Supervision of Early Intensive Behavioral Intervention Onsite or via Videoconference; Outcomes in a Randomized Controlled Trial Pilot

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Abstract

This study compared the outcome of Early Intensive Behavioral Intervention when supervision was given over videoconference for half of the meetings. This started after 3 months of intervention. The participating children were diagnosed with autism spectrum disorder and were randomly placed in either the videoconference group or in the onsite group. The dependent variables were autism severity, preferences for socially mediated stimuli and problematic behaviors. The independent variable was supervision onsite or by videoconference. The results showed no significant differences between the groups on any of the outcome measures. A limitation of this study was the small group sizes, which limits generalization of the results to other children and settings. Furthermore, the onsite group received some supervision sessions via videoconference due to the COVID-19 pandemic. Nevertheless, our tentative conclusion is that supervision via videoconference has the potential to replace onsite supervision at least partially, but that larger scale research in a variety of settings is needed.

Keywords:

Autism, Early Intensive Behavioral Intervention, supervision, videoconference

Introduction

Autism Spectrum Disorder (ASD) is marked by challenges in communication, social interaction, repetitive behaviors, and narrow interests. Worldwide, it is estimated that over 1% of children receive an ASD diagnosis (Zeidan et al., 2022; Talantseva et al., 2023). The severity of ASD varies and includes a spectrum of intellectual and adaptive functioning levels, with some individuals living independent lives while others require lifelong care.

Early Intensive Behavior Intervention (EIBI) is an empirically supported provision for children with ASD. Numerous systematic reviews have demonstrated significantly more positive outcomes with EIBI compared to control and comparison groups (Makrygianni et al., 2018; Rodgers et al., 2021, According to Green et al. (2002) service models differ, but there are several elements that are in common. (a) The treatment is broad, which means it includes all development

areas and goals are individualized; (b) to reduce disruptive behaviors and shape a functional repertoire, many different behavior analytic procedures are used, such as discrete-trial training, prompting and differential reinforcement; (c) individuals in charge of the treatment have advanced training in behavior analysis and experience working with children diagnosed with ASD; (d) intervention manuals and normal development guides the intervention; (e) the parents are actively engaged in the treatment; (f) the treatment starts in a one-to one format and gradually shifts to a group or classroom format; (g) the treatment is conducted in the child's home in the beginning phase, and later be generalized to other settings (supervisors) the program is comprehensive, usually at least 20 hours of structured teaching every week as well as instructions and practice in unstructured daily settings; (i) the treatment, in most cases, lasts for two years or more; and (j) the children will start with the treatment in preschool age.

In Norway, EIBI is most often provided in the child's local mainstream preschool. Either specialist health services such as the Habilitation Services or the local educational authorities are responsible for oversight and training to the preschool personnel involved in EIBI programs. However, not every municipality or special health service are able to offer such supervision and training (Eldevik et al., 2020). One of the reasons is the lack of EIBI-trained professionals along with the increase in the prevalence of ASD (Baio et al., 2018)

This raises concerns regarding the scalability of EIBI. Often a significant portion of the supervisors time, is spent on travel (Hay-Hanson et al., 2023). Considering these challenges, it is important to explore alternative ways of supervising EIBI programs, such as videoconference. Several studies report successfully using telehealth for training personnel and parents to implement a wide range of behavior analytic procedures such as functional analyses (Benson et al., 2017; Machalicek, et al., 2009; Machalicek, et al., 2010; Wacker et al., 2013), functional communication training (Simacek et al., 2017; Suess et al., 2016), preference assessments (Higgins et al., 2017; Machalicek, et al., 2009); and procedures often embedded in EIBI such as discrete trail teaching (Barkaia et al., 2017; Subramaniam et al., 2016). Hay-Hansson et al., (2013) compared a videoconference group and an onsite group when teaching staff to do discrete trial training (DTT), They included staff from one preschool and one special school. The participants worked with six children, between 5 and 14 og age. Four of the children had an ASD diagnosis and the other two were diagnosed with moderate developmental disability. The participants were randomly placed in two different groups, one group received training by videoconference and the other group received onsite training. Both groups received the same type of

training in DTT with three different programs (matching to sample, receptive- and expressive labeling). The results showed no significant differences between the groups following training. Craig et al. (2021) used telehealth when training paraprofessionals, (e.g., preschool teachers) to teach functional living skills to autistic children.

The increasing number of children diagnosed with ASD and the scarcity of professionals trained in EIBI pose a significant challenge. Moreover, travel time further aggravates this challenge. The adoption of videoconferencing may to some degree mitigate these issues. This study aims to assess the impact of replacing some of the onsite supervision with videoconference-based supervision on EIBI outcomes.

Method

Participants

The participants were 13 boys and 3 girls between 23 and 48 months of age (mean age 36.9 months) all diagnosed with ASD according to ICD-10 criteria (ICD-10; 2022b). The diagnostic assessments were conducted by professionals independent of this study using the ADI-R and the ADOS (Lord, Rutter, & Le Couteur, 1994; Lord, Rutter, DiLavore, Risi, Gotham, & Bishop, 2012).). The children were referred to the Child Habilitation Services by their general practitioner and their local Educational Psychology Service. Participants were then randomly assigned to either an onsite or a videoconference group drawn as a lottery by an independent individual. Initially, both groups had eight children, but due to technical difficulties, one child was moved from the videoconference group to the onsite group. Another child was withdrawn from preschool due to concerns about the coronavirus. As a result, the onsite group ended up with eight children, while the videoconference group had seven children.

Design

The dependent variable in this study was child outcome. The independent variable was the type of supervision. Both groups began with onsite supervision for a period of 3 months. Subsequently, every second supervision session for the experimental group was replaced with video-based supervision. The onsite group received onsite supervision throughout the entire period. Before the treatment program commenced, an independent t-test was conducted to check for significant differences between the two groups. The t-test indicated no significant differences between the groups on any of the intake variables, suggesting that the groups were similar, see Table 1.

Table 1:

Participant characteristics at intake. Age in months, Autism Diagnostic Observation Scale (ADOS) and Autism Diagnostic Interview-Revised (ADI-R) scores. No significant differences between groups were found.

Characteristics	Onsite (n=8)		Videoconference (n=7)		
	Mean	SD (range)	Mean	SD (range)	p
Age at intake	35.6	6.6 (23-41)	39.9	3.9 (35-47)	.17
ADOS (Social Affect)	16.9	3.2 (12-22)	17.4	2.9 (12-20)	.73
ADOS (Repetative)	2.0	1.5 (0-4)	2.9	1.3 (0-4)	.27
ADOS (Total)	18.9	3.8 (12-24)	20.3	4.1 (12-24)	.50
ADI-R	21.5	10.4 (6-38)	26.9	14.4 (5-46)	.42

Setting

The setting was the same for both groups. As is common in Norway all participants received their intervention in their local mainstream preschool. Each preschool had a designated work room, which was equipped with all the necessary materials for EIBI sessions Materials for the sessions was readily available, including the day's training schedule, individualized training plans for the children, and reinforcement items such as toys.

The participating preschool and families received information about both the study and the treatment. The videoconference group were provided with seven-inch iPads with 4G connectivity. These iPads came preconfigured with an Apple ID user account and a Gmail account. Furthermore, the required videoconferencing software, known as "JOIN," had already been pre-installed on the iPads.

Outcome measures

The Childhood Autism Rating Scale-Second Edition (CARS2; Schopler et al., 2010; Vaughan, 2011). CARS2 is a screening tool based on observations of the child. It also yields three categories of severity. It measures behavior across fifteen items that typically can be related to ASD and has been validated (Vaughan, 2011). For example, imitation, emotional response, or relations to other people. The scoring ranges from one to four, where one indicates that the child's behavior is as expected in a child without ASD. A score of four indicates that the child's behavior is abnormal. The scores from each item are added together to achieve a total raw score. The CARS2 was completed by the EIBI supervisor in collaboration with the preschool staff at intake and after 12 to18 months of intervention.

Aberrant Behavior Checklist (ABC; Aman et al., 1985; Kaat et al., 2013). Aberrant Behavior Checklist (ABC) is a questionnaire consisting of 58-items that assesses problem behavior. These items are distributed on five subscales; (a) irritability: (b) lethargy; (c) stereotypy; (d) hyperactivity and (e) inappropriate speech. Behaviors are rated from 0 to 3. A score of 0 indicates no problem behavior, while a score 3 indicates severe problem behavior. The Aberrant Behavior Checklist was first published by Aman et al., (1985), and has later been validated specifically for children with an ASD (Kaat et al., 2013). The parents scored this questionnaire at intake and after 12 to 18 months of intervention.

The Socially Mediated and Automatic Reinforcer Questionnaire (SMARQ; Klintwall & Eikeseth, 2012). The SMARQ is a questionnaire developed to assess the children's preference for socially mediated and non-social stimuli. The first part of the questionnaire lists behaviors commonly observed in children with ASD, and that are often considered maintained through automatic reinforcement contingencies. These include body rocking, maintaining a distance from others, or frequently toggling a light switch. Staff members assess whether these behaviors are present or absent during a typical day. The second part of the questionnaire assess behaviors maintained by reinforcers that are socially mediated. These may include receiving fruit, listening to a song, or being tickled. The preschool staff completed this questionnaire at intake and after 12 to 18 months of intervention. The SMARQ has not yet been validated.

Procedure

The intervention involved parents, preschool teachers, assistants, and supervisors from the child habilation services. All 8 supervisors had a minimum of a bachelor's degree, all but one had completed an extra year of study in special education or were working either on their master's degree or had completed a master's degree in an area relevant to this type of work. The supervisors had an average of 20.9 years of experience with EIBI (range 8 to 27 years).

The Child Habilation Services followed the national guidelines for implementation of EIBI (Vea et al., 2015). The intervention started with a 2-day workshop, where the staff-members were given more detailed information about autism and EIBI. The child was present for parts of the workshop for assessments and demonstrations of teaching programs. The supervisors demonstrated teaching programs and procedures and then observed and gave feedback to staff and parents doing the programs.

Due to the COVID-19 restrictions the children were placed in small groups with 2-5 teachers or assistants. The participating supervisors had two children participating in the study, one in each group. Intervention was provided between 10 and 20 hours per week, averaging about 15 hours. During the first three months the training program was organized and implemented by using the same principles. The

supervision meetings usually included modeling, coaching, feedback, discussion, and documentation. In modeling, the supervisor demonstrated the teaching procedures for new teaching programs. A description of the teaching program was provided. During coaching, the staff-members and parents were coached in the implementation of the modeled training strategies and how to make individual adjustments for each child. The staff received feedback from the supervisor while doing the teaching. Feedback on the teaching was given until each staff member had reached an acceptable level of proficiency. The discussion and the documentation parts are closely related since both focused on the child's progression and making plans for how to progress further. The documentation made it possible to evaluate the intervention and for staff to write a detailed plan for the next training session. For example, planning new training goals, training strategies and what the team should focus on. After three months with supervision onsite both groups were responsible for the content in the training plans.

After the initial three months the videoconference group had every second meeting on videoconference, i.e., every fourth week. In between these videoconferences they had one onsite supervision meeting. The onsite group continued to have supervision onsite every second week. The videoconference group received an iPad with access to the Norwegian Health Network's video meeting platform where the staff-meetings, between the preschools and supervisors, would be organized. The meetings for both groups included an evaluation of the children's progress, changes that needed to be made and agreeing on new goals. The supervision meetings lasted for approximately two hours regardless of if it was onsite or on videoconference.

Treatment integrity

The supervisors and the preschool staff members monitored the intervention using a checklist that represented the national EIBI standards. In addition, the supervisors followed a plan for the implementation of the treatment in the project, including which tests and assessments that should be done when and by whom.

Data analysis

All the t-tests were conducted using SPSS version 28. The degrees of freedom, t-value, p-value, and effect size were measured and retrieved from the SPSS files. Due to the small groups and the different number of participants in the groups, the effect size (ES) was computed using the Hedges g. The effect size (ES) shows the differences from pre-test to post-test within each of the two groups. According to Bobbit (2021), and effect size of .2 is low, an effect size of .5 is medium

and an effect size of .8 is large. Negative values indicate that the mean of the post-test scores is lower than the mean of the pre-test scores.

Results

An independent t-test was conducted to see if there were any differences between the videoconference group and the onsite group at intake and in how much the CARS2 scores changed from pre-test to post-test. The test showed no significant difference between the two groups, (t (11) = -.299, p > .05). The ES for the videoconference group showed -.835, with 95% confidence interval (CI) (-1,650, .030) from pre-test to post-test. For the onsite group, the ES was -1.187, with 95% CI (-2.084, -.247) from pre-test to post-test. See figure 1 for scores pre and post for each group. One child from the videoconference group and one child from the onsite group were not available for the post-test. For the pre-test, four of the children had their CARS2 scores transformed based on their ADOS scores. In the post-test this was the case for six of the children. One child had both pre-test scores and post-test scores on the CARS2 calculated based on matching items from the ADI-R and ADOS.
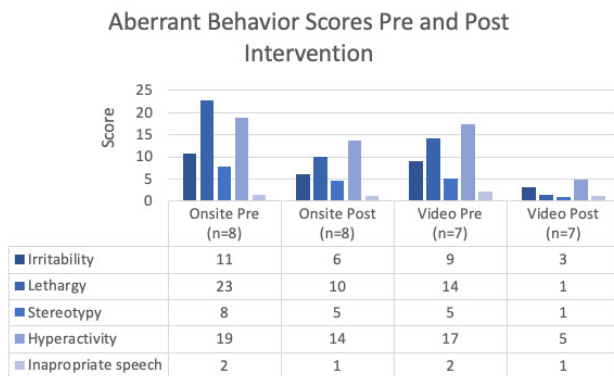
Figure 1:

CARS2 autism severity raw scores, pre and post intervention for onsite and video conference groups.

Autism Severity	Pre	Post
Onsite (n=6)	37,8	30,8
Video (n=7)	34,6	26,5
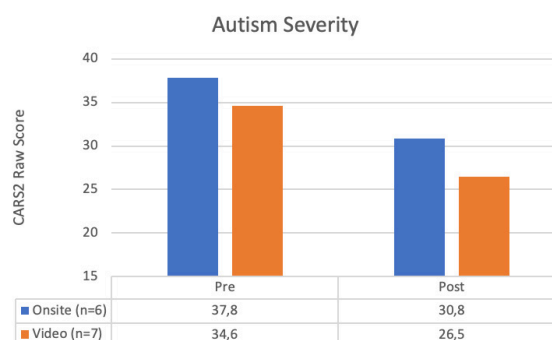
The independent t-test for all each category on the ABC showed no significant differences between the two groups from pre-test to post-test. Irritability was (t (13) = -1.369, p > .05) and the (ES) was -.667, with 95% CI (-1.643, .333). Lethargy was (t (13) = -1.096, p > .05) and the (ES) was -.534, with 95% CI (-1.500, .452). For stereotypy, the test showed (t (13) = -1.188, p > .05) and (ES) was -.579, with 95% CI (-1.548, .411). Hyperactivity showed (t (13) = -.410, p >.05) and (ES) was -.199, with 95% CI (-1.153, .762). For Inappropriate speech, the test showed (t (13) = -1.206, p > .05) and the (ES) was -.587, with 95% CI (-1.557, .404), see x. The pre-test scores for the onsite group were lower than the videoconference group, on all the categories except hyperactivity. The post-test showed a decrease from pre-test for both groups in all categories except for inappropriate speech for the videoconference group. The onsite group had a greater decrease in all the five categories. See figure 2 for scores on each category pre and post intervention.

Figure 2:

Aberrant behavior scores on each of the five areas measured, pre and post intervention for the onsite and video conferences groups.

Aberrant Behavior Scores Pre and Post Intervention

	Onsite Pre (n=8)	Onsite Post (n=8)	Video Pre (n=7)	Video Post (n=7)
Irritability	11	6	9	3
Lethargy	23	10	14	1
Stereotypy	8	5	5	1
Hyperactivity	19	14	17	5
Inapropriate speech	2	1	2	1

The independent t-test for changes in the number of socially mediated reinforcers showed no significant difference between the two groups from pre-test to post-test, (t (13) = -.387, p > .05). The ES for the videoconference group was 1.052, with 95% CI (.085, 1.968). For the onsite group, the ES was .511, with 95% CI (-.173, 1.165). For socially mediated reinforcers the onsite group had a higher count on the pre-test, however the post-tests scores were almost the same.

Figure 3:

Preferences for socially mediated and non-social stimuli, pre and post intervention for onsite and video conference groups.

Preferences for socially mediated and non-social stimuli
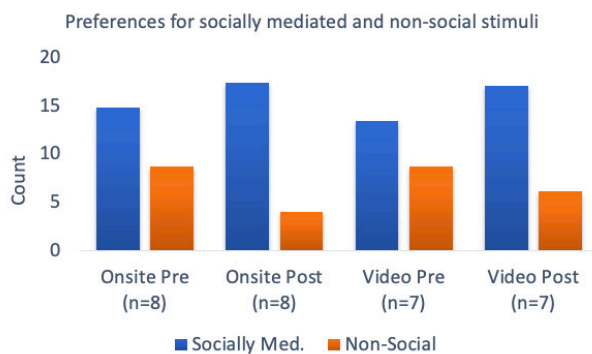
There was no significant difference between the two groups from pre-test to post-test in the number of non-social reinforcers, (t (13) = -1.249, p > .05). The ES for the videoconference group was -.865, with 95% CI (-1.644, -.041). While the ES for the onsite group was -1.216, with 95% CI (-2.072, -.319). In SMARQ non-social both groups preferred approximately the same number of non-social reinforcers in the pre-test. The post-test showed a decrease in the preferences of non-social reinforcers in both groups, but the decrease was greater for the onsite group. See figure 3 for scores pre and post intervention for each group.

Discussion

Our results suggest that video-based supervision of EIBI programs can at least partly replace onsite supervision. Outcome data in this pilot study suggest that this will not affect children outcome negatively. Our analysis shows no significant differences between the two groups from pre-test to post-test on any of the outcome measures employed. We may add however that there is a small but not statistically significant difference in favor of the onsite group on all three measures compared to the videoconference group. Our small sample size means that we don't have the statistical power to draw any conclusions at this point. Hence, studies with more participants and greater statistical power are needed.

The use of videoconference might make it easier to restructure the resources and use them more effectively. The number of qualified supervisors is small compared to the number of cases of children with ASD. And the number of cases is increasing in Norway as it is in the rest of the world (Surén et al., 2019). If videoconference can replace at least some of the onsite supervision it will reduce the time spent on traveling, making it possible to serve more children without compromising quality and outcome. Indeed, a recent study found that the EIBI supervision done via videoconference were more efficient in the sense that the meetings tended to be shorter and staff better prepared than supervision meetings onsite. Furthermore, videoconference supervision was considered by both supervisors and preschool staff to be acceptable and sometimes even a preferred replacement for onsite supervision (Hay-Hansson et al., 2023)

This is in line with several other studies show that videoconferencing can be used for training school staff and parents to do behavior analytic procedures. Several studies show that teaching and supervision of staff and parents based on videoconference can have about the same results as onsite training for number of interventions targeting a wide variety of outcome raging from improving daily living skills to reducing problem behavior (Benson et al., 2017; Machalicek, et al., 2010; Wacker et al., 2013; Simacek et al., 2017; Suess et al., 2016; Higgins et al., 2017; Machalicek, et al., 2009; Barkaia et al., 2017; Subramaniam et al., 2016)

While we conducted the present study the preschools had to close for a period of six to eight weeks due to the COVID-19 outbreak. This resulted in a reduced intervention program for both the staff and the children. The closed preschools might have influenced the results since they did not receive the intervention as planned. Moreover, when the preschools opened, they had to do minor adjustments to comply with the corona restrictions given by the government. The preschools reduced the number of staff members

so there were 2-5 staff members working with each child. Also, we had to provide supervision via videoconference to the onsite group as well. This meant that the staff members from both groups received the same type of supervision for three to four months. This is of course a significant threat to the internal validity of the present study. Nevertheless, there was still a significant difference in the number of onsite supervision meetings between the groups.

Another threat to the validity is the missing data for two of the children on the CARS2 measure of autism severity. One child in the videoconference group, and one child in the onsite group were not available for the post-test. Also, several of the CARS2 scores were based on the ADOS and ADI-R assessment. There appears however to be some literature that suggest that this can be done without compromising the data (Molnar et al., 2017)

One notable strength of this study is the random assignment of participants to either the videoconference group or the onsite group. The impartial allocation of individuals was performed by an independent party who was not affiliated with the research project. This rigorous process can in theory help ensure that both groups are as similar as possible. However, a significant limitation of this study pertains to the small number of participants. For the randomization process to be truly effective a larger sample size would be needed.

The limited group sizes also represent a significant challenge particularly in terms of generalizability. With only eight and seven children in the two groups, it is hard to extend the study's findings to the broader population.

One if the studies strengths is in the use of reliable and validated assessment tools. Two of the three measures employed in this study have undergone prior validation and have been utilized in similar research on ASD treatment programs, enhancing the credibility of the outcomes. The fact that both groups had reduced scores in autism severity and problem behavior suggest that the intervention itself was effective and may add to the growing evidence base for the use of EIBI and applied behavior analysis as intervention for ASD. We also added a novel measure of preference for socially mediated reinforcers. This appeared to increase somewhat in both groups while preference for non-social stimuli was somewhat reduced. This measure is yet not properly validated so care need to be shown in the interpretation of these results. If indeed preferences can be changed to include more socially mediated reinforcers this can in theory have large downstream effects on language and social skills development.

Future research should consider increasing the number of participants. Increasing the sample size will facilitate generalization of the study's findings to the wider population. Additional recommendations are to look at the impact of further reducing the onsite supervision. Is there a limit for how much of the supervision and training that can be done using videoconference before it impacts child outcome? Furthermore, other outcome measures could be included such as a measure of adaptive behavior and intellectual functioning. Also, measures of acceptability and social validity can be conducted.

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