

Internet-based versus face-to-face intervention training for parents of young children with excessive screen-time and autism spectrum disorder-like symptoms: a comparative study

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Internet-based intervention approach is one novel strategy to train. However, only a few clinical trials have compared internet-based parent training intervention with an equal face-to-face intervention for children with autism spectrum disorder (ASD)-like symptoms. The primary aim of this study was to compare treatment outcomes of an internet-based intervention with a face-to-face intervention for young children with excessive screen-time and ASD-like symptoms. A total of 40 mother–young children with excessive screen-time and ASD-like symptoms dyads were assigned to the Internet-based ($n = 20$) and to the face-to-face intervention ($n = 20$). Parents in both groups received intervention that involves 7 sessions (one session per week). Primary outcome measures were the Gilliam autism rating scale - second edition (GARS-2), repetitive behavior scale- revised (RBS-R) and parenting stress index (PSI). The analysis yielded no significant between-group difference for any of the pre- to post-intervention measurements. At post-intervention both intervention conditions revealed significant symptoms changes compared to before the intervention. Also, the parental stress was significant related to the child's autism symptoms and repetitive behaviors severity. Internet-based parent training intervention for young children with excessive screen-time and ASD-like symptoms and their parents is equally beneficial to regular face-to-face parent training intervention. These findings support the potential for using telehealth to provide research-based parent training interventions to any family that has access to the Internet.

Keywords: internet-based parent training; ASD-like symptoms; excessive screen-time

Introduction

Exposure of young children to digital devices (smartphones, tablets, televisions, etc.) has increased in recent years (Chang *et al.* 2018, Kabali *et al.* 2015). Many of research has shown that early excessive screen time is associated with autism spectrum disorder (ASD)-like symptoms (Chen *et al.* 2020, Dieu-Osika *et al.* 2020, Hill *et al.* 2020).

Waldman *et al.* (2006) show that early childhood television viewing probably could be an environmental risk factor for the onset of ASD symptoms. However, this conclusion is speculative and requires investigation in future research. Heffler and Oestreicher (2016)

proposed a model that seeks to explain how digital devices can cause autism spectrum disorder. In this model, excessive screen time in young children as an inappropriate environmental experience during critical periods of brain development and neuroplasticity leads to the specialization of brain non-social pathways and leads to the development of autism disorder. Hermawati *et al.* (2018) demonstrated the relationship between early electronic screen exposure and autistic-like behaviors (e.g. language delay, short attention span and hyperactivity) in children. Yurika *et al.* (2018) found that excessive screen time in children was associated with autistic symptoms (i.e. ocular problems, hyperactivity and language delay). A recent review of the literature on this area found that screen media itself is the causal factor for ASD (Slobodin *et al.* 2019). In a

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recent study, Heffler *et al.* (2020) investigated association of early-life social and digital media experiences with development of autism spectrum disorder-like symptoms and found that television and/or video exposure and less caregiver-child interactive play at 12 months of age were each significantly associated with greater ASD-like symptoms, but not with the risk of ASD. Chen *et al.* (2020) reported that longer daily screen time and longer cumulative years of screen exposure since birth were associated with the presence of autistic-like behaviors at preschool age.

In some cases, digital devices replaced by child's active relationship with environment and children are exposed to permanent digital devices (Chen *et al.* 2020, Dieu-Osika *et al.* 2020, Hill *et al.* 2020). In this lifestyle that called 'Digital Nanning', children lose the opportunity to interact with their mothers or caregivers and do not get rich environment that are necessary for normal development of the nervous system (Pouretmad *et al.* 2016). Digital Nanning referred to the conditions that young children had been exposed to digital devices for more than half their waking hours (Sadeghi *et al.* 2019a).

Throughout our previous paper we use 'Post Digital Nanning Autism Syndrome (PDNAS)' refer to condition where after young children excessive exposure to digital devices (for more than half their waking hours), develop subclinical autism symptoms that we hypothesized this is a new subtype of autistic spectrum disorder that caused by children lifestyle and excessive screen-time (Sadeghi *et al.* 2019c). In this case, it is assumed that young children autism symptoms caused by early excessive exposure to digital devices. Children with PDNAS have difficulties in eye contact and communication skills and also, they have restricted and repetitive behaviors or interests. At the moment, because of the similarity of PDNAS and formal autism, make differential diagnosis is impossible. Now this is just a possible hypothesis and should not be exaggerated. Further experimental investigations are needed to answer the question of whether early excessive screen time causes autism. Similarly, Zamfir (2018) suggested that early media exposure represents a different type of autism, called 'virtual autism'.

Despite the value of screens, it has now been suggested that excessive engagement with screen media may lead to deprivation and social isolation (Bickham and Rich 2006, Ray and Jat 2010, Stiglic and Viner 2019, Taheri 2013). There is evidence that the restricted environments and experiences and early social isolation can cause autism symptoms and repetitive behaviors. For example, Rutter *et al.* (1999, 2007) reported that children who grew up in institutions are at increased risk for 'quasi-autistic' patterns of behavior (Rutter *et al.* 1999, Rutter *et al.* 2007). In other study, Hoksbergen *et al.* (2005) suggested a similar disorder

that described as post-institutional autistic syndrome (PIAS) in 16 percent of previously institutionalized infants. Although children with PIAS and quasi-autism have overlapping symptoms, including social communication difficulties and repetitive behaviors with ASD, these researchers described several features that distinguish between children with PIAS and quasi-autism, which are different from those commonly found in 'ordinary' ASD. For instance, equal female: male ratio (1: 4 female to male ratio compared to formal autism) and the general tendency to reduce the severity of autism symptoms over time (Levin *et al.* 2015).

As mentioned above, much work on the early excessive screen time consequences has been carried out. Some studies have also been done to reduce the use of digital devices by children. For example, Özyurt *et al.* (2018) used the Positive Parenting Program (Triple P) intervention and Adams *et al.* (2018) used the responsive parenting intervention to show that parent training is effective method for reduce the duration of children's screen time and television exposure. In another study, Pearson *et al.* (2020) conducted a 12-week, home- and school-based pilot randomized controlled trial to reduce children's screen time and unhealthy snacking. This study finding showed reductions in children's screen-time after the intervention. Also, in recent studies, researchers demonstrated that early parent-child interaction is associate with normalized patterns of brain activity (EEG absolute, relative and ratio power), which were associated with reducing the duration of screen-time, improvements in executive functioning problems, autism symptoms and repetitive behaviors of young children with autism symptoms and excessive screen time (Sadeghi *et al.* 2019a, 2019b, 2019c). It is suggested that parents can be considered the initial experts on their children, spending more time with them than almost any other adult the child encounters in their day-to-day lifetime (Bordelon and Bradley 2019). Although, it is important to note that parents of children with autism spectrum disorder symptoms themselves may need to interventions because of the high stress they experience (Anyanwu *et al.* 2019, Davis and Carter 2008, Gong *et al.* 2015, McStay *et al.* 2014, Pottie *et al.* 2009, Soltanifar *et al.* 2015) and involving these parents in interventions for their children can reduce their stress and enhance their mental health (Catalano *et al.* 2018, Estes *et al.* 2014).

As described earlier, previous studies have revealed that parent training is the most effective approach to the reduce children's screen-time and make communicative lifestyle (Adams *et al.* 2018, Özyurt *et al.* 2018, Sadeghi *et al.* 2019a, 2019b, 2019c), only a small proportion of families benefit from evidence-based interventions (Jensen *et al.* 2011). The families problems to receiving face-to-face parent training include the difficulties of attending in intervention in terms of costs,

time, and location and the lack of trained staff that can provide treatments (Kazdin and Blase 2011, Kazdin and Rabbitt 2013). It is likely that internet-based interventions can help increase the availability and acceptance of evidence-based interventions, and provide the opportunity to conduct effective interventions over long distances (Khan et al. 2019). So, a possible alternative way for training parents of children with special needs at home or in a clinic is the training and coaching of parents at a distance, via Internet-based methods (Meadan and Daczewitz 2015). The application of internet-based technologies to provide evidence-based treatment across a range of cases is growing at a rapid pace, with services increasingly moving from clinics to the home (Bearss et al. 2018).

Internet-based parent training interventions have a lot of benefits over traditional interventions, such as overcoming geographical barriers for parents to receive psychoeducation, higher fidelity, greater accessibility, convenience, and reduced time and costs (Aqdassi et al. 2019, Aqdassi et al. 2021, Barak and Grohol 2011, Breitenstein et al. 2014, Hammond et al. 2012, Khanna et al. 2007, Ristkari et al. 2019). Internet-based interventions have already been used to treatment autism spectrum disorder symptoms and its effectiveness has been demonstrated (Ashburner et al. 2016, Baharav and Reiser 2010, Boisvert et al. 2010, Gibson et al. 2010, Hamad et al. 2010, Lindgren et al. 2016, Shire et al. 2020, Speyer et al. 2018, Sutherland et al. 2018, Vismara et al. 2013). For example, Pennefather et al. (2018) reported that after a three-week online training program for sixteen parents of children with autism, parents reported: decreased parental stress, increased relevant knowledge, increase in the child's prosocial behavior, decrease in hyperactive behaviors and high levels of satisfaction with the intervention. Also, Bearss et al. (2018) conducted a feasibility trial of parent training via telehealth with children aged 3-8 with autism and disturbing behavior for 30 families. These researchers revealed that parent training through telehealth was acceptable to parents and that therapists could reliably deliver treatment. Results of Sutherland et al. (2018) systematic review study suggested that for children with autism, services delivered through telehealth were equivalent to services provided face-to-face. In a recent randomized control trial study, Marino et al. (2020) reported that significant improvements were obtained in parental management of children's behavior through the utilize a 12 sessions of an applied behavioral analysis (ABA) tele-assisted intervention. Shire et al. (2020) compared a face-to-face and remote support for interventionists learning to deliver a social communication intervention. Their study showed that there was no significant difference between the results of the face-to-face and remote support intervention methods and both interventions improved initiations of joint attention,

requests, and play diversity in children with ASD. Sutherland et al. (2019) investigated the reliability and utility of telehealth language assessments for school-aged children with ASD. The results of this research provide preliminary evidence the use of telehealth evaluations of school-aged children with ASD. Also in another study, Speyer et al. (2018) in a systematic review study compared telehealth intervention with standard face-to-face interventions in 43 relevant studies. They study did not show significant differences between the efficacy of telehealth by allied health professionals and nurses in rural and remote areas and standard face-to-face interventions.

The aim of this study is to compare treatment outcomes of an internet-based intervention with a face-to-face intervention for young children with excessive screen-time and ASD-like symptoms.

Materials and method

Participants

This was an experimental design. Among young children that were referred to the Tehran Autism Center from September 2018 to April 2020, 40 young children with subthreshold autism symptoms who had not received an autism diagnosis, and had been exposed to digital devices for more than half their waking hours, together with their parents, were selected as sample groups. Parents self-reported their children's screen-time duration in intake interview. All subjects evaluated by an ASD specialist with a Ph.D. in clinical psychology and at least one assistant (with at least a master's degree in clinical psychology). Diagnosis was made on the basis of informed clinical judgment following interaction with the child, formal testing, and review of parent reports and records. The Gilliam autism rating scale-second edition (GARS-2) (Gilliam 2006) was also administered to parents of the subjects. Children whose severity and frequency of ASD symptoms were below the threshold of clinical diagnosis were selected as the sample group. Inclusion criteria included no neurological problems in the child, no severe sensory problems in the child and parent (blindness and deafness) and parents' familiarity with Skype software and video conferencing. Exclusion criteria included the absence of parents in intervention sessions and if the child was receiving drugs or other interventions simultaneously with the present study. We didn't choose a waiting list group for ethical considerations. For example, because of the critical ages of children, parents did not consent to their children assignment to a waiting list group for two months.

Measures

Lifestyle checklist

To assess a child's lifestyle, we have compiled a checklist that parents had to record at home every 5 min what

their child is doing. In this method, we measured the child's sleep, waking time, screen time, and interactions. Parents complete this checklist two days (one day a week and one day a weekend). Based on the results of this instrument, children with subthreshold autism symptoms who had been exposed to digital devices for more than half their waking hours are identified as children with excessive screen-time and ASD-like symptoms. We calculated the average hours of child's screen time. For more details, see our previous study (Sadeghi et al. 2019a, 2019b, 2019c).

Repetitive behavior scale-revised (RBS-R)

RBS-R (Bodfish et al. 2000) is a 43-item informant-based rating scale intended to assess 6 dimensions of repetitive behavior (Stereotyped Behavior, Self-Injurious Behavior, Compulsive Behavior, Ritualistic Behavior, Sameness Behavior, and Restricted Behavior). The sum of the ratings for all the items in a subscale gives the 'Overall Score'. Lam and Aman (2007) reported internal consistency of subscale from 0.78 to 0.91 and construct validity for subscale from 0.68 to 0.98. The mentioned descriptions were mostly reproduced from our previous study using similar instrument (Sadeghi et al. 2019a). RRBs is one of the core symptoms of ASD and include a heterogeneous set of behaviors such as intense preoccupations, stereotyped movements, and resistance to change (American Psychiatric Association 2013, Boyd et al. 2012). RBS-R has already been translated into Persian and its validity and reliability have been reported (Khamoushi and Mirmahdi 2015, Rezayi and Lari Lavasani 2017).

Gilliam autism rating scale-second edition (GARS-2)

GARS-2 (Gilliam 1995) used for assess severity of autism before and after the parent training intervention. GARS-2 is a 42-items, 4-point Likert scale that collects information on three areas of communication, stereotyped behaviors and social interaction. Its internal reliability ranges from 0.88 to 0.93. The scale has high criterion validity with other tools, such as, the Autism Behavior Checklist (0.94) (Healy et al. 2008). Samadi and McConkey (2014) indicated that the GARS is a valid and reliable instrument for assessing the severity of autism among Iranian children. Other studies have also shown the reliability of this scale in measuring the severity of autism symptoms in Iranian children (Aqdassi et al. 2019, Pouretamad et al. 2016, Sadeghi et al. 2017).

Parenting stress index-short form (PSI-SF)

PSI-SF (Abidin 1995) is a 36-item self-reporting scale that assess perceived stress related to parenting role. PSI is a widely used tool for measuring parental stress in parents of children with ASD (Hayes and Watson

2013). The PSI-SF consists of three 12-item subscales, which include the Parental Distress (PD), Parent-Child Dysfunctional Interaction (PCDI) and Difficult Child (DC) subscales, as well as a Total Stress scale. Previous studies demonstrated that all three subscales and the total stress scale have a good internal consistency, test-retest reliability, and validity (Haskett et al. 2006, Whiteside-Mansell et al. 2007). This instrument has been cultural adapted from English to Persian and validated for the Iranian people (Fadaei et al. 2011) and in previous study, its reliability has been well reported (Sadeghi et al. 2020).

Intervention

All parents trained to minimize their child's screen time and to have interactions with children.

They received the parent training intervention (Emotional Diet Intervention) developed by Pouretamad (2010). Our intervention consists of 7 parent training sessions (one session per week, 90 min per group session and 30 min per individually session). We assess the follow-up to the recommendations by parents through their self-report in individual sessions. Sadeghi (2019) evaluated the social validity of this intervention and reported that this program has good social validity. Session topics are described in Table 1. Parents in both groups received intervention in the same treatment modules, chronological order and time-frame.

Procedures

Forty children with excessive screen-time and ASD-like symptoms aged 18–48 months and their parents that referred to Tehran Autism Center (Tehran, Iran) were recruit for this study. After receive written consent from the parents, who were residents of Tehran allocated in the face-to-face group and parents who were away from Tehran were placed in the Internet-based group.

In this study, parents were train to do proactive interactions and use some of the antecedent-based environmental modifications to remove any time slot for the incidence of non-communicative behaviors and digital device use. The therapist was an Iranian Ph.D. degree child clinical psychologist who was in Tehran. The face-to-face parent training was conducted on Tehran Autism Center and for internet-based parent training was conduct on Skype software video call for five groups of parents (each group included the parents of 4 children). Parents only attended in both online and face-to-face sessions without their children. Before and after the intervention (pre-test and post-test), the therapist sent the online link of questionnaires to the parents on both groups. Parent attendance to the face-to-face sessions or completion of the online sessions was recorded weekly. Figure 1 shows the flowchart of the procedure of the study.

Table 1. Parent training sessions summary.

Objective	Session	Method	Activities examples
Program goals and check-in	One	Group	<ul style="list-style-type: none"> • Introducing group members • Talk about excessive screen time • Discuss the nature of this intervention • Teaching parents to observe and record children’s daily life activities and routines • Review the Videotape an episode of mother - child interaction • Help parent develop a profile of their child’s symptoms and communication skills
Joining parents and their child to develop an emotional bond between them (first level)	Two	Group	<ul style="list-style-type: none"> • Training parents to minimize digital devices use and managing it (i.e. removing the TV from the child’s bedroom, not using digital devices by the parents while being with the child, do not feed the child while watching TV, etc.) • Help parents manage child’s routines (i.e. sleeping, feeding, etc.) • Training parents in simple activities or plays for develop a relationship with the child (e.g. physical play, emotional activities, and sensory paly) • Help parents find shared activity
	Three	Individually	<ul style="list-style-type: none"> • Training parents to increase children’s eye contact • Review the videotape of previous session activities to identify problems and discuss about issues. • Discuss about parents’ common problems in last week
Parent–child interaction (second level)	Four	Group	<ul style="list-style-type: none"> • Training techniques for parents to enhance communication with children while playing with toys • Training parents to develop a special play time routine • Training parents to prevent (not confront) repetitive and non-communicative activities
	Five	Individually	<ul style="list-style-type: none"> • Review the videotape of previous session activities to identify problems and discuss about these. • Discuss about parents’ common issues in last week
Bilateral interactions between parent and child (third level)	Six	Group	<ul style="list-style-type: none"> • Training parents to establish shared control over the activities during play with child • Training parents to take turns in the communicative activities with the child • Training parents to help children to enhance their imitation skills and imitate parents’ activities while playing
	Seven	Individually	<ul style="list-style-type: none"> • Review the videotape of previous session activities to identify problems and discuss about these. • Discuss about parents’ common issues in last week

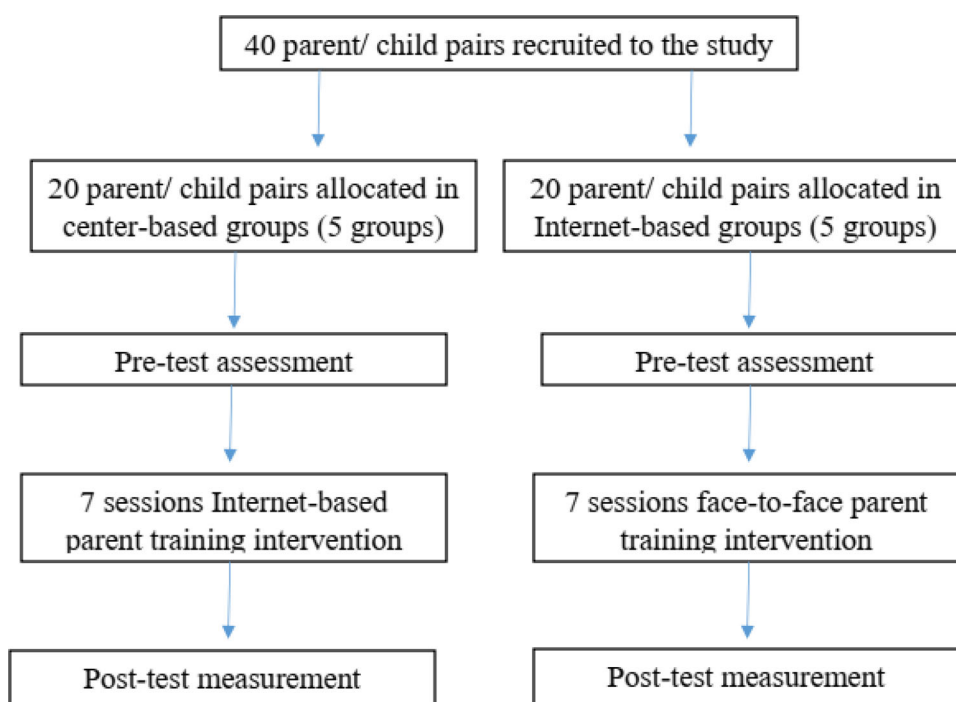


Figure 1. Flowchart of the procedure of the study.

All procedures were approved by the Shahid Beheshti University ethical committee. This study is registered with the Iranian Registry of Clinical Trials, registration number IRCT20161210031330N3.

Statistical analysis

Independent t-test was conducted to test for differences in subjects' baseline characteristics. A multivariate generalized linear model (GLM) used to compare outcome measures between internet-based intervention and face-to-face intervention groups. Also, dependent t-test used to compare within groups effects. For improved interpretation and comparison, we calculated *Cohen's d* and *Eta* effect sizes. The data were analyzed using SPSS₂₂ software (Corp 2013).

Results

In this study, 40 mother–children with excessive screen-time and ASD-like symptoms dyads participated. Participant demographics information is presented in Tables 2 and 3.

As shown in the table above, no significant differences were found between the children and parent's age in internet-based and face-to-face intervention groups ($p < 0.05$).

Baseline characteristics of the two groups included in this research are shown in Table 4. No significant differences were found between the Internet-based and face-to-face intervention groups at baseline ($p < 0.05$).

Table 2. Description of study sample (age).

Variable	Group	<i>M</i>	<i>SD</i>	<i>MD</i>	<i>t</i>	<i>P</i>
Age of children	Month	31.90	7.90	1.45	0.66	0.53
	IBG	30.45	5.83			
Age of mothers	Year	32.40	2.91	0.95	0.783	0.439
	IBG	31.45	3.58			
Age of fathers	Year	34.90	3.24	0.50	0.402	0.690
	IBG	34.40	4.52			

F-t-F, face-to-face group; IBG, Internet-based group; M, Mean; SD, standard deviation; MD, mean differences.

Table 3. Sociodemographic characterization of the study sample.

Variable		Online group		Face-to-face group		
		Frequency	Percent	Frequency	Percent	
Number of children in the family	One child	13	65	16	90	
	Two children	7	35	3	15	
	Three children	0	0	1	5	
Education	High School	Father	2	10	5	25
		Mother	2	10	5	25
	Undergraduate	Father	10	50	8	40
		Mother	14	70	9	45
	Master	Father	5	25	7	35
		Mother	3	15	5	25
Doctoral	Father	3	15	0	0	
	Mother	1	5	1	5	
Economically active	Do not Work	Father	0	0	1	5
		Mother	17	85	15	75
	Work	Father	20	100	19	95
		Mother	3	15	5	25
	Retired	Father	0	0	0	0
		Mother	0	0	0	0

In the analyses presented in Table 5, results show statistically significant change in both groups from the beginning of treatment to the end of treatment. Intervention was effective for decreasing autism symptoms ($p < 0.0001$), repetitive behaviors ($p < 0.001$), and parenting stress ($p < 0.05$) in internet-based group. Also, intervention was effective for decreasing autism symptoms ($p < 0.0001$), repetitive behaviors ($p < 0.0001$), and parenting stress ($p < 0.0001$) in face-to-face group. Effect sizes in the Internet-based group and the face-to-face group can be considered large for autism and repetitive behaviors and medium for parenting stress (Cohen 2013).

Between groups analyses for compare the effects of intervention between two groups, shown in Table 6, do not reveal a significant between groups difference ($p < 0.05$).

In overall, both internet-based and face-to-face participants showed reductions in autism symptoms, repetitive behaviors and parenting stress, with no significant differences by treatment modality.

In addition, to investigate the relationship between the severity of the children's autism symptoms (Figure 2), repetitive behaviors (Figure 3) and their parents' reports of stress, Pearson's correlations were carried out between the parenting stress total score, children's repetitive behaviors total score and autism symptoms total score measures in the all participants. The parenting stress showed a statistically significant correlation with children's autism symptoms ($r = 0.53$, $p < 0.0001$). Furthermore, the parenting stress showed a statistically significant correlation with the severity of children's repetitive behaviors ($r = 0.61$, $p < 0.0001$).

Discussion

The aim of this study was to test an internet-based parent training intervention against a comparable, traditional face-to-face parent training intervention for children with excessive screen-time and ASD-like behaviors. To our knowledge this is the first study for children with excessive screen-time and ASD-like

Table 4. Baseline characteristics of the face-to-face (n = 20) and internet-based (n = 20) groups.

Variable		Group	<i>M</i>	<i>SD</i>	<i>MD</i>	<i>T</i>	<i>P</i>
Autism symptoms (GARS)	Stereotyped behaviors	F-t-F	39.15	5.88	3.48	1.95	0.06
		IBG	35.67	5.54			
	Communication	F-t-F	42.35	5.85	-0.94	-0.42	0.67
		IBG	43.29	8.06			
	Social interaction	F-t-F	38.60	6.34	-0.21	-0.11	0.92
		IBG	38.91	6.31			
Autism Index (total score)	F-t-F	120.10	14.60	2.34	0.49	0.62	
	IBG	117.76	15.59				
Repetitive behaviors	Stereotyped behaviors	F-t-F	11.10	2.73	0.29	0.33	0.74
		IBG	10.81	2.86			
	Self-injurious behaviors	F-t-F	9.65	2.21	0.55	0.95	0.35
		IBG	9.01	1.48			
	Ritualistic behaviors	F-t-F	10.75	3.17	0.80	0.89	0.38
		IBG	9.52	2.54			
	Sameness behaviors	F-t-F	9.10	3.24	-0.38	-0.38	0.70
		IBG	9.48	3.03			
	Restricted behaviors	F-t-F	17.10	4.83	1	0.74	0.47
		IBG	16.10	3.87			
	Compulsive behaviors	F-t-F	8.15	3.25	1.29	1.40	0.17
		IBG	6.86	2.65			
Total score	F-t-F	65.85	13.77	3.56	0.87	0.39	
	IBG	62.29	12.39				
Parenting Stress Index	Parental distress	F-t-F	34.45	9.26	-1.35	-0.53	0.60
		IBG	33.40	7			
	Parent-child dysfunctional interaction	F-t-F	33.50	7.59	-0.50	-0.24	0.81
		IBG	33.25	5.85			
	Difficult child	F-t-F	33.65	9.30	0.54	0.20	0.84
		IBG	34	8.06			
	Total parenting stress score	F-t-F	101.60	20.06	-1.31	-0.23	0.82
		IBG	100.65	16.50			

Abbreviations: F-t-F: face-to-face group, IBG: Internet-based group, M: mean, SD: standard deviation, MD: mean differences.

behaviors comparing both intervention forms with equivalent treatment modules and treatment length. This study provides support for the effectiveness of delivering parent training from a distance and in person. The present study suggests that internet-based parent training intervention was as effective as face-to-face intervention in improving symptoms in the children with excessive screen-time and ASD-like symptoms and parenting stress.

The main finding of this study is that the Internet-based parent training intervention is indeed as effective as face-to-face parent training intervention for children with excessive screen-time and ASD-like symptoms. This is in line with previous studies comparing face-to-face interventions with internet-based interventions for children with autism spectrum disorder (Ashburner *et al.* 2016, Baharav and Reiser 2010, Boisvert *et al.* 2010, Gibson *et al.* 2010, Hamad *et al.* 2010, Lindgren *et al.* 2016, Shire *et al.* 2020, Sutherland *et al.* 2018, Vismara *et al.* 2013). The within group effect size in the Internet-based group ranged from $d=0.32$ to $d=0.86$ and in the face-to-face group ranged from $d=0.38$ to $d=1.09$ for autism symptoms, repetitive behaviors and parental stress. For stereotyped behaviors, communication and social interaction, the effect size was larger in the face-to-face group than in the Internet-based group. While, for ritualistic behaviors, sameness behaviors and parent-child dysfunctional interaction, the effect size was larger in the Internet-

based group than in the face-to-face group. The results of our study add to the growing empirical evidence for the efficacy of telepractice service-delivery models. It seems that by providing services to families over the Internet, many of the challenges and barriers to face-to-face service delivery (e.g. the traveling expenses, the cost of service delivery, the amount of travel time required of the provider and complications with scheduling center visits) may be reduced.

A possible explanation for the parent training effects on children's autism symptoms, repetitive behaviors and parent's stress is that this intervention can increase the number of intervention hours a child receives and improve child outcomes. In other words, parents can be considered the initial experts on their children and online parent training same face to face parent training makes it possible for the child to receive intervention from parents. Indeed, both internet-based and face-to-face parent training is an interactive intervention that educate parents to have an intensive interaction with their child and promote they social-communication skills during play and daily routines. Also, one of the most effective strategies to treat autism symptoms such as repetitive behaviors at an early age is antecedent-based approaches (Boyd *et al.* 2012). In this study, parents were train to do proactive interactions and use some of the antecedent-based environmental modifications to remove any time slot for the incidence of non-communicative behaviors and digital device use; as a

Table 5. Intervention effect on outcome measures per intervention condition (within subject).

Variable	Time	Internet-based intervention group					face-to-face intervention group				
		<u>M</u>	<u>SD</u>	<i>t</i>	<i>Sig</i>	<u>d</u>	<u>M</u>	<u>SD</u>	<i>t</i>	<i>Sig</i>	<u>d</u>
Autism symptoms (GARS)	Pre-test	35.67	5.5	1.78	0.09	0.39	39.15	5.88	3.79	0.001	0.98
	Post-test	33.52	5.58				34.30	4.24			
Communication	Pre-test	43.29	8.057	3.25	0.004	0.70	42.35	5.85	3.11	0.006	0.80
	Post-test	38	6.92				37.55	6.19			
Social interaction	Pre-test	38.81	6.30	4.82	0.0001	0.86	38.60	6.34	4.17	0.001	1.05
	Post-test	33.14	6.83				32.95	4.19			
Autism Index (total score)	Pre-test	117.76	15.59	4.85	0.0001	0.81	120.10	14.60	4.52	0.0001	1.11
	Post-test	104.67	16.84				104.80	12.82			
Repetitive behaviors	Pre-test	10.81	2.86	5.25	0.0001	0.86	11.10	2.73	3.67	0.002	1.09
	Post-test	8.62	2.18				8.70	1.49			
Self-injurious behaviors	Pre-test	9.09	1.48	1.63	0.12	0.32	9.65	2.20	2.21	0.04	0.59
	Post-test	8.67	1.15				8.65	0.99			
Ritualistic behaviors	Pre-test	9.95	2.54	3.24	0.004	0.48	10.75	3.18	1.64	0.12	0.36
	Post-test	8.95	1.53				9.80	1.99			
Sameness behaviors	Pre-test	9.48	3.03	2.47	0.023	0.64	9.10	3.24	1.68	0.11	0.38
	Post-test	7.76	2.32				8.05	2.095			
Restricted behaviors	Pre-test	16.09	3.87	2.43	0.025	0.65	17.10	4.83	4.52	0.0001	0.91
	Post-test	13.81	3.04				13.70	2.10			
Compulsive behaviors	Pre-test	6.86	2.65	2	0.059	0.44	8.15	3.25	3.49	0.002	1.05
	Post-test	5.81	2.09				5.55	1.32			
Total score	Pre-test	62.29	12.39	3.88	0.001	0.76	65.85	13.77	4.51	0.0001	1.07
	Post-test	53.62	10.25				54.45	5.89			
Parenting Stress Index	Pre-test	33.40	7.04	1.42	0.17	0.34	34.45	9.26	1.90	0.07	0.38
	Post-test	30.25	10.99				31	8.66			
Parent-child dysfunctional interaction	Pre-test	33.25	5.88	3.11	0.006	0.71	33.50	7.59	3.42	0.003	0.45
	Post-test	28.85	6.49				29.95	7.35			
Difficult child	Pre-test	34	8.22	2.27	0.035	0.50	33.65	9.30	2.49	0.02	0.47
	Post-test	29.80	8.51				29.40	8.82			
Total parenting stress score	Pre-test	100.65	16.85	2.74	0.013	0.55	101.60	20.06	3.13	0.004	0.53
	Post-test	89.45	23.06				90.75	21.03			

Abbreviations: M: mean, SD: standard deviation, d: Cohen's d effect size, MD: mean differences.

Table 6. Tests of between-subjects' effects to compare two groups in outcome variables.

Variable		SS	F	Sig	η^2
Autism symptoms (GARS)	Stereotyped behaviors	1.062	0.055	0.817	0.002
	Communication	4.123	0.111	0.742	0.004
	Social interaction	0.522	0.020	0.889	0.001
	Autism Index (total score)	14.316	0.079	0.781	0.003
Repetitive behaviors	Stereotyped behaviors	0.103	0.037	0.849	0.001
	Self-injurious behaviors	0.032	0.036	0.852	0.001
	Ritualistic behaviors	0.222	0.127	0.724	0.005
	Sameness behaviors	0.129	0.032	0.860	0.001
	Restricted behaviors	5.957	0.958	0.337	0.037
	Compulsive behaviors	4.399	1.339	0.258	0.051
	Total score	10.299	0.180	0.675	0.007
	Parenting Stress Index	Parental distress	78.639	1.188	0.286
Parent-child dysfunctional interaction		0.566	0.017	0.898	0.001
Difficult child		4.496	0.087	0.770	0.003
Total parenting stress score		56.250	0.188	0.668	0.007

Abbreviations: SS: Sum of Squares, η^2 : Eta effect size.

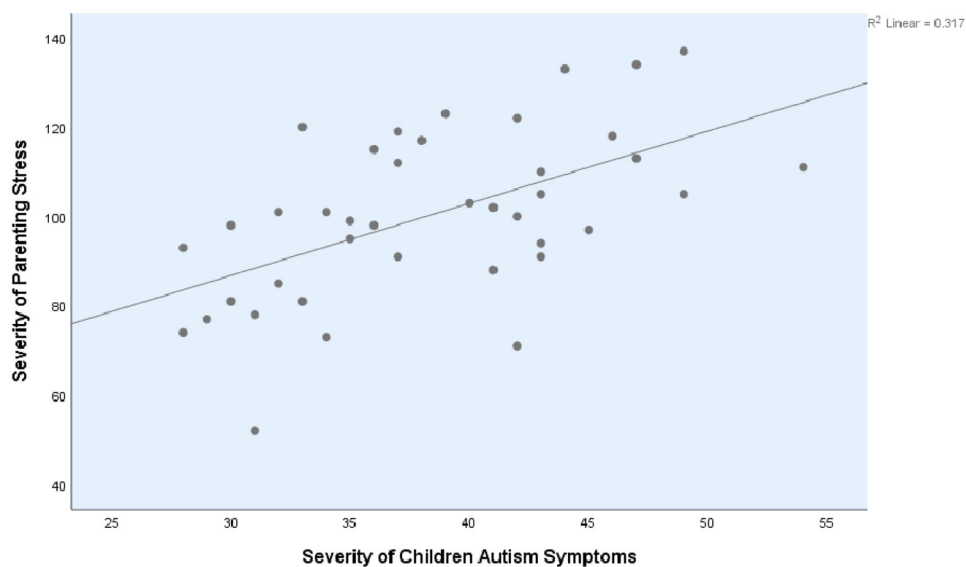


Figure 2. Parenting stress in relation to children's autism symptoms severity.

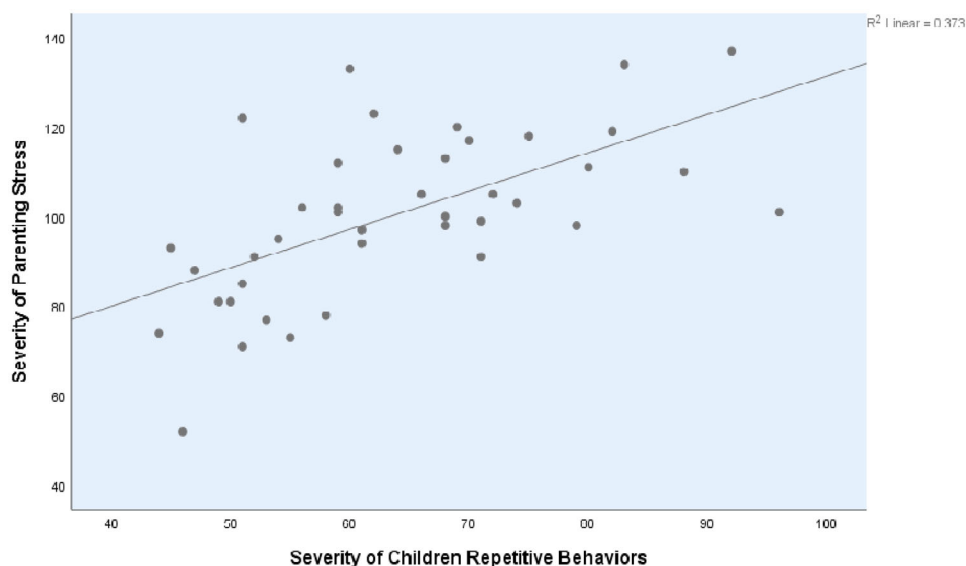


Figure 3. Parenting stress in relation to children's repetitive behaviors severity.

result, the child was less likely to engage in media use and autistic behaviors and interests. Similarly, Zamfir (2018) in a longitudinal study observed better therapeutic outcomes for children with ASD-like symptoms with a history of excessive screen time before the age of three (more than 4 h per-day) compared to children with ASD without a history of excessive screen time (Zamfir 2018).

Further, the parental stress showed a significant correlation with children's autism symptoms and repetitive behaviors. This finding is consistent with the prior literature (Davis and Carter 2008, Gong et al. 2015, McStay et al. 2014, Pottie et al. 2009, Soltanifar et al. 2015). This result suggests that parents who perceive the autism symptoms and repetitive behaviors of their children are more severe tend to perceive more stress. A possible explanation for this might be that the demands of managing a child's autism symptoms and repetitive behaviors may threaten a parent's coping resources, resulting in greater stress and concern. In other word, the severity of child's autism symptoms and problems leads to more parenting stress, which in turn interferes with appropriate parenting strategies and results in more child behavior problems. However, these explanations are speculations and require future studies and empirical foundation. In sum, we found that providing training to parents from a distance using internet-based technologies was an effective modality of service delivery for young children with ASD-like behaviors.

Limitation

Our study has a number of limitations, which need to be addressed. First, all measures administered as self-rated questionnaires in an online setting. Second, because we had not follow-up assessments, we cannot draw any conclusions about the long-term effects of the two interventions. Third, because of ethical considerations, we didn't choose a control group that these issues may have effects on our finding's validity. Forth, there is not a measure of children's screen-time duration in post-intervention. Fifth, the social validity has been previously evaluated in the face to face context, and that following studies should evaluate that aspect in internet base implementation.

Conclusion

This study gives preliminary results that a brief internet-based parent training intervention for children with excessive screen-time and ASD-like symptoms is as effective as comparable face-to-face parent training intervention. Internet-based intervention may be the solution for tackling children's autism symptoms, repetitive behaviors and parental stress in a more cost-effective way than traditional face-to-face interventions. It seems that internet-based interventions, has the potential to replace or augment traditional service models as

face-to-face interventions to increase access to well-documented interventions. These interventions can reduce the cost of referring to health centers and rehabilitation, saving time, increasing access remote areas, and provide health care and the ability to receive long-term services in the natural context of the living environment to provide affordable services for all those in need. However, further study is needed to replicate these results and possible differences in underlying mechanisms between internet-based and face-to-face interventions need to be evaluated.

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