

## A Call for Research on the Relationship between ASD and Screen-Time

### **The Burden of ASD**

ASD is defined as a neurodevelopmental disorder, one that is marked by the impaired ability of a child or an adult to be able to participate in reciprocal human relationships. It is hard to imagine what life must be like without this ability but clearly it must be lonely scary and difficult. Imagine living in your own little world disconnected from the people around you, not knowing whom to trust, and all the while being subject to ridicule, bullying, and scorn.

Taking care of a child with ASD is both too expensive and too demanding. Children on the spectrum lack connection to the humans around them, seeing other people more as objects. They often have difficult and baffling behaviors. Uncontrollable tantrums, inflexible eating demands, personal hygiene issues, and disruptive sleeping habits are common and difficult problems for families with a child on the spectrum.

Treatment and care for people with ASD in general is both costly and time consuming. The cost of caring for such a child over a lifetime has been recently estimated between \$1.4 and \$2.4 million dollars beyond the usual cost of raising a child. (Ariane Beuescher, 2014)

### **The Increasing Prevalence of ASD**

One child with ASD is sad, truly sad enough, but at this point in time and for the last fifty years the prevalence of ASD, regardless of the classification system in use, keeps going up dramatically year after year. According to the CDC's most recent report published in 2014 the prevalence went up 30% from their prior study two years earlier. In the recent study, the prevalence for boys was one child out of 49, with four to five times as many boys as girls. Forty years ago, one out of 2,500 children born ended up on the spectrum. According to the CDC ASD is nearly 30 times more common than in 1960. (CDC Autism and Developmental Monitoring Network Surveillance Year, 2014). The number of children so affected seems to go higher every year creating a crisis situation for our society.

This dramatic increase in the number of children on the spectrum is found around the world. For instance in population studies from Sweden, where all children are registered and tracked over time, the prevalence of ASD increased nearly tenfold in the last ten years. (Sandin, Lichtenstein, & etc., 2014). Interestingly enough the highest rate of ASD have been found in areas that have embraced high tech development such as South Korea (Kim, 2011) and Eindhoven a high tech area in Holland (Are Autism Spectrum Conditions More Prevalent in an Information-Technology Region? A School-Based Study of Three Regions in the Netherlands., 2012).

If we agree ASD is a terrible problem affecting more and more children each year then the next question must be what is causing so many children to develop ASD in the last 50 years and what if anything can be done?

In the ASD research community there has been two widely held misconception about ASD which have slowed progress in the study and understanding of ASD. In this last year important studies have been published which have refuted these ideas setting the stage for new studies that hopefully will be able to find the cause of ASD.

### **The Extent of the Genetic Role in the Causation of ASD**

The first misconception was that ASD is by and large a genetic disorder; that children are born with it or not. Based on small twin studies from some 20 years ago it was commonly thought up to 90% of the cause of ASD would come from genetic factors. However recent population studies from Sweden, Denmark, and California have placed the heritability of ASD close to 50%. These studies involve very large cohorts of children giving them great validity. (Sandin, Lichtenstein, & etc., 2014) (Therese K Gronborg, 2013) (J Hallmayer, 2011)

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There is no dispute that genetic factors play an important role in the cause of ASD. That point is settled. But then so do environmental factors which account for the other 50% of the cause of ASD according to these studies. If the proper environmental factors can be found, the door to prevention will be opened.

### **The Age of Onset of ASD**

The second common misconception that hampered understanding of ASD was the idea ASD started well after the first year of life. This idea was held because ASD was undetectable in children before this age. Again recent studies have lead researchers to realize that ASD has its roots in the first year of life. Using eye tracking technology Jones & Klin showed children who were destined to develop ASD had abnormal eye tracking findings as early as 6 months of age (Warren Jones & Ami Klin, 2013). Another study, again using eye tracking technology, showed reactions to human speech at six months of age could separate children who would develop ASD from those who would not (Federick Shic, 2014). Finally a third study this time using neuroimaging demonstrated a difference in the actual structure of white matter tracts going to and from the occipital cortex in the brains of children who will develop ASD, again at 6 months of age. (Jed T Elison, 2013). The occipital cortex is the part of brain responsible for vision.

Not only has ASD been shown to start in the first year of life, but a recent study has shown it can be detected and treated effectively during this time period. (S J Rogers, 2014)

This recent research shows ASD begins in the first year of life and that 50% of the cause is something in the environment of the baby or infant. Researchers need to look for environmental factors that can impact infants and babies during the first year of life or before. They also need to look for a factor that in the last 50 years has become more of a part in the lives of young children around the world. What could that factor be?

### **How Screen-Time might be linked ASH**

We in SSAS-C believe that this factor is exposure to screen-time (the time infants and toddler spend looking at televisions, videos, tablets, smart phones etc.). Infants and toddlers are exposed to much more screen-time than a generation ago (Mary Courage, 2010). Exposure to screen-time as a possible cause of ASD has been largely overlooked by the ASD research community despite the publication of a few important studies supporting this connection (W Chonchaiya, 2011) (M Waldman, 2006) that will be discussed further.

It is known that infants learn the sounds of the language spoken to them during the first year of life and by the end of the first year are no longer attending to non-native sounds (Patricia K Kuhl, 2005). The critical time for learning this part of speech is during the first year of life. Could social behavior be the same? There are studies showing language acquisition is impaired by screen-time (Chonchaiya, 2008) (K Okuma.T Tanimura, 2007) and the learning of social behavior could likewise be impaired.

Why do we think there is the connection between screen-time and ASD? The 'The Pied Pipers of Autism' by the author goes into this question in a lot more depth than can be done here. Nevertheless keeping in mind, ASD is the failure of a child to develop reciprocal social relationships with other human beings, how might screen-time in infancy block or interfere with the development of this vital skill set?

#### **1. Change in Visual Processing**

Screen-time may alter how babies learn to see. An infant is first exposed to visual images at the time of birth. Babies typically learn how to see by moving their eyes and bodies as they visually explore the world around him.

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The first six months of life is a critical time for an infant to learn how to process and organize the light coming from the moving three dimensional 360 degree visible world we all actually live in. This learning shapes the structure of the brain especially in the occipital cortex.

Screen-time presents novel images to the developing brain that could alter the course of normal visual learning and processing. Screen-time images contrast sharply with those of the natural world. With screen-time, a still infant sits in front of a fixed screen. Visual activity takes place on a two dimensional fixed small plane completely disconnected from both the social and physical world surrounding the child. These novel images could plausibly alter how young infants learn to process visual stimuli. This altered processing could affect the brain in a way to increase the susceptibility of infants to ASD. For instance, it could interfere with tasks that require infants to scan the three dimensional world such as joint attention, a critical social skill for the child under one (Charman, 2003).

### **2. Distraction from Social Relationships**

Up until the last 50 years babies and infants were surrounded by other humans and these humans were almost certainly the most interesting thing in the baby's world and those humans captured their attention. Screen-time presents an alternative world, one full of colors, sounds, music, movement, faces, voices; all things that may be more attractive to some babies and infants than the people in his family. It is clear many infants and toddlers are happily content in front of one screen-device or another. Screen-time is thought to be a major distractor from social relationships in older children with ASD and there is no reason to think that this distraction would not start from the time of first exposure of infant to screen-time (Engelhardt & Mazurek, 2014).

### **3. Loss of Mutual Imitation**

How do infants and babies form social relationships with the people around them? This has been well studied and one thing they do is imitate each other. Mutual imitation shows mutual attention and is a critical part of human social interactions. Mutual imitation also seems to be part of how we learn understand the intentions of others (Iacoboni, 2008). Starting from the earliest age, the child and caregiver enjoy the pleasure of reciprocal imitation in vocalization, facial expressions, and eye contact (Meltzoff, 1999). Clearly there is no mutual imitation possible with a screen device. Whatever is going on the screen is independent of whatever the infant is doing or feeling.

Screen-time cannot offer social interaction. A baby and infant can make all kinds of cute baby sounds and faces that will melt your heart and the screen device does not care and cannot react reciprocally. Learning social interaction requires social interaction. Screen devices are social dead ends for infants and babies.

### **4. Infants will imitate the people around him who are focused on screen devices**

In today's world as an infant looks around at people and follows their eyes to see where they are looking, there is a good chance those eyes will lead back to a screen device. Most children with ASD are entranced by screen devices. If there is another child in the household already impacted by ASD, then the chances of this happening becomes almost a certainty. In today's world the infant who imitates the people around him may end up spending his time looking at a screen device.

These mechanisms of actions show some of the ways screen-time might alter normal social development in susceptible babies and infants. They are not only plausible but likely operative and work together contributing to the origins of ASD in infants.

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As screen-time becomes more and more a normal part of infant life and occupies more and more hours of their time awake might more and more children fail to learn how to interact with the people around them and end up on the ASD spectrum? This is the core question we wish to research.

### **The published research on the linkage between Screen-time and ASD**

Are there studies in the literature that investigate the connection between screen-time and ASD? There are a few but they have been overlooked by the research community and at times scorned by the public. Let us look at them briefly.

In 2006 Dr. Waldman published - "Does Television Cause Autism?" (M Waldman, 2006). The study looked back at the time when cable television was first introduced to various counties in Pennsylvania, California, Washington, and Oregon the late 1970's and early 1980's. These are states that have kept track of the number of children with ASD for many years. The introduction of cable TV was followed by a 17% increase in the number of cases of ASD. In those areas where rainy days kept children inside more, the introduction of cable TV had an even greater impact on the number of children with ASD. This study was subject to national exposure which was followed by scorn.

In 2011 Dr. Chonchaiya (W Chonchaiya, 2011) published a study looking retrospectively comparing groups of 50 children with and without ASD. She found that those children who developed ASD had started watching television six months earlier at six months of age and by the age of 12 months were watching twice as much television a day as the children without ASD.

Of late, Dr. Waldman has shared with me another study he is doing that is soon to be published. The FCC first allowed children's television on cable in 1979. This study compares the rates of ASD in areas where Nickelodean was first introduced as part of 'Basic' cable service to areas where it was part of a 'Premium' package at extra cost. There was a sharp increase in the number of cases of ASD a few years after the introduction of Nick on cable TV. The increase was nearly double in the areas where Nick was a basic service compared to areas where the cost was extra.

Since the 1980's the number of children with ASD has exploded and so has the exposure to screen-time. To children's television we must now add video, DVR, computer, car VCR, tablets, and smart-phones. The amount of time infants spend in front of these striking images and sounds is usually one to two hours a day and many times much more (Mary Courage, 2010). If you subtract the 16 hours a day for infant's sleeping and two more hours for feeding and changing, images coming from screen devices are absorbing much of infants' time awake.

The sad fact is that these few studies are all the studies we can find looking at the question on what is the impact of screen-time on ASD in the first and second year of life.

There are no prospective randomize studies and one is needed badly. Let us suppose for a minute that one was done and screen-time was indeed found to impede social development, what might the impact of this finding be?

### **The impact if the linkage between ASD and screen-time could be demonstrated.**

It would open the door to simple measures to prevent ASD. Shielding infants from screen-time could be like the SIDS story where a simple change in sleeping position lowered the numbers of children dying from this condition by 50% almost overnight.

It would encourage further research to understand the mechanisms of how screen-time might alter neuro-social development perhaps even through epigenetic mechanisms.

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It would encourage further research on the role of face-to-face time in the social development in very young children.

### **Conclusion**

The fundamental question we need to answer is what should be the place of screen-time in the lives of our children. AAP has taken a bold and clear stance. The AAP recommends no screen-time until the child is two years old and no more than two hours a day after that (American Academy of Pediatrics, 2011).

Our proposed area of study addresses a question for our times. What role should screen-time as opposed to face-to-face time play in our lives and the lives of our very young children?

As we slide further into 21<sup>st</sup> century, what is in store if screen-time disrupts our ability to communicate with each other face-to-face?

We believe this question is being answered today by infants and children under two who for one reason or another are most susceptible to ASD.

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### About the Author and SSAS-C

I am a practicing physician trained at the UCSF medical school, an uncle of three nephews with ASD, the author of "The Pied Pipers of Autism" a book published two years ago about the connection between ASD and screen-time, and the President of the Society for the Study of ASD and Social-Communication (otherwise known as SSAS-C). Our web site is found at <http://www.ssas-c.com>. It is an organization dedicated to the better understanding of social-communication in very young children and its connection to ASD and screen-time.