



# Progress and challenges in early intervention of autism spectrum disorder in China

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**Abstract:** Autism spectrum disorder (ASD) is a neurodevelopmental disorder whose prevalence has increased rapidly in recent decades. Advances in the fields of intervention for ASD have contributed to a more optimistic outcome for children with ASD. Furthermore, the development of early detection, screening, and diagnosis has highlighted the importance of early intervention for young children with ASD. The present article reviews commonly used intervention approaches for children with ASD in China, including recently introduced approaches and originally developed Chinese models for early intervention, and then briefly summarizes the progress and challenges of intervention in combination with associated services and supports.

**Keywords:** Autism spectrum disorder (ASD); early intervention; China

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Autism spectrum disorder (ASD) is a group of developmental disorders defined by deficits in social communication and social interaction, and the presence of restricted, repetitive patterns of behavior, interests, or activities that can persist throughout life with varying severities (1-3). The Autism and Developmental Disabilities Monitoring (4) Network of the Center for Disease Control and Prevention in America estimates that the ASD prevalence among children aged 8 years in multiple United States communities increased from approximately 1 in 150 children between 2000 and 2002 to 1 in 59 during 2014, more than doubling during this period (2,4-8). Other countries have reported similar prevalence (9-11). In China, autism was first reported by Dr. Tao Guotai in 1982 and has aroused growing attention over the past few decades. In 2013, Sun *et al.* (12) performed a meta-analysis based on 24 epidemiological investigations in mainland China, Hong Kong, and Taiwan between 1987 and 2011 and reported a prevalence of classical autism in China of approximately 11.8 in 1,000 and a prevalence of ASD of

26.6 in 1,000, increasing over time. With the development of early screening and the ability to diagnose ASD before the age of 3 in China, the need for systematic, effective and regular interventions for ASD, especially early intervention for ASD toddlers, has never been greater, and would improve the quality of life and overall prognosis of ASD.

In this review, we will first focus on the overall trend of development and services of intervention for children with ASD especially in developed countries. This will be followed by a review of interventions used in China, including early intervention with very young children. Finally, the challenges of intervention of ASD in China will be outlined.

## Development and services of intervention and education for children with ASD worldwide

As the study of operant learning treatment for autism increased during the 1960s and 1970s (13-15), the

effectiveness of the method in improving language (16), social (17), self-help, and academic skills (18), in addition to reducing challenging behaviors (19), emerged. Later in the 1980s, the representative treatment model of behavioral-based intervention for autism, applied behavior analysis (ABA), was developed and proved to be effective in improving the IQ of children with autism (20), with discrete trial training (DTT). Since then, various models based on ABA have been developed and conducted with ASD patients.

Almost at the same time, the works of Piaget *et al.* (21,22) laid the foundations of modern developmental psychology. Researchers in the field showed that children, especially those with autism, learn best when they are engaged as active participants in developmentally appropriate learning experiences and in meaningful contexts of affectively rich social interactions (23). Accordingly, some developmental and relationship-based intervention approaches such as the Denver model, the developmental, individual difference, relationship-based model (DIR/Floortime™) (24), relationship development intervention (RDI) (25), and the social communication, emotional regulation, and transactional support model (SCERTS) (26) emerged successively.

With the development of behavioral and developmental disciplines applied in the interventions for ASD children and reflection of limitations respectively, naturalistic developmental behavioral interventions (NDBIs) (27), which emphasize the integration of developmental principles and sequences with behavioral strategies, was proposed and has been implemented in ASD children, especially in younger ASD toddlers. This method focuses on helping children with ASD learn developmental-matched, integrated skills across the entire range of developmental domains in a meaningful, emotional-social context using behavioral techniques such as shaping, fading, discrimination training, and errorless learning. Among NDBIs, there are focused interventions [e.g., incidental teaching (IT) (28); reciprocal imitation training (RIT) (29)] and comprehensive interventions [e.g., early start Denver model (ESDM) (30,31)]. There have been an increasing number of studies that give support to NDBIs as validated, evidence-based treatments.

In general, parents of children with ASD experience more challenges and stress associated with decreased feelings of efficacy, increased mental and physical health problems, and significant economic burdens. Therefore, families of children with ASD need to be provided with a

variety of supports. In the United States, the Individuals with Disabilities Education Improvement Act (IDEA) requires states that receive federal money to provide early intervention services for infants and toddlers (younger than 3 years) with disabilities and education and related services for children of 3 to 21 years (32). Another important mechanism used in America to provide these supports are the home- and community-based services (HCBS) waivers which provide hospital, nursing home, and other institutional care for people with disabilities, including ASD (33). The United Kingdom, France, and Spain also have policies specifically designed for autistic individuals (34). The support for families is indeed associated with positive impact on family quality of life (FQoL) and child progress (35,36). However, in some developing and low-income countries, such as Vietnam (37) and Ethiopia (38), resources and policies for supporting children with ASD are still very limited.

## Interventions for children with ASD in China

### *Preliminarily used interventions*

#### **ABA**

ABA was developed based on theories of learning and operant conditioning (20). When operating, structured ABA approaches usually define DTT, which are addressed through intensive trials of antecedent-behavior-consequence chains to help ASD children shape positive behaviors. The core techniques of ABA mainly include task analysis, reinforcement, prompting, fading, shaping, and chaining. As one of the earliest and most effective operational comprehensive interventions for ASD, ABA is also most commonly used in China.

A randomized controlled trial (RCT) performed by Yan *et al.* (39) demonstrated that compared with children who received conventional intervention (including physical therapy, and sensory and auditory integration therapies), children who received extra ABA intervention (30–40 hours/week for 6 months) showed significant improvements in autism severity, developmental outcomes, quality of daily life, and social function. However, another self-control study by Ding *et al.* (40) showed the 3-month ABA training for ASD children might not have satisfying advantages on improving the quality of life. It should be noted that Ding *et al.* did not describe the intensity of their ABA intervention.

### **The treatment and education of autistic and related communication handicapped children (TEACCH)**

The TEACCH program was developed by Schopler and his team at the University of North Carolina in the 1970s. Taking advantage of the visual dominance of ASD children, the intervention strategies emphasize physical and visual structure, schedules, work systems, and task organization, which constitute an individualized system for ASD individuals.

In 2005, Zou *et al.* (41) reported that participants receiving intensive home-based short-term TEACCH (42 hours/week for 6 month) intervention showed significant progress in language, social interaction, behavior, and sensory perception assessed by Autism Treatment Evaluation Checklist (ATEC). A longitudinal study by Tsang *et al.* (42) illustrated that after receiving TEACCH training for 6 months, the experimental group subjects demonstrated significantly more improvement than those in the control group in the perception, fine motor, and gross motor domains. A recent RCT demonstrated improvement in cognition, language comprehension, nonverbal and verbal behavior, emotional expression, and adaptive behaviors following the implementation of TEACCH in hospital for 6 months (43). Additionally, Huang *et al.* (44) noted that home-based TEACCH interventions could reduce the anxiety and depression of mothers with ASD children.

### **RDI and developmental, individual-difference, relationship-based/Floortime™ (DIR/Floortime)**

The RDI program was developed by the psychologist Steven Gutstein (45) in the 1990s. RDI is a family-based program focusing on cultivating the foundation of social connection—such as social referencing, emotion sharing, and experience sharing, leading to the child's eventual competence as an active participant in dynamic, emotion-based systems (25). Similarly, the DIR/Floortime™ model of Greenspan and Wieder (46) focuses on relationships, social skills, meaningful, spontaneous use of language and communication, and an integrated understanding of human development.

Self-control studies by Wang *et al.* (47,48) showed that after 6-month RDI intervention, children with ASD demonstrated significant improvement in language and social interaction. When extending the duration of intervention to 12 months, the behavior also showed significant development, but still no significant development in sensory perception. The DIR/Floortime™ model has usually been delivered in combination with other approaches such as TEACCH and sensory integration training, as

part of a comprehensive intervention in domestic research. Findings (49,50) suggest that participants receiving DIR/Floortime™ gained significant improvements in language, reciprocal interaction, behavior, and sensory perception. Liao *et al.* (51) from Taiwan reported that ASD children made significant changes in emotional functioning, communication, and daily living skills. Moreover, the mothers perceived positive changes in their parent-child interactions. A case study using DIR/Floortime™ alone (52) revealed that subjects showed various degrees of improvement in 7 domains found in The Chinese Edition of Psychoeducational Profile, Third edition (C-PEP-3) after an 8-month intervention.

### **Visual support**

#### **Picture exchange communication system (PECS)**

PECS (53) is an augmentative and alternative communication (AAC) (54) system developed for non- or minimum-verbal children with ASD. It aims to facilitate spontaneous social-communication skills using symbols or pictures, based on behavioral principles (55). An early RCT (55) indicated increased rates of pupils' initiations and use of symbols but the effects were not maintained. A meta-analysis (56) in 2010 reflected small to moderate gains in communication but small to negative gains in speech. More recent studies have reported more positive results in improving social communicative skills (57) and interactions between peers with autism (58). Yang *et al.* (59) conducted a self-control PECS study showing improved social skills, sensory cognitive awareness, and language.

With the development of technology, some new, high-tech forms of AAC, for example, speech generating devices (SGDs), have been rapidly adopted in interventions of ASD. Studies comparing SGDs and PECS (60-63), including an RCT (64), have commonly found equally significant improvements in social-communicative skills and/or requesting. A study in China (65) also suggested the SGD, called Yuudee, was a useful tool for helping minimally verbal children with ASD make requests.

#### **Video modeling (VM)**

VM was developed by Buggey *et al.* (66) based on Bandura's social learning theory (67) which suggests that social learning occurs through observation. VM includes basic VM (adult or peer modeling), video self-modeling (VSM), point-of-view modeling, and mixed modeling. VM, taking advantage of the visual dominance of ASD children, can be applied in both low- and high-functional children. Moreover, it is convenient in that it uses numerous models

to maintain and generalize targeted skills.

An early meta-analysis (68) of 22 single-case research design (SCRD) studies concluded that VM, including VSM, produced improvements in social communication skills, functioning skills, and behavioral functioning. Afterwards, several reviews (69-71) reported similar positive results, especially in social communication skills. A domestic study by Li *et al.* (72) comparing the effects of VM and *in vivo* modeling demonstrated that VM showed significant advantages in improving and maintaining the social communication skills of ASD children.

### Virtual reality (VR)

VR is an artificial environment experienced through multisensory stimuli (such as sights and sounds), including some interactive video gaming and virtual environments (73). VR has emerged as an effective new intervention approach for ASD, allowing ASD children to be trained in a manipulated realistic environment thus reducing their anxiety from unpredictable conditions. A recent meta-analysis (73) of 31 studies including 602 subjects aged 3 to 20 found moderate evidence supporting the effectiveness of VR-based interventions in ASD, especially in social, emotional, daily living, and communication skills. However, only 10 of the 31 studies compared an experimental group with a control group, while the others evaluated only the impact after intervention. It should be noted that ASD patients with lower verbal IQ and executive function might need more support when completing tasks in a VR environment (74).

A case-control study by Wang *et al.* demonstrated that digital audio-visual integrated systems combined with VR technology had a short-term effect for children with autism in improving language, and cognitive, social, and self-care ability (75).

Most studies of the above visual-support-related interventions were small-sampled without control groups and/or adequate steps. Future studies should be validated through well-designed evaluation processes with expanded samples and consider combining these techniques with other behavioral interventions.

### Peer-mediated intervention (PMI)

PMI is a treatment approach in which peers (e.g., classmates) are trained to participate in the intervention and implement instructional programs, behavioral interventions, and facilitate social interactions (76). PMI directing interaction among peers helps foster inclusion in school settings and generalize their acquired skills across individuals and settings (77). Therefore, PMI may be

advantageous for ASD individuals and has been proven effective in inclusive settings (78-81). Moreover, PMI can be implemented in combination with other intervention approaches, including pivotal response training (PRT) (82), PECS (83) and VM (84), to further improve the effect of intervention.

An RCT by Luo *et al.* (85) revealed that PMI could further reduce the anxiety and depression of ASD children, and improve their activity of daily living significantly on the basis of conventional intervention. It is worth noting that the peers participating in the intervention were relatively well-recovered ASD children (children with ASD, and with relatively good receptive and expressive language skills, communication skills and adaptive skills after intervention), rather than typically developing children. Studies of PMI with large samples are still scarce, partially because of the lack of inclusive institutions and professionals. In the future, it is hoped that PMI will be delivered by typically developing classmates, siblings, or cousins of ASD children in inclusive educational institutions.

### Other intervention approaches

Studies of other assistant approaches of ASD intervention, such as sensory integration training (86), auditory integration training (87-89), music therapy (90,91), and play-based therapy (92,93), have been conducted in China, including some RCTs. These interventions have been proven to have certain effects in improving social communicative behaviors, speech, sensory perception, adaptive behaviors, and play skills, as well as reducing repetitive behaviors, self-stimulating, and aggressive behaviors. Most studies, especially in music and play-based therapies, were short-term case studies without systematic design and longitudinal follow-up. The limitations in the study designs and evaluation processes mean that conclusions should be made with caution.

### Early intervention developing in recent years

#### ESDM

ESDM, developed by Rogers and Dawson, is a representative approach of comprehensive NDBI and is appropriate for ASD children between the developmental ages of 12 and 60 months. ESDM focuses on implementing intervention activities based on relationship and development, while simultaneously integrating strategies from ABA. The positive effect of ESDM has been documented by previous studies (30,94-99). Reports from the first RCT (30,31) indicated

that ESDM intervention delivered by therapists for 2 years improved cognitive, linguistic, and adaptive behavior and reduced severity of symptoms of ASD toddlers compared with community interventions, with these gains being maintained 2 years later (100).

ESDM was introduced into China in 2013 by Dr. Xiu Xu of the Children's Hospital of Fudan University, and the manual guides for professionals (101) and parents (102) have been translated into Chinese. Several researchers have performed controlled trials of ESDM intervention. A non-randomized RCT (NRCT) by Zhou *et al.* (103) using parent-delivered ESDM (P-ESDM) under the guidance of professionals for 24 weeks indicated that the P-ESDM group demonstrated greater improvement in developmental outcomes (especially in the language domain), social affect, parent-reported social communication, and symbolic play. Although neither group demonstrated significant change in ASD severity, parents in the P-ESDM group experienced decreased parenting stress when compared with the community group. A recent study by Li *et al.* (104) illustrated that ESDM is more effective in improving the aberrant behavior of children with ASD than conventional treatment. Xu *et al.* (105,106) reported that 5 hours per week of ESDM intervention by professionals for 8 weeks could significantly improve interpersonal relationships, imitation, emotional expression, perception, communication, and ASD severity measured by Childhood Autism Rating Scales (CARS), when compared with the control group.

Furthermore, Vivanti *et al.* (96) implemented ESDM in a group-based community childcare setting (group-ESDM) with a child-staff ratio of 1:3 and an intensity of 15–25 hours per week for 12 months. Compared with peers with ASD receiving a different intervention program in a similar community childcare service, participants in the group-ESDM showed significantly higher gains in developmental rate and receptive language. Therefore, group-ESDM would be promising if applied in community services, inclusion kindergartens, or other group settings.

### PRT

PRT was developed by Koegel (107) and is based on ABA in a more natural way to facilitate generalization, increase spontaneity and motivation, and reduce prompt dependency. The basic premise of PRT is that positive changes in pivotal areas including responsivity to multiple cues, motivation, self-management, and self-initiation can result in widespread positive effects on many other behaviors (108). Compared with adult-centered or

structured ABA, children demonstrated significantly lower levels of disruptive behavior and greater gains in communicational skills, especially verbal expressive communication measured by mean length of utterance during the PRT condition. Numerous research studies using PRT in various settings including clinics, children's homes, communities, preschools, and middle schools (82,109-116) have supported its effectiveness in improving social, communicational, and developmental outcomes. Moreover, results of a functional magnetic resonance imaging (fMRI) study (117) suggested the functional changes induced by PRT were marked by a shift in connectivity from the orbitofrontal cortex to the occipital-temporal cortex, which is involved in social perception. In an Asian context, there also have been several studies in Korea (118-120) supporting the applicability of the PRT model. PRT has been introduced into China and applied in some intervention centers (121,122); however, the effectiveness of PRT in China needs further examination.

### SCERTS

The SCERTS model is a comprehensive and multidisciplinary educational approach developed by Prizant and Wetherby which focuses on enhancing the social communication and emotional regulation (ER) of children with ASD through transactional support (TS) including educational, learning, interpersonal, family, and professional supports (26).

An RCT with an individual early social interaction (individual-ESI) group and a group-ESI group applying the curriculum of SCERTS (123) suggested that children in the individual-ESI group showed differential change on social communication and receptive language skills measured by an examiner, in addition to improved communication, daily living, and social skills reported by parents, when compared with the Group-ESI. A recent study in Hong Kong (124) implementing a SCERTS model-based intervention with different durations (5 *vs.* 10 months) revealed significant improvements of children with ASD in social communication and emotional behavior, as well as motor ability and adaptive behaviors. However, in both trials, there was no group used as a control who did not receive SCERTS-related intervention, and very few other studies have examined the effectiveness of the model. Therefore, the efficacy of SCERTS needs to be further investigated.

### Other evidence-based approaches of early intervention for ASD

Several well-designed RCTs have shown that Preschool

Autism Communication Trial (PACT) (125,126), Joint Attention Symbolic Play Engagement and Regulation (JASPER) (127,128), and RIT (29) are also effective approaches for early intervention of children with ASD. However, more empirical studies need to be conducted in China to prove the effectiveness of these approaches.

### *Recent new interventions originally developed in China*

#### **Parental skill training (PST)**

Considering the characteristics of the learning process and the importance of parent's participation in early intervention of children with developmental disorders, especially for toddlers younger than 3 years, the World Health Organization has developed a Caregiver Skills Training (CST) program for children with ASD and developmental disorders. Members of Dr. Xiu Xu's team in the Children's Hospital of Fudan University have attended the training of CST, and then developed a series of curricula for PST, combining the framework of CST and the strategies of ESDM. The training courses involve setting up an environment, developing objectives (verbal communication, non-verbal communication, social interaction, imitation, fine motor skills, etc.), designing activities, dealing with challenging behaviors, etc.

The primary results of an ongoing pilot study (unpublished) of PST suggests that after 8-week parent training, both parents' knowledge and techniques of intervention for ASD improved, but the change in children has not been evaluated. They are further improving the training course according to feedback from parents and planning a long-term, community-based RCT with a reasonably longer duration of parent training and follow-up.

#### **Behavior-structure-relationship (BSR) model**

The BSR model (129) was developed by Dr. Xiaobing Zou of the Child Developmental Behavior Center, The Third Affiliated Hospital, Sun Yat-sen University. Based on the theory of child developmental psychology and the methods of ABA and RDI, the BSR model aims to manage challenging behavior, cultivate behavioral function, set up the structural teaching, and improve the social ability of children with ASD.

An RCT (130) recruited children aged 2 to 6 years with ASD and compared the effects of the experimental group (n=70) receiving BSR intervention in hospital for 6 hours/day with a duration of 1 month and the control group (n=71) receiving any intervention available. Both

groups were evaluated by Psychoeducational Profile, Third Edition (PEP-3) before and after intervention. Results showed that the experimental group showed significant gains in raw scores of cognition, language comprehension, imitation, emotional expression, social interaction, non-verbal behaviors, and adaptive behavior. However, authors mentioned that not all children benefited from the intervention, which might be influenced by the individual differences and severities of symptoms and the degrees of parents' cooperation. The long-term effect of the BSR model needs to be validated through more well-designed studies with expanded samples and comprehensive evaluations. Furthermore, systematic parent training and coaching should be emphasized to facilitate the maintenance and generalization of acquired skills.

#### **Play-based communication and behavior intervention (PCBI) model**

Dr. Xiaoyan Ke *et al.* from Nanjing Medical University developed the PCBI model based on the theory of development and behavioral management strategies, emphasizing parent coaching and participating in home-based intervention in daily life. The main content of PCBI sessions includes behavior training and management, and play-based training of social skills.

Researchers designed a self-control study and an RCT (131) to explore the short-term effects of the model for ASD toddlers. The results of the self-control study demonstrated that after 12-week PCBI intervention, toddlers with ASD (n=104, aged 8–30 months) showed significant improvement in overall development outcome evaluated by Portch's Early Developmental Behavior Checklist and ASD severity by the ATEC. In the RCT (n=74, aged 19–30 months), compared with the control group (n=37) who received ABA intervention, children receiving PCBI (n=37) gained greater improvements in cognition and equivalent improvements in language, motor, and self-care function along with ASD severity. Additionally, PCBI could partly alleviate parenting stress, and relatively low-income parents tended to improve more significantly.

However, the main limitation of the study is that all evaluations for effects of the intervention were parent reported, instead of results assessed by professionals. Furthermore, the diagnoses of subjects in the study might need to be further confirmed by some diagnostic instruments, such as Autism Diagnostic Observation Schedule-Toddler and Autism Diagnostic Interview-Revised. Especially for infants, the diagnosis of ASD needs

to be more cautious with longitudinal follow-up.

## Summary of intervention for ASD in China

### Progress

With a growing appreciation among practitioners of the importance of early screening for ASD, several well-designed studies (132,133) based on two-stage screening during routine health care and personal observation or interview have proved it effective for improving the early diagnosis of ASD. Thus, more well-designed studies focusing on early intervention for ASD toddlers younger than 30 months have been conducted and published in recent years. The starting age of early intervention for ASD has tended to grow younger.

Meanwhile, with the introduction and popularization of the NDBIs, an increasing number of practitioners have realized the importance of the roles of social interaction and the relationship between parents and children, as well as the roles of families and home-based settings as the “naturalistic” environment. Therefore, parent-training and parent-delivered intervention under supervision from professionals have been emphasized and evaluated in a growing number of studies, and the feedback from parents also has become an important indicator for evaluating early intervention models (103,131).

In general, the early intervention for ASD has been gradually changing from adult-centered highly structured training to child-led and home-based naturalistic training. The gaps between the age of intervention start and parents' participation have been narrowing. Moreover, support and guidance for early intervention to families of children with ASD from professionals have been increasing. In 2017, “Expert Consensus of Early Identification, Early Screening, and Early Intervention of Autism Spectrum Disorder” (134) was published in the *Chinese Journal of Pediatrics*, one of the most authoritative academic magazines in China in the field, with the aim to improve the capacity of pediatricians in the early identification and the overall awareness of early intervention.

It is rather remarkable that the application of advanced technology, including virtual reality, artificial intelligence, and robotics (135), along with their combinations with behavioral interventions, has been developing rapidly in China. Their controllability and predictability in input of stimuli and reaction to participants would be advantageous in intervention of ASD, making them promising in the future.

Besides therapists and parents, support from society and the government also has a significant positive impact on the effectiveness of intervention for children with ASD. Domestic studies suggest that social support helps parents increase the positive ways of coping with their children with ASD, thus improving the effectiveness of their intervention and quality of life (136,137). The support for intervention and rehabilitation of children with ASD from the government has also been improving. During 2011–2015, the Rehabilitation Project for Poor Children with Autism had been implemented by China Disabled Persons' Federation with a fund input of over ¥400 million, providing allowance for intervention to nearly 40,000 children with ASD (138). During the past decade, over 6,000 professionals on rehabilitation for ASD have been trained with the support of the government. On 1 October 2018, the Rehabilitation Assistance System for Disabled Children was in full implementation, and included children aged 0 to 6 years with ASD (139). With the advancement of social assistance, a growing number of children with ASD and their families would have access to systematic training with support from the society and government.

### Challenges

Despite the significant progress of the above-mentioned interventions for ASD in China, there are still many challenges for professionals, families, and society as a whole.

First, due to the heterogeneity of the clinical manifestations of ASD and different trajectories of its onset reflected in behaviors (140), early detection and screening merely depending on behavioral indicators has limited effect in advancing the age of early diagnosis and intervention. Most children are diagnosed with ASD between the ages of 3 to 4 years in China and receive intervention even later than this (141). An increasing number of studies have supported the notion that some indices, for example, event-related potentials (ERPs) to faces and speech (142), might be promising in predicting the diagnosis. Therefore, well-designed prospective case-control studies need to be implemented to explore and confirm some practicable and valid objective indices, including neurophysiological risk indices, structural, chemical, and functional brain imaging, and biomarkers in blood and/or body fluids, to help further detect high-risk children in their early childhood, even in infancy, and to advance early intervention.

Second, multidisciplinary cooperation is quite crucial for early ASD intervention. However, the subspecialties

involved, such as speech-language pathology, occupational therapy, and physical therapy, have not been fully developed in China, leading to a shortage of professionals and therapists in these fields. Another area of concern is the disparity in services in terms of availability, quality, and utilization between regions and families with different levels of educational and financial resources.

Third, although the Chinese government has invested a large quantity of financial and human resources to support and facilitate the development of intervention for children with ASD, the resources and services remain relatively insufficient because of the huge base of population and patients in China. An investigation (141) into the parents of children with ASD in 2013 from Shanghai, Beijing, and Shandong revealed that almost 90% (89.7%) of the participants reported needing more financial support, and 100% indicated the need for more appropriate services. A more recent investigation (136) into 509 parents of children with ASD demonstrated that formal social support from the government, institutions, and schools was scarce, while informal support from family members and social relations was still the main source of support. It should be noted that apart from instrumental and informative support, emotional support is also important to parents and families of children with ASD. The government, professionals, social workers, non-government organizations (NGOs), and social enterprises could be integrated to build a stable and comprehensive social support system for children with ASD and their families.

Fourth, due to the insufficiency of training services organized by the government, private institutions and services are the main choice of most families of children with ASD, especially for early intervention during the pre-school period. However, there is a lack of training of frontline staff in techniques for a spectrum disorder as heterogeneous as autism (143). As for the selection of approaches for intervention in these institutions, the most commonly used approaches are still behavioral-intervention-based ABA, sensory integration training, and TEACCH (144). Moreover, staff in most private institutions have a very limited knowledge of development- and relationship-based interventions and NDBIs. Therefore, the quality of intervention in private institutions needs to be addressed.

Last but not the least, although school-age children and adolescents with ASD could receive education in special schools founded and supported by the government, there is a lack of systematic training of social function and work

skills for them to integrate into society to the utmost. One study (144) discovered that 72.2% of parents hoped that the government would provide sheltered or supported employment to ASD individuals, and 58.3% expected to receive home care support. Therefore, how to provide appropriate and systematic support services for the whole life cycle of individuals with ASD according to their different levels of function urgently needs to be considered.

In summary, studies and services of intervention for children with ASD, especially early intervention for younger toddlers in China, have evolved rapidly during the past two decades. Nevertheless, we must endeavor to establish a more comprehensive service system for individuals with ASD and their families—one which includes public awareness, early screening and monitoring, evidence-based intervention programs, special and inclusion educations, and extensive support from society.

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