

Effectiveness of Family Participation Intervention for Children with Autism Spectrum Disorders: A Meta-Analysis

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This study aimed to verify the effectiveness of Family Participation Intervention (FPI) for children with Autism Spectrum Disorders (ASD) by integrating and comparing effect sizes of single-subject studies published in Republic of Korea between 2000 and 2021. For this purpose, twenty-seven dissertations and journals were selected based on predefined criteria and were analyzed. Effect sizes were calculated according to various variables such as treatment approach, goals, subject group characteristics, and session characteristics using a random effects model. The results are as follows. First, the overall effect size of FPI for children with ASD was $\text{Tau-}U .88$, indicating a medium effect. Additionally, the effect size for the maintenance phase was $\text{Tau-}U .95$, indicating a large effect. Second, this study found that for elementary school students, using a community-centered or play (activity)-centered approach with the goal of improving adaptive behavior, involving various family members, conducting at least 20 sessions, showed better effects than other condition. This study is meaningful in that it verifies the effectiveness and validity of FPI for children with ASD. Additionally, it provides detailed information on the factors improving the intervention effectiveness.

Keywords: family participation intervention, autism, meta-analysis, parents participation

Introduction

Autism Spectrum Disorder (ASD) is a representative developmental disorder characterized by significant maladaptation, impairments in social interaction and communication, as well as restricted interests and repetitive behaviors (American Psychological Association [APA], 2013). Despite active research on interventions for children with ASD, there have been ongoing issues regarding

the difficulty of generalizing intervention effects to everyday life or different environments, as well as the challenges of maintaining the effects when interventions are discontinued (Kim et al., 2014).

In line with these trends, family participation interventions that involve the direct participation of family members in the intervention process within familiar environments for the child with ASD have begun to receive attention. Family participation intervention refers to a method in which family members of the target child participate in some or all the intervention process to enhance the child's functioning and behavioral changes. Family participation interventions have advantages in terms of being cost-effective and efficient, as family members can intervene with their child for an extended period without limitations of time and frequency, which is beneficial for the generalization and maintenance of intervention effects (Kwon & Shin, 2010).

In Republic of Korea, clinicians also recognize the importance

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of family participation intervention and use it as a method of intervention for children with ASD. Along with this, numerous experimental studies have been conducted to verify the effectiveness of family participation interventions. In addition, studies describing the overall characteristics and trends of family participation intervention research have been conducted. Kim et al. (2013) reviewed 21 studies on family participation interventions for children with ASD from 2007 to 2013. The researchers found that the studies primarily focused on children's development, utilized single-subject designs, and included children aged 5 years or older. The interventions covered various strategies such as communication-centered strategies, problematic behavior-reduction strategies, and pivotal response training. Examining relevant meta studies, Conrad et al. (2021) indicated that parents participation-intervention for children with ASD had a moderate effect size, primarily addressing disruptive behavior. Furthermore, Deb et al. (2020) showed small to moderate treatment effects for three specific interventions: Developmental, Individual-differences, and Relationship-based model (DIR) Floor time, Pivotal Response, and parent-centered education. Additionally, Bene and Rapina (2021) found that sibling participation intervention for children with ASD yielded a medium effect size, effectively enhancing social and communication abilities. However, a comprehensive meta-analysis to assess the effectiveness and validity of family participation interventions has not been conducted yet.

Therefore, we would examine the overall effect size of family participation interventions for children with ASD in single-subject studies conducted in Republic of Korea from 2000 to 2021 first in this study. It also aimed to determine the overall effect size for maintenance period after intervention. Additionally, by analyzing the effect sizes for each specific variable like treatment approach, outcome, subject group characteristics, and session characteristics, the study aimed to confirm which variables should be considered in designing the family participation interventions to achieve favorable outcomes.

Methods

Method Data Collection and Selection Process

The target articles for the meta-analysis in this study were collect-

ed using domestic databases. Additionally, relevant studies and references used in previous research analyzing the trends in family participation interventions for children with ASD or developmental disorders (Kim et al., 2013; Choi & Lee, 2020) were reviewed to include any papers missing during the initial search. The selected articles were then chosen based on inclusion and exclusion criteria that aligned with the research objectives, resulting in a final selection of 27 articles for analysis. The criteria for selecting are as follows.

Firstly, the articles focused on children under the age of 18 diagnosed with ASD. Studies that included children with ASD along with other disabilities were excluded.

Secondly, only single-subject studies conducted in Republic of Korea from 2000 to 2021 were selected. Single-subject research is a commonly used research method in special education and clinical settings, especially in intervention studies for ASD, where forming multiple identical groups is often challenging. Since most family participation interventions in Korea have been conducted as single-subject studies, our analysis was limited to single-subject research. Designs that did not demonstrate functional relationships, such as AB designs and ABA designs, were excluded, while designs that repeatedly demonstrated intervention effects through reversal designs (ABAB designs) were included.

Thirdly, only articles that clearly identified the role of the family as a main therapeutic mediator were included. Studies in which the family member provided assistance but did not directly participate in the intervention as a main mediator were excluded.

Data Analysis

In this study, Tau-*U* was used for meta-analysis. Parker and Vanneest (2009) suggested criteria for Tau-*U* effect sizes, categorizing absolute values of 0 to .65 as small intervention effects, .66 to .92 as medium intervention effects, and .93 to 1.00 as large intervention effects.

To verify if the individually calculated effect sizes estimate the population effect size, a homogeneity test (Q-Statistics) was conducted. To explore differences in effect sizes based on variables at the analysis level of individual effect sizes, a meta-ANOVA analysis was conducted. Group effect sizes were calculated according to the variables specified in the analysis framework of this study, and

significant differences were tested. For variables showing significant differences ($p < .05$), Bonferroni Correction was applied in post-hoc testing.

Finally, we conducted a publication bias to demonstrate the validity of the results of this meta-analysis and to compensate for the distortion of the findings caused by missing studies. For this purpose, a Funnel plot was examined. In cases where asymmetry was observed in the Funnel Plot, the statistical significance of the bias was tested using Egger's Regression Test.

Results

Overall Effect Size of Family Participation Interventions and Publication Bias

To analyze the overall effect size of family participation interventions, the average of 160 effect sizes from 27 selected studies was calculated using a random-effects model, and a homogeneity test was conducted. The overall effect size (Tau-U) of family participation interventions was .88, indicating a medium effect size (Table 1). To examine the maintenance effect of family participation interventions, the overall effect size for the maintenance phase as compared to the baseline phase was calculated, resulting in a value of .95, indicating a large effect size (Table 1). The results of the homogeneity test indicate that for both the intervention and maintenance phases, there is no statistical heterogeneity ($df < Q$, $p(Q) = 1.000$, Table 1). When analyzing the Funnel plot to assess the presence of publication bias, we observed a slightly asymmetric pattern around the mean effect size (Appendix 2). Subsequently, Egger's regression intercept gave a 0.066, indicating no evidence of publication bias.

Effect Sizes of Family Participation Interventions According to the Variables

When analyzing the research participants based on school levels (pre-school, elementary school, middle school), interventions for children in elementary school showed the largest effect size, with a Tau-U .97. Children in middle school (Tau-U = .89) and preschool (Tau-U = .86) exhibited a medium effect size. Post-hoc analysis revealed a statistically significant difference between elementary school children and preschool children ($p = .016$, $a < b$, Table 2).

Regarding the effect of the main mediator of family participation interventions, siblings showed a large intervention effect (Tau-U = .95), followed by parents (Tau-U = .90), all family members (Tau-U = .88), and mothers (Tau-U = .86), which exhibited medium effect sizes. There were statistically significant differences in intervention effects between groups ($p = .000$, $a < b$, Table 2).

Considering the number of sessions, interventions conducted 21-30 times (Tau-U = .90), 11-20 times (Tau-U = .89), and more than 31 times (Tau-U = .88) showed medium effect sizes. Interventions conducted 1-10 times (Tau-U = .59) had a small effect size and were significantly lower than other groups ($p = .002$, $a < b, c, d$, Table 2).

In terms of the intervention method, which are independent variables, community-centered therapy (Tau-U = 1.00) and play (activity)-centered therapy (Tau-U = .98) showed large effect. Adult-led strategies (Tau-U = .90), structuring and social environment (Tau-U = .88), positive behavior support (Tau-U = .87), pivotal reaction training (Tau-U = .87), and augmentative and alternative communication (Tau-U = .76) exhibited medium effect. There were no statistically significant differences between groups ($p = .054$, *n.s.*, Table 2).

Table 1. Results of the Overall Effect Sizes and Homogeneity of Family Participation Intervention

Intervention period	<i>k</i>	Tau-U				Heterogeneity			
		<i>M</i>	<i>SE</i>	<i>Z</i>	<i>p</i>	<i>Q</i>	<i>df</i>	<i>p(Q)</i>	<i>I²</i>
	160	.881	.022	39.550	.000	75.002	159	1.000	.000
Maintenance period	<i>k</i>	Tau-U				Heterogeneity			
		<i>M</i>	<i>SE</i>	<i>Z</i>	<i>p</i>	<i>Q</i>	<i>df</i>	<i>p(Q)</i>	<i>I²</i>
	160	.954	.034	28.218	.000	31.740	143	1.000	.000

I²: 0-.025 (small heterogeneity), .26-.74 (medium heterogeneity), .75-1.00 (large heterogeneity). Tau-U: 0-.65 (small effect size), .66-.92 (medium effect size), .93-1.00 (large effect size).

k = number of effect size; *SE* = Standard error; *n.s.* = not significant.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2. Effect Sizes according to Specific Variables of Family Participation Intervention

Variables	Sorts	<i>k</i>	Tau- <i>U</i>	<i>SE</i>	<i>p</i> (post-hoc)
School age	Pre-school (a)	123	.859*	.025	.016 (a < b)
	Elementary school (b)	28	.965*	.051	
	Middle school (c)	9	.894*	.117	
Mediator of FPI	Mother (a)	101	.856***	.028	.000 (a < b)
	Sibling (b)	24	.952***	.052	
	Parents (c)	26	.900***	.060	
	All family members (d)	9	.881***	.103	
Method of intervention	Positive behavior support	19	.866	.074	.054 (n.s.)
	Play (activity)-centered therapy	19	.980	.060	
	Augmentative and Alternative Communication (AAC)	18	.756	.067	
	Structuring the social environment	44	.877	.045	
	Adult-led strategy	12	.898	.095	
	Natural teaching	36	.883	.041	
	Pivotal reaction training	9	.865	.096	
	Community-centered therapy	3	1.000	.173	
Goal of intervention	Social interaction (a)	66	.875*	.033	.019 (n.s.)
	Community and language (b)	42	.886*	.042	
	Challenge behavior (c)	18	.899*	.073	
	Adaptive behavior (d)	6	1.000*	.134	
	Cognition and learning (e)	6	.713*	.153	
Number of sessions	1-10 sessions (a)	7	.592**	.135	.002 (a < b, c, d)
	11-20 sessions (b)	64	.889**	.036	
	21-30 sessions (c)	57	.898**	.040	
	Above 31 sessions (d)	32	.879**	.042	

Tau-*U*: 0-.65 (small effect size), .66-.92 (medium effect size), .93-1.00 (large effect size).

k = number of effect size; *SE* = Standard error; n.s. = not significant.

p* < .05, *p* < .01, ****p* < .001.

Examining the effect sizes based on the goal of intervention, which are dependent variables, studies targeting adaptive behavior (Tau-*U* = 1.00) showed the highest intervention effect. This was followed by studies focusing on challenging behavior (Tau-*U* = .90), communication and language (Tau-*U* = .89), and social interaction (Tau-*U* = .88), which exhibited medium effect. Studies targeting cognition and learning (Tau-*U* = .71) had a medium effect but had the lowest effect among the intervention goals (*p* = .019, Table 2).

Discussion

The overall effect size of family participation interventions for children with ASD was .88, which falls within the category of medium intervention effect. Additionally, the effect size for the maintenance was .95, indicating a large effect. This suggests that there is a greater change in the maintenance phase as compared to the

intervention phase, indicating that family participation interventions can have a higher effect in the maintenance period. This result suggests that family members who participate in intervention can continue to use the skills they have acquired even after the intervention ends, leading to an increase in the effectiveness of the targeted behaviors. This result is consistent with previous studies (Lee, 2009; Dunlap et al., 2006) that have shown the beneficial effects of family participation interventions in terms of maintenance.

Analyzing the effect sizes based on developmental level of the participants, interventions targeting elementary school students showed a high level of intervention effect. In contrast, interventions for preschool children had the lowest effect despite being the most frequently studied group. These findings are consistent with the results of a meta-analysis conducted by Liao et al. (2021) on parental involvement in communication skills interventions for in-

dividuals with ASD. The meta-analysis revealed that interventions targeting children aged 7 and above exhibited greater intervention effects as compared to the 1-3 years and 4-6 years age groups. This suggests that elementary school students, who are in a developmental stage where they can comprehend objectives of intervention and establish a close rapport with their family members acting as mediators, demonstrated stronger effects compared to preschool children.

Analyzing the effect sizes based on the mediator of intervention, siblings showed a large intervention effect. When siblings serve as mediator, it is expected that parents would also participate in the intervention process as the child's caregivers or collaborators, thus amplifying the intervention effect. Additionally, it was found that interventions conducted by both parents together had a higher effect as compared to those conducted solely by mother. Therefore, it can be concluded that having various family members working towards a common goal can increase the effectiveness of the intervention.

Analyzing the effect sizes based on the number of sessions, interventions conducted for 21-30 sessions showed the highest effect, while interventions conducted for 1-10 sessions had the lowest effect size with significant statistical differences. This indicates the importance of an adequate number of intervention sessions since there is a learning and training period for families to acquire intervention skills.

In terms of intervention methods, play-centered and community-centered therapy showed higher effect sizes. This suggests that active participation and direct experiences in play or community activities have a positive impact on the learning and behavioral changes of children with ASD. However, in the case of community-centered therapy, with only three analytical papers available, caution should be made interpreting the results, and it is necessary to revalidate the findings by including additional studies in the future.

Regarding the goals of the intervention, adaptive behavior showed the largest effect, while cognition and learning exhibited a significantly lower effect as compared to adaptive behaviors. This implies that family participation interventions are more effective in improving adaptive behaviors, social interaction, communication skills, and reducing problem behaviors in children with ASD, rather than

cognition and learning of children with ASD.

To summarize, when applying family participation interventions, it is expected to be highly effective to target elementary school-aged children and enhance adaptive behavior. Additionally, utilizing play-centered and community-centered strategies is effective, and collaboration among various family members and environmental systems is crucial. Furthermore, it is recommended to conduct therapy for a minimum of 20 sessions.

The study holds significance for its valuable information regarding the clinical application of family participation interventions for the first time. There are verified programs for ASD mediating parents or family, such as the Research Units in Behavioral Intervention (RUBI) parent training program at The RUBI Autism Network in the US. However, it is noteworthy that these programs have been relatively recently introduced in the Republic of Korea, and the landscape is marked by their dearth of program variety and diversity. Thus, this research can be utilized as foundational data for implementing family participation interventions in clinical and educational settings.

However, this study has limitations in that it did not conduct a qualitative analysis on the selected articles, and in some cases, it is impossible to compare given the insufficient number of relevant studies. Another limitation is that this study includes only domestic studies for analyses and did not conduct qualitative analysis. Therefore, future research should focus on conducting meta-analyses of research data encompassing both domestic and international sources, including qualitative analysis. Additionally, it is recommended to compare family participation intervention with other interventions, such as peer or teacher participation intervention.

Author contributions statement

YHM: graduate student at Hanyang University, collected and analyzed data, and led manuscript preparation; HSK: professor at Hanyang University, supervised the research process.

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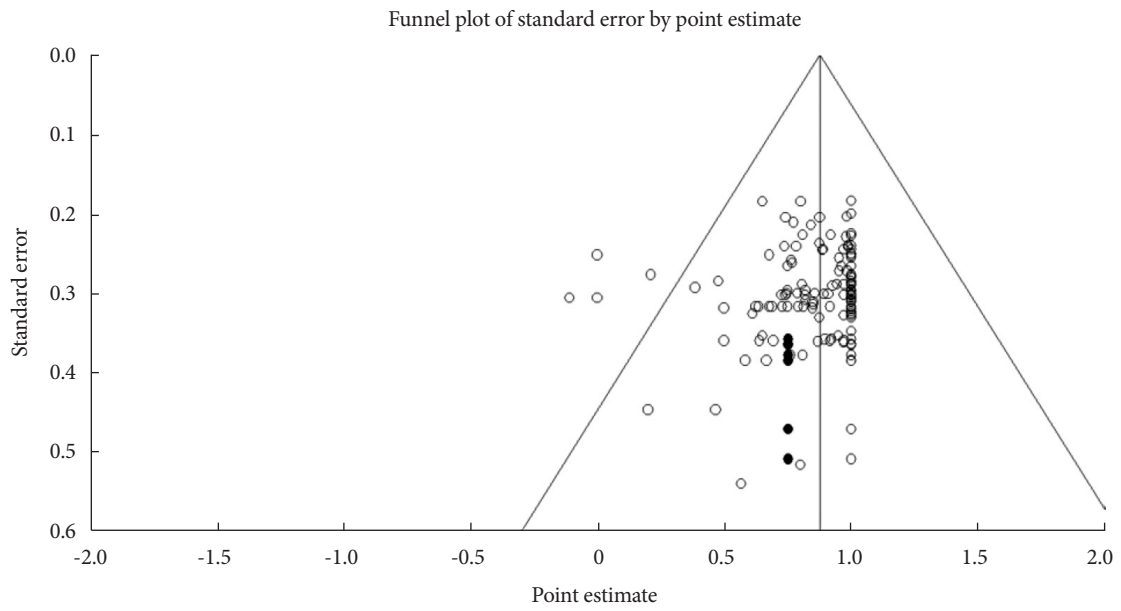
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Appendix 1. Overview of Subjected Studies of Family Participation Intervention

Author	Year	Type	School age	No. of participants	Mediator	Independent variable	Dependent variable	No. of session
Keum	2001	Thesis (master)	Elementary school	3	Sibling	Environment-centered language intervention	Communication	Over 31
Lee & Lee	2002	Academic journal	Pre-school	3	Mother	Intervention using wordless picture books	Language skills, Mom's teaching skills	21-30
Kim	2002	Thesis (master)	Pre-school	3	Sibling	PECS	Communication	11-20
Yoon & Kwak	2006	Academic journal	Pre-school	1	Parents	ABA	Challenge behavior, Parenting behavior	11-20
Hwang	2006	Academic journal	Pre-school	3	Mother	Social interaction training	Social behavior, Interaction	Over 31
Moon & Park	2008	Academic journal	Pre-school	3	Family	Positive behavioral support	Challenge behavior	21-30
Chae & Lee	2008	Academic journal	Pre-school	3	Mother	Pivotal reaction training	Joint interest behavior	Over 31
Kim	2009	Academic journal	Middle school	1	Family	Positive behavioral support	Communication	11-20
Choi & Kim	2010	Academic journal	Elementary school	3	Sibling	Community-centered therapy	Purchasing skills	11-20
Hwang	2010	Academic journal	Pre-school	3	Mother	Social interaction training	Joint interest behavior	Over 31
Lim & Kim	2013	Academic journal	Pre-school	1	Parents	Pivotal reaction training	Communication	11-20
Kim	2014	Academic journal	Pre-school	2	Parents	Animal assisted activity	Social skill, Challenge behavior	11-20
Nam & Lee	2014	Academic journal	Pre-school	3	Mother	Relationship-centered communication intervention	Joint interest behavior	11-20
Park et al	2016	Academic journal	Pre-school	3	Mother	Individual trial training, Natural teaching	Learning goals, Parent-teaching skills	1-10
Kim	2017	Academic journal	Middle school	3	Mother	Group home referenced vocational education	Cooking skills	11-20
Shim & Kim	2017	Academic journal	Pre-school	3	Mother	Responsive Training (RT)	Communication, Social interaction	11-20
Yoon & Lee	2017	Academic journal	Pre-school	3	Mother	Responsive communication	Joint interest behavior	11-20
Lee & Lee	2017	Academic journal	Pre-school	3	Mother	Educational app play activities	Social interaction	21-30
Kim & Choi	2018	Academic journal	Pre-school	1	Mother	Social communication training	Play participation behavior, Empowering mothers	11-20
Min & Kim	2018	Academic journal	Pre-school	4	Mother	Responsive interaction	Joint interest behavior	21-30
Son	2018	Academic journal	Pre-school	3	Mother	Joint interest skill education	Joint interest behavior	11-20
Kim & Kim	2019	Academic journal	Elementary school	1	Mother	Multicomponent behavioral intervention	Interfering behavior with home learning	11-20
Kim & Lee	2020	Academic journal	Pre-school	3	Sibling	Sibling led interaction	Social interaction	11-20
Kim & Choi	2020	Academic journal	Pre-school	4	Mother	AAC	Communication, Play participation	21-30
Yoon	2020	Academic journal	Pre-school	3	Mother	Based on SCERT model social communication intervention	Social interaction	21-30
Kang	2021	Thesis (doctor)	Elementary school	1	Parents	ABA	Challenge behavior	1-10
Lee	2021	Thesis (doctor)	Pre-school	4	Mother	PECS	Communication, Parenting stress	Over 31



Appendix 2. *Funnel plot of family participation intervention.*