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Parent-implemented interventions in Chinese families of children with autism spectrum disorder

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This study aims to test the effects of the parent-implemented interventions (PIIs) on children with autism spectrum disorder (ASD) in China and to explore the effects of PIIs on the family quality of life of families of children with ASD in China. This study adopted a randomized controlled trial (RCT) design based on PIIs. Participants is divided into intervention group ($N(\text{parents}) = 35$, $\text{Age}(M \pm SD) = 35.69 \pm 3.45$; $N(\text{children}) = 35$, $\text{Age}(M \pm SD) = 5.49 \pm 2.74$) and control group ($N(\text{parents}) = 35$, $\text{Age}(M \pm SD) = 36.06 \pm 4.28$; $N(\text{children}) = 35$, $\text{Age}(M \pm SD) = 5.71 \pm 3.25$); parents in intervention group were trained with PIIs and required to implement family interventions for their children with ASD as they learned. This study will provide data to support the development and improvement of PIIs, and will also benefit the well-being and sustainability of children with ASD and their families. Compared to control group, the children in intervention group had a significant improvement in social communication ability ($p < 0.05$), and the families in intervention group had a significant enhancing in family quality of life (satisfaction) ($p < 0.001$). This study found that PIIs are effective in enhancing the social communication ability of children with ASD in China and the family quality of life (satisfaction) of their families. PIIs is a good and cost-effective complement to rehabilitation training in professional institutions, and have positive significance for the well-being and sustainability of children with ASD and their families.

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Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder (Dawson et al., 2023). American Psychiatric Association (2013) published the criteria for ASD diagnosis as part of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), including: (i) persistent deficiencies in social communication and social interaction in multiple contexts; (ii) restricted, repetitive patterns of behavior, interests, or activities; (iii) symptoms must appear at an early developmental stage (but may not fully manifest until social demands exceed limited capacity, or may be masked by learned strategies later in life); (iv) these symptoms cause clinically significant impairment in social, occupational or other currently important functioning areas; (v) these disorders are not better explained by intellectual disability (intellectual developmental disorder) or global developmental delay. Intellectual disability and ASD often co-occur; to make a combined diagnosis of ASD and intellectual disability, social communication should be below what would be expected at the general developmental level. ASD is incurable and lifelong (Lovell et al., 2021).

It is estimated that the prevalence of ASD is increasing globally (Ritchie, 2017). ASD places a tremendous burden on the families of children with ASD, and the physical and psychosocial well-being of the caregivers of children with ASD is greatly challenged (Cohrs and Leslie, 2017; Khanna et al., 2011; Lovell et al., 2021). Evidence suggests that parents or caregivers of children with ASD experience greater physical, mental, parenting, and family relationship stress than parents or caregivers of children with other types of disabilities, such as intellectual disability, Down Syndrome and so on (Merriman et al., 2020; Nahar et al., 2022; Postorino et al., 2019). In addition, attention needs to be paid to the financial stress that is prevalent in families of children with ASD (Hall and Graff, 2011; Khusaifan and El Keshky, 2021). Regarding ASD rehabilitation, the clinical recommendation is usually to provide intensive services (e.g., 25–40 h per week, one-to-one adult-child ratio for a year or longer), which is difficult for many families to achieve (Cheng et al., 2023). Based on the severity of the ASD, families of individuals with ASD spend between \$67,000 and \$72,000 per year on treatment in the US (Moldin and Rubenstein, 2006). In China, the existing medical policies provide limited help, and the cost of treatment for children with ASD is mainly shouldered by their families, resulting in many families falling into poverty and destroying the family vibe (Gao et al., 2023). Based on the real-life difficulties and limitations faced by families of children with ASD, professionals have begun to explore cost-effective solutions and alternative methods, including home-based interventions provided by parents (Cheng et al., 2023; Hatcher and Page, 2020; Pi et al., 2022).

Parent-implemented interventions (PIIs; also referred to as parent training or parent-mediated interventions) (Akamoglu and Meadan, 2018; Cheng et al., 2023) entail intensive professional training to support parents use individualized interventions to intervene with children with developmental disabilities (e.g., ASD) in everyday life settings, such as the home and community, to promote parent-child engagement and improve children's problems in behavior, communication, social and daily living skills (Bearss et al., 2013; Connie et al., 2014; Ha, 2015; Hume et al., 2021; Kasari et al., 2014; Wong et al., 2015). Some studies have revealed the positive effects of PIIs in the areas of motor skills, communication, and socially adaptive behaviors of children with ASD (Aldred et al., 2004; Beaudoin et al., 2019; Cheng et al., 2023; Ginn et al., 2017; Kaiser and Roberts, 2013; Lang et al., 2009; Reitzel et al., 2013). In addition, through the PIIs, the relationship between parents or caregivers and professionals is well maintained, resulting in a solid support system consisting of the child with ASD, the parents or caregivers of the child with

ASD, and the professionals (Rogers et al., 2014). In early intervention for children with developmental disabilities, professional communication with their caregivers contributes to the positive advancement of family intervention (Młynarski et al., 2009). In China, there are few relevant studies. Most of the research on PIIs in the field of ASD has focused on theoretical and literature review studies (Wang and Mo, 2022; Xiao, 2016; Zeng and Hu, 2015). A few studies have conducted empirical studies. These studies confirm the role of PIIs in improving children with ASD in terms of joint attention behaviors and social interaction behaviors (Liu and Liu, 2010; Qi, 2020; Zhou, 2021). Therefore, based on existing research, it can be concluded that "PIIs have a positive effect on improving the social communication ability of children with ASD".

Combining the above, most of the existing relevant studies have focused on the effects of PIIs on children with ASD, with fewer detailed discussions on another important group—the families of children with ASD. A child's diagnosis of ASD brings great challenges to his or her family. Social support theory suggests that providing individuals or groups in distress with the necessary emotion, appraisal, information, and instrument support can promote positive, sustainable development for the individuals or groups and their families (Cohen and Wills, 1985; Wong and Shorey, 2022). PIIs as a support deserves to be explored for its effects on families of children with ASD. Especially on the family quality of life, a good family quality of life has a definitive effect on the well-being and sustainable development of a family and its members (Brown et al., 2006; Kuhlthau et al., 2014; Poston et al., 2003; Udo et al., 2013). At present, there is a lack of relevant research. Given the need for more replication studies in educational research for the development of educational policies and practices (Bakan, 1966; Brandt et al., 2014; Makel and Plucker, 2014), the transferability of the above findings to China seems appropriate for testing. Therefore, based on previous research, the first objective of this study is to test the effects of the PIIs on children with ASD in China. At the same time, based on the reality that there is a lack of concern for families of children with ASD in this field, another objective of this study is to explore the effects of PIIs on the family quality of life of families of children with ASD in China. Therefore, the research questions of this study are as follows:

- (i) What are the effects of PIIs on the abilities of children with ASD in China?
- (ii) Does the PIIs have the effects on the family quality of life of families of children with ASD in China? If so, what are the effects?

Methods

Participants. Participants in this study were children with ASD ($N = 70$) and their parents ($N = 70$). All came from a public hospital (the Fifth Hospital of Yulin City (Postal Code: 719000), Yulin City, Shaanxi Province, China) within China that specializes in the care of neurodevelopmental disorders. The hospital was conducting training on PIIs. In the role of a trainer's assistant, the researcher (Xin Gao) has involved in some of the hospital's practices for a long time. The researchers contacted the administration and ethics committee of the hospital, and obtained permission and ethical approval to conduct this study.

The inclusion criteria for parents of children with ASD including: (i) having a certain level of education (Junior high school and above) and being able to understand the information expressed in the scale; (ii) being the biological parent of a child with ASD; (iii) only one parent can be recruited for a family; (iv)

Table 1 Participant (parents) demographic characteristics.

Construct	Metric	Intervention group	Control group	Intervention group (M ± SD)	Control group (M ± SD)	Chi-square test (p-value)
Gender	Male (Father)	13(37.1%)	15(62.9%)	/	/	0.63
	Female (Mother)	22(42.9%)	20(57.1%)			
Age	25-35	26(74.3%)	26(74.3%)	35.69 ± 3.45	36.06 ± 4.28	0.29
	36-45	9(25.7%)	9(25.7%)			
Education Level	Junior High School	10(28.6%)	8(22.9%)	/	/	0.91
	High School	16(45.7%)	19(54.3%)			
	Bachelor's degree	8(22.9%)	7(20.0%)			
	Master's degree and above	1(2.9%)	1(2.9%)			
Employment Status	Employed	27(77.1%)	25(71.4%)	/	/	0.58
	Unemployed	8(22.9%)	10(28.6%)			

Table 2 Participant (children with ASD) demographic characteristics.

Construct	Metric	Intervention group	Control group	Intervention group (M ± SD)	Control group (M ± SD)	Chi-square test (p-value)
Gender	Male	26(74.3%)	28(80.0%)	/	/	0.57
	Female	9(25.7%)	7(20.0%)			
Age	2-5 (pre-school age)	23(65.7%)	25(71.4%)	5.49 ± 2.74	5.71 ± 3.25	0.48
	6-12 (school age)	12(34.3%)	10(28.6%)			
The Severity of the ASD	Mild	6(17.1%)	5(14.3%)	/	/	0.74
	Moderate	7(20%)	5(14.3%)			
	Serious	22(62.9%)	25(71.4%)			

having a complete parenting experience (from the time of the child's diagnosis to the present). For children with ASD, there should be a certificate of diagnosis of ASD and a detailed diagnostic report issued by the legally qualified hospital or organization.

In this study, children with ASD and their parents were divided into an intervention group ($N(\text{parents}) = 35$, $\text{Age}(M \pm SD) = 35.69 \pm 3.45$; $N(\text{children}) = 35$, $\text{Age}(M \pm SD) = 5.49 \pm 2.74$) and a control group ($N(\text{parents}) = 35$, $\text{Age}(M \pm SD) = 36.06 \pm 4.28$; $N(\text{children}) = 35$, $\text{Age}(M \pm SD) = 5.71 \pm 3.25$). The age range of parents of children with ASD is 25-45 years. Children with ASD are predominantly in the pre-school age, i.e., 2-5 years old, with more than 65% in both groups; the rest are in the school age, i.e., 6-12 years old. The demographic characteristics of all participants in this study are shown in Table 1 and 2. The results of chi-square tests of demographic variables for both groups of parents showed no significant differences in gender, age, education level, and employment status between the two groups ($p > 0.05$) (see Table 1). A chi-square test was also performed for demographic variables in the two groups of children with ASD, and the results showed no significant differences between the two groups in terms of gender, age, and severity of ASD ($p > 0.05$) (see Table 2).

Measurement and hypotheses

Caregiver Skills Training (CST). The training is based on the World Health Organization's Caregiver Skills Training (CST) program (OpenWHO, n.d.) for families of children with developmental delays or disabilities, including ASD. The training aims to enhance caregiver's capacity to use everyday play and home routines as opportunities to build their children's communication, engagement in activities, positive behavior and daily living skills, while improving caregiver's overall well-being. The professional trainers from the above-mentioned hospital conducted the intervention training for the parents of children with ASD in the intervention group. The training was divided into 15 modules

Table 3 CST modules.

No.	Module theme
M-1	Getting children engaged
M-2	Continuing to get children engaged
M-3	Keeping children engaged
M-4	Keeping children engaged in interaction
M-5	Helping children to share engagement in play and home routines
M-6	Helping children to participate in play routines
M-7	Understanding communication
M-8	Promoting communication
M-9	Teaching new skills in small steps and levels of help
M-10	Understanding your child's behavior
M-11	Preventing challenging behavior - Helping children stay engaged and regulated
M-12	Understanding the reasons for challenging behavior
M-13	Teaching alternatives to challenging behaviors
M-14	Ongoing practice and goal setting
M-15	Problem solving and self-care

(see Table 3), all of which were conducted in the hospital training room. The training time for each module was 40-60 min.

Childhood Autism Rating Scale, Second Edition (CARS-2). The CARS was developed by Schoplen and Mary E. Van Bourgondien in 1988 and was originally developed for the TEACCH (Structured Instruction) program to provide observational ratings of speech, behavior, and perception in children with ASD (Chlebowski et al., 2010). In 2010, the CARS-2 was published. The CARS-2 Standard Version Rating Booklet (CARS2-ST) (Schopler et al., 2010) was used in this study. The scale contains 15 items, each rated on a 4-point scale. Each level of rating in turn has a specific descriptive explanation, with a view to achieving as much consistency as possible between different raters. If the total score is below 30, the initial judgment is no ASD; 30 to 36, mild to

moderate ASD; 37 to 60, and at least 5 items with a score higher than 3, severe ASD. As with the original CARS, CARS2-ST has a strong internal consistency reliability coefficient ($N = 1034$, $\alpha = 0.93$), and has a good validity (Schopler et al., 2010; Vaughan, 2011).

Beach Center Family Quality of Life Scale (FQOL Scale). The FQOL Scale contains 25 items that assess 5 domains: family interaction; parenting; emotional well-being; physical/material well-being; and disability-related support. The FQOL Scale uses satisfaction as the primary response format. The anchors of the items rated on satisfaction are rated on a 5-point scale, where 1 = very dissatisfied, 3 = neither satisfied nor dissatisfied, and 5 = very satisfied. The FQOL Scale has a good reliability (For the FQOL subscales on importance, $\alpha = 0.94$; for the FQOL subscales on satisfaction, $\alpha = 0.88$; test-retest reliability was examined in both importance and satisfaction responses for each of the FQOL subscales and correlations were significant at the 0.01 level or beyond (df from 59 to 63).) and has a good validity (Hoffman et al., 2006; Park et al., 2003; Poston et al., 2003; Summers et al., 2007).

Hypotheses. Based on the above, this study makes the following hypotheses:

H1: The PIIs has a significant effect on the improvement in the abilities of children with ASD in China.

H2: The PIIs had a significant effect on the satisfaction of family interaction of families of children with ASD in China.

H3: The PIIs had a significant effect on the satisfaction of parenting of families of children with ASD in China.

H4: The PIIs had a significant effect on the emotional well-being of families of children with ASD in China.

H5: The PIIs had a significant effect on the physical/material well-being of families of children with ASD in China.

H6: The PIIs had a significant effect on the satisfaction of disability-related support of families of children with ASD in China.

Procedure. This study adopted a randomized controlled trial (RCT) design based on PIIs, divided into five main phases: pre-test phase, training phase, family interventions phase, post-test phase, and follow-up assessment.

Pre-test. Pre-contacts were made to obtain information about children with ASD and their parents in the hospital; the final study participants were then confirmed through researcher-initiated invitations and snowball sampling. In the specific rating process, professional trainers from the above-mentioned hospital conduct the ratings (CARS2-ST) based on the information provided by the parents, the detailed diagnostic records of the child, and the continuous on-site observation and contact with the child. For each abnormal behavior, the characteristics, frequency, intensity, and duration of the behavior need to be considered in order to objectively assess its severity (Grissom, 2011; Schopler et al., 2010). The FQOL Scale was completed by the parents of the children with ASD participating in the study.

Training. 15 PIIs sessions were conducted for parents in intervention group. Twice a week, once on Wednesday and once on Friday, for about 40–60 min each session. Training by professional trainers from the above-mentioned hospital. The entire training took two months.

Family interventions. From the end of the first training, parents in the intervention group are required to combine what they have learned and to conduct at least 90–120 min of intervention

training with their children everyday, and video or audio recordings are required for testing and checking purposes. The duration of the family intervention is 5 months (from the first family intervention to the follow-up assessment) and long-term implementation is encouraged. Children in both groups received regular rehabilitation training in the hospital as usual.

Post-test. At the end of all sessions, children with ASD and their parents in both groups were again assessed on the CARS2-ST scale and the FQOL Scale.

Follow-up assessment. After 3 months, children with ASD and their parents in both groups were follow-up assessed on the CARS2-ST scale and the FQOL Scale.

Results

In this study, a total of 140 scales (70 for children and 70 for parents) were administered in the pre-test, with 140 valid scales; 140 scales (70 for children and 70 for parents) were administered in the post-test, with 140 valid scales; and 140 scales (70 for children and 70 for parents) were administered in the follow-up assessment, with 140 valid scales. The researchers entered the collected data into SPSS 27.0 for statistical analysis. This study took a total of 7 months.

Effects on children with ASD. The results of the descriptive statistics of this study are shown in Tables 4 and 5. Based on the pre-test, post-test, and follow-up assessment values of CARS2-ST in this study, the researchers conducted a 2 (intervention group, control group) \times 3 (pre-test, post-test, and follow-up assessment) multifactorial repeated measures ANOVA. The results showed a significant main effect, $F(2, 67) = 101.85$, $p < 0.001$; the groups effect was not significant, $F(1, 68) = 3.69$, $p > 0.05$; the interaction effects of pre-test, post-test, and follow-up assessment with groups were significant, $F(2, 67) = 49.61$, $p < 0.001$.

Based on the above, a further simple effects analysis can be performed. The results showed no significant difference between the intervention group and control group in the pre-test phase, $F(1, 68) = 0.176$, $p > 0.05$; in the post-test phase, there was a significant difference between the intervention group and control group, $F(1, 68) = 5.63$, $p < 0.05$; and in the follow-up assessment phase, there was a significant difference between the intervention group and control group, $F(1, 68) = 8.78$, $p < 0.05$. In the intervention group, there was a significant difference between pre-test and post-test, between post-test and follow-up assessment, and between pre-test and follow-up assessment, $p < 0.001$; in the control group, there was no significant difference between pre-test and post-test and between post-test and follow-up assessment, $p > 0.05$, and a significant difference between pre-test and follow-up assessment, $p < 0.05$; this means that parents non-involvement\hospital-only rehabilitation of these children will have a certain degree of effects, but they are not as effective as simultaneous parents and hospital intervention and need to take longer to produce effects.

The researchers then conducted paired-samples t-tests on the pre-test and post-test data of the children in the intervention group to detect differences between these children on various indicators of the CARS2-ST scale; in addition, paired-samples t-tests were conducted on the post-test and follow-up assessment data to detect the maintenance of the intervention effect. The statistics of CARS2-ST indicators in the intervention group are shown in Table 5. The results showed that at the post-test stage, children in the intervention group had significant differences compared with the pre-test stage in the following indicators: imitation ($p < 0.05$), emotional response ($p < 0.001$), fear and

Table 4 Statistics of CARS2-ST and FQOL Scale data.

Construct	Metric	Intervention group (M ± SD)	Control group (M ± SD)	Intervention group t-value (Pre*Post)	Intervention group t-value (Post*F)
CARS2-ST	Pre-test	38.89 ± 2.63	39.17 ± 3.05	/	/
	Post-test	37.31 ± 2.65	38.97 ± 3.17		
	Follow-up assessment	36.69 ± 2.68	38.71 ± 2.89		
FQOL Scale (Family Interaction)	Pre-test	14.14 ± 1.19	13.85 ± 0.81	6.39**	6.42**
	Post-test	15.09 ± 1.29	14.11 ± 1.02		
	Follow-up assessment	15.69 ± 1.23	14.11 ± 1.02		
FQOL Scale (Parenting)	Pre-test	14.74 ± 1.15	14.74 ± 1.15	13.52**	3.51*
	Post-test	16.40 ± 1.12	14.85 ± 1.19		
	Follow-up assessment	16.71 ± 0.99	14.89 ± 1.37		
FQOL Scale (Emotional Well-being)	Pre-test	9.26 ± 0.82	9.11 ± 0.53	5.45**	2.24*
	Post-test	10.06 ± .91	9.26 ± 0.66		
	Follow-up assessment	10.23 ± .94	9.57 ± 0.81		
FQOL Scale (Physical/ Material Well-being)	Pre-test	12.03 ± 0.95	11.91 ± 0.95	2.76*	3.43*
	Post-test	12.26 ± 0.98	12.03 ± 1.01		
	Follow-up assessment	12.51 ± 1.07	12.14 ± 1.12		
FQOL Scale (Disability-Related Support)	Pre-test	10.37 ± 1.17	10.23 ± 1.19	5.76**	/
	Post-test	11.31 ± 0.72	10.31 ± 1.16		
	Follow-up assessment	11.31 ± 0.72	9.83 ± 0.82		
FQOL Scale (Total Score)	Pre-test	60.54 ± 3.09	59.86 ± 2.44	12.15**	8.20**
	Post-test	65.11 ± 3.01	60.57 ± 2.59		
	Follow-up assessment	66.46 ± 3.09	60.54 ± 2.57		

*p < 0.05, **p < 0.001.

Table 5 Statistics of CARS2-ST in the intervention group.

Indicators	Pre-test (M ± SD)	Post-test (M ± SD)	Follow-up assessment (M ± SD)	t-value (Pre*Post)	t-value (Post*F)
Relationship to people	2.80 ± 0.41	2.80 ± 0.41	2.80 ± 0.41	/	/
Imitation	2.60 ± 0.50	2.37 ± 0.49	2.31 ± 0.47	3.17*	1.44
Emotional response	2.91 ± 0.28	2.00 ± 0.00	1.89 ± 0.32	19.04**	2.10*
Body use	2.11 ± 0.32	2.11 ± 0.32	2.11 ± 0.32	/	/
Object use	2.60 ± 0.50	2.60 ± 0.50	2.60 ± 0.50	/	/
Adaptation to change	2.46 ± 0.51	2.37 ± 0.49	2.31 ± 0.47	1.79	1.44
Visual response	2.34 ± 0.48	2.34 ± 0.48	2.34 ± 0.48	/	/
Listening response	2.34 ± 0.48	2.34 ± 0.48	2.34 ± 0.48	/	/
Taste-smell-touch response and use	2.37 ± 0.49	2.37 ± 0.49	2.37 ± 0.49	/	/
Fear and nervousness	2.46 ± 0.51	2.31 ± 0.47	2.17 ± 0.38	2.38*	2.38*
Verbal communication	2.60 ± 0.50	2.60 ± 0.50	2.60 ± 0.50	/	/
Non-verbal communication	2.29 ± 0.49	2.17 ± 0.38	2.11 ± 0.32	2.1*	1.44
Activity level	2.54 ± 0.51	2.46 ± 0.51	2.34 ± 0.48	1.79	2.10*
Level and consistency of intellectual response	3.00 ± 0.00	3.00 ± 0.00	3.00 ± 0.00	/	/
General impressions	3.46 ± 0.78	3.46 ± 0.78	3.40 ± 0.78	/	1.44
Total Score	38.89 ± 2.63	37.31 ± 2.65	36.69 ± 2.68	12.58**	5.76**

*p < 0.05, **p < 0.001.

nervousness ($p < 0.05$), non-verbal communication ($p < 0.05$). And the mean value of each indicator in the post-test \leq the mean value of each indicator in the pre-test. Paired-samples t-tests of post-test and follow-up assessment scores showed significant differences in emotional response ($p < 0.05$), fear and nervousness ($p < 0.05$), and activity level ($p < 0.05$) among children in the intervention group. The mean value of each indicator in the follow-up assessment phase \leq the mean value of

each indicator in the post-test phase. The final results suggest that PIIs have positive effects in improving imitation, emotional response, fear and nervousness, and non-verbal communication in children with ASD in China, and can have even better effects when combined with rehabilitation training in specialized hospitals or institutions. Therefore, H1 has been verified, and this result also has a high degree of consistency with the results of the previous studies.

Effects on the family quality of life. Descriptive statistics for both groups of parents regarding pre-test, post-test, and follow-up assessment scores on the FQOL Scale are shown in Table 4. Based on the FQOL Scale data (total score and scores on each dimension), the researchers conducted a 2 (intervention group, control group) \times 3 (pre-test, post-test, and follow-up assessment) multifactorial repeated measures ANOVA. From the total score, the main effect was significant, $F(2, 67) = 91.87, p < 0.001$; the groups effect was significant, $F(1, 68) = 35.04, p < 0.001$; the interaction effect of pre-test, post-test and follow-up assessment with groups was significant, $F(2, 67) = 53.92, p < 0.001$.

Based on the above, a further simple effects analysis could be performed. The results showed that there was no significant difference between the intervention group and control group in the pre-test phase, $F(1, 68) = 1.06, p > 0.05$; in the post-test phase, there was a significant difference between the intervention group and control group, $F(1, 68) = 45.80, p < 0.001$; and in the follow-up assessment phase, there was a significant difference between the intervention group and control group, $F(1, 68) = 75.77, p < 0.001$. In the intervention group, there were significant differences between pre-test and post-test, between post-test and follow-up assessment, and between pre-test and follow-up assessment, $P < 0.001$; in the control group, there were no significant differences between pre-test and post-test, between post-test and follow-up assessment, and between pre-test and follow-up assessment, $P > 0.05$. This suggests that PIIs have a positive impact on the life quality (satisfaction) of families of children with ASD.

The researchers then performed a paired-samples t-test on the data from the intervention group. The results are shown in Table 4. The results showed that at the post-test stage, parents in the intervention group had significant differences compared with the pre-test stage on five dimensions: family interaction ($P < 0.001$), parenting ($P < 0.001$), emotional well-being ($P < 0.001$), physical/material well-being ($P < 0.05$), and disability-related support ($P < 0.001$). At the follow-up assessment stage, intervention group parents' assessment data were significantly different from the post-test stage in four dimensions: family interaction ($P < 0.001$), parenting ($P < 0.05$), emotional well-being ($P < 0.05$), and physical/material well-being ($P < 0.05$). It can be seen that the family quality of life (satisfaction) of families of children with ASD in China was significantly improved in the five dimensions of family interaction, parenting, emotional well-being, physical/material well-being, and disability-related support after the PIIs. In addition, after three months, the family quality of life (satisfaction) of these families was maintained to a certain degree. Therefore, H2, H3, H4, H5, and H6 has been verified.

Discussion

This study shows that PIIs for children with ASD in China in the family environment plays a positive role in improving a range of abilities in children with ASD. This view is consistent with the existing studies (Qing et al., 2013). It has been noted that the attachment of children with ASD to their parents is not significantly different from that of normal children. They have the same high level of attachment to their parents as the normal children (SHAPIRO et al., 1987). The attachment of children with ASD to their parents may make family intervention more effective for parents who have received professional training. The study by Koegel et al. (2010) also noted that parents trained in systematic intervention methods for children with ASD can create a more positive intervention environment for their children.

In this study, PIIs for children with ASD in China had a positive effect on several aspects: imitation, emotional response, fear and nervousness, and non-verbal communication. The PIIs

for children with ASD in this study was based on the CST program framework. Therefore, the training focused more on the following areas: deeper parental understanding of ASD and their own child; parent-child communication (verbal or non-verbal); emotional maintenance between parent and child; and improvement of the child's behavior problems (OpenWHO, n.d.). These emphases are consistent with the results of this study. All of these aspects can be summarized as an improvement in the social communication ability of children with ASD. This is consistent with existing studies (Beaudoin et al., 2019). In addition, according to the results of this study, the combination of institutional and family interventions has a more significant effect on the improvement of the ability of children with ASD and a shorter period of time than only receiving intervention treatment from a professional institution, which is conducive to reduce the economic burden of families of children with ASD. PIIs is a cost-effective way of rehabilitation training for children with ASD.

This study also showed that the family quality of life (satisfaction) of families of children with ASD in China improved in several areas after the implementation of family interventions. It has been shown that the family quality of life of families of children with developmental disabilities is significantly and positively correlated with the level of social support (Fallahchai and Fallahi, 2022), and that access to social support facilitates better children care for families and is important for meeting parents' emotional needs and maintaining their psychological well-being (Feng et al., 2022). Therefore, the PIIs may also contribute to the improvement of family quality of life (satisfaction) of families of children with ASD as an emotional support, information support, and instrumental support (Gao et al., 2023). A good family quality of life has a positive effect on the well-being as well as the future development of children with ASD and their families (Feng et al., 2022; Kuhlthau et al., 2014; Logrieco et al., 2022).

Conclusions

This study found that PIIs are effective in enhancing the social communication ability of children with ASD in China. It is also effective in enhancing the family quality of life (satisfaction) of families of children with ASD in China from the areas in family interaction, parenting, emotional well-being, physical/material well-being, and disability-related support. PIIs is a good and cost-effective complement to rehabilitation training in professional institutions. PIIs have positive significance for the well-being and sustainability of children with ASD and their families.

Limitations and implications for future research

First, the sample for this study is from a single source, and future research needs to be conducted with a broader sample scope based on the diversity of China's population, geography, culture, etc. Second, based on the Chinese local context, there is a need for a more in-depth analysis of the factors impacting the family quality of life of families of children with ASD in China. Thirdly, regarding the treatment of ASD, intervention training that accompanies individuals with ASD throughout their lives is the only option. However, the high time, economy, and labor costs are not affordable to every family of individuals with ASD. Therefore, in addition to the interventions mentioned in this study, research on social policies, social welfare and social services for individuals with ASD and their families need to be further explored. Fourth, the PIIs in this study had a positive effect on both the social communication skills of children with ASD and the quality of life (satisfaction) of their families. However, what family interventions should be implemented for

individuals with ASD at other life stages? This issue needs to be further studied.

Data availability

With the consent of all participants in this study, all data generated and/or analyzed during this study may be requested from the corresponding author(s), with reasonable requests.

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Author contributions

Conceptualization: Xin Gao, Syazwani Drani; methodology: Xin Gao; data collection and analysis: Xin Gao; writing (original draft preparation): Xin Gao; writing (review and editing): Xin Gao, Syazwani Drani; all authors have read and agreed to the published version of the manuscript.

Competing interests

The authors declare no competing interests.

Ethical approval

The study followed the Measures for Ethical Review of Biomedical Research Involving Human Beings issued by the National Health Commission of the People's Republic of China and the 1964 Helsinki Declaration and its later amendments; Ethical approval for this study was obtained from the Ethics Committee of the Fifth Hospital of Yulin City (Yulin City 719000, Shaanxi Province, China), ethical approval number: 20220112E, date of approval: 12/01/2022. To ensure the interests of the study participants, with permission from the study participants, all original paper data in this study were encrypted and sealed by the archives department of the Fifth Hospital of Yulin City; and during the electronic data entry process, participants' names were encoded and anonymized, and all were stored in encrypted storage device.

Informed consent

Informed consent was obtained from all participants. Children with ASD who participated in this study had their co-participating parents sign an informed consent form.

Additional information

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