr.2010.03.002>
- [60] Shafai, T., Mustafa, M., Mulari, J., & Curtis, A. (2017). Impact of infant feeding methods on the development of autism spectrum disorder. *Autism - Paradigms, Recent Research and Clinical Applications*. doi:10.5772/67624
- [61] Sakr, N. (1999). Satellite television and development in the Middle East. *Middle East Report*, (210), 6. doi:10.2307/3012492
- [62] Alterman, J. B. (1998). *New media, new politics?: From satellite television to the Internet in the Arab world*. Washington, DC: Washington Institute for Near East Policy.
- [63] Sayfo, O. A. (n.d.). The emergence of Arab Children's television and animation Industry in the Gulf States. *State-Society Relations in the Arab Gulf States*, 77-100. doi:10.2307/j.ctt1df4hq3.7
- [64] Cantor, P., & Cornish, M. M. (2016). *Techwise infant and toddler teachers: Making sense of screen media for children under 3*. Charlotte, NC: Information Age Publishing.
- [65] Schlembach, Sue & Johnson, Marcus. (2014). Parents' beliefs, attitudes and behaviors concerning their young children's screen media use. *NHSA Dialog A Research-to-Practice Journal for the Early Intervention Field*.
- [66] Vaala SE. The nature and predictive value of mothers' beliefs regarding infants' and toddlers' TV/Video Viewing: Applying the integrative model of behavioral prediction. *Media Psychol*. 2014;17(3):282-310. doi:10.1080/15213269.2013.872995
- [67] Morrongiello, B. A., Corbett, M., Mccourt, M., & Johnston, N. (2005). Understanding unintentional injury-risk in young children I. The nature and scope of caregiver supervision of children at home. *Journal of Pediatric Psychology*, 31(6), 529-539. doi:10.1093/jpepsy/jsj045
- [68] DeHart, G., Sroufe, L. A., Cooper, R. G., & Patterson, C. (2004). *Child Development: Its nature and course*. Boston: McGraw-Hill.
- [69] Beyens, I., & Eggermont, S. (2014). Putting young children in front of the television: antecedents and outcomes of parents' use of television as a babysitter. *Communication Quarterly*, 62(1), 57-74. doi:10.1080/01463373.2013.860904
- [70] Cingel, Drew & Krcmar, Marina. (2013). Predicting media use in very young children: The role of demographics and parent attitudes. *Communication Studies*. 64. 374-394. doi:10.1080/10510974.2013.770408.
- [71] Cassidy, J., & Shaver, P. R. (2018). *Handbook of attachment theory, research, and clinical applications*. New York, London: The Guilford Press.
- [72] Delmolino, L., & Harris, S. L. (2014). *Essential first steps for parents of children with autism: Helping the littlest learners*. Mill Road, Bethesda, MD: Woodbine House.
- [73] Schore, A. N. (2005). Back to basics: Attachment, affect regulation, and the developing right brain: linking developmental neuroscience to pediatrics. *Pediatrics in Review*, 26(6), 204-217. doi:10.1542/pir.26-6-204
- [74] Detnakarintra, K., Trairatvorakul, P., Pruksananonda, C., & Chonchaiya, W. (2019). Positive mother-child interactions and parenting styles were associated with lower screen time in early childhood. *Acta Paediatrica*, 109(4), 817-826. doi:10.1111/apa.15007
- [75] Thye, M. D., Bednarz, H. M., Herringshaw, A. J., Sartin, E. B., & Kana, R. K. (2018). The impact of atypical sensory processing on social impairments in autism spectrum disorder. *Developmental Cognitive Neuroscience*, 29, 151-167. doi:10.1016/j.dcn.2017.04.010
- [76] Fuchs, J. L., Montemayor, M., & Greenough, W. T. (1990). Effect of environmental complexity on size of the superior colliculus. *Behavioral and Neural Biology*, 54(2), 198-203. doi:10.1016/0163-1047(90)91422-8
- [77] Greenough, W. T., Larson, J. R., & Withers, G. S. (1985). Effects of unilateral and bilateral training in a reaching task on dendritic branching of neurons in the rat motor-sensory forelimb cortex. *Behavioral and Neural Biology*, 44(2), 301-314. doi:10.1016/s0163-1047(85)90310-3
- [78] Christakis, D. A., Ramirez, J. S., & Ramirez, J. M. (2012). Overstimulation of newborn mice leads to behavioral differences and deficits in cognitive performance. *Scientific Reports*, 2(1). doi:10.1038/srep00546