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Transition to school for children with autism spectrum disorder: A systematic review

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Abstract

AIM

To identify factors that promote a positive start to school for children with autism spectrum disorder (ASD).

METHODS

Web of Science, MEDLINE, Scopus, and PsychINFO searches were conducted to identify literature published after 1991 and relevant to school transition processes in children with ASD. Twenty studies were deemed eligible for inclusion. These studies evaluated a range of factors including school readiness, parent and teacher perspectives on transition practices, characteristics of children with ASD that are associated with successful transition to school and the impact of school based intervention programs.

RESULTS

A review of these studies showed that children with ASD are less school ready emotionally than their peers and those children with ASD appear to have more externalising behaviours and self-regulation difficulties that affect their school engagement and their relationships with their teachers. There was a paucity of research looking at interventions targeting school readiness. However, school-based behavioural interventions appear to improve cognitive, language and daily living skills, but have less impact on socialisation and peer inclusion.

CONCLUSION

Children with ASD face more challenges transitioning

to school, particularly with social interaction. Further development and implementation of specific school-based interventions is needed in order to assist children with autism to maximise their success in starting school.

Key words: Autism spectrum disorder; School transition; School readiness; School preparation; School based intervention

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Core tip: This systematic review examines current school transition research for children with autism spectrum disorder (ASD), focusing on school readiness, parents and teachers school transitions expectations and experiences, individual factors affecting school transition and school-based interventions. Research in this area is disparate and sparse, but suggests that children with ASD have more difficulty adjusting to school, particularly in relation to active engagement and social interactions with the teachers and peers. Teachers and parents agree comprehensive transition processes are needed throughout the first years. School-based intervention programs in the first years can improve cognitive, language and daily-living but more interventions are needed targeting social interaction.

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INTRODUCTION

Starting school is a major event in any child's life and while for children with disabilities this transition can be challenging^[1], this is particularly significant for children with autism spectrum disorder (ASD). The unique social, communication and behavioural difficulties that children with ASD experience may present additional barriers to a positive start to school^[2,3]. This is particularly relevant as teachers rate social skills as more important than academic skills for successful kindergarten adjustment^[4]. An increasing body of evidence supports the notion that children who have a positive start to school are likely to engage well and experience academic and social success^[2,3]. Children with ASD have a greater risk of poor school outcomes including emotional and behavioural problems^[5] and bullying^[6] that result in school exclusion^[7] or peer rejection^[8]. It is therefore critical that protective factors, as well as barriers to positive school transition in children with ASD are identified and understood^[2,3].

The transition process begins at pre-school age whereby the child is prepared for school while also

evaluating if the child is "ready", described as "school readiness". Typically, the focus has been on the child "gaining competence" in a range of areas; emotional, behavioural, social and academic^[9]. However, it is equally important that parents, schools and teachers are prepared for the special needs of children with ASD. Consequently, it is important to identify the strengths and deficits of children with ASD before they start school, as well as obtaining multiple perspectives from all parties. For this transition process to be successful, intervention and support needs to go beyond the preparation stage and continue after the commencement of school. Decades of research has demonstrated the positive effects of early intervention programs for children with ASD and also the success of later intervention programs for school-aged children. However, substantially less research has specifically evaluated school-based interventions^[10,11]. Additionally, much of this research has focused on the later years and not the critical "transition to school" period in the first years of primary school^[11]. Finally, for children with ASD, interventions targeting socialisation and communication skills are critical. In order to provide a successful start to school for these children, it is therefore important to develop school-based programs that target a range of skill development across behavioural and social as well as academic domains. However, to develop evidence-based programs, it is important to first establish what aspects of current school-based interventions have been successful in targeting a wide range of skills and behaviours.

While there has been considerable research undertaken on typically developing children's transition to primary school, there is a paucity of empirical studies that examine transition to school for children with ASD^[4,12]. Additionally, the research available is not disseminated and there is a lack of synthesis of the available evidence that means that strengths and weaknesses in our current knowledge base are not readily apparent. Thus, there is a great need to establish and consolidate the current evidence on how and when children with ASD are ready for school, the types of supports required by children with ASD, their families and schools, and specific interventions and individual factors that serve to enable a positive start to school. This paper will review the existing research on the preparation and transition of children with ASD to primary school. Specifically, this systematic review aims to examine: (1) School readiness of children with ASD; (2) Parents' and teachers' views and experiences of the school transition process for children with ASD; (3) The characteristics related to positive school transition experiences for children with ASD, such as individual characteristics of the child as well as family variables and teacher, classroom and school characteristics; and (4) School-based interventions to enhance school readiness and transition in the first years of school that were associated with successful school transition for

children with ASD.

MATERIALS AND METHODS

Search strategy

Studies included in this review were located by searching the following electronic databases; Web of Science, MEDLINE, Scopus, and PsychINFO from January 1991 and April 2016. The search was limited to articles published after January 1994, given the adoption of the Individuals with Disabilities Education Act in the early 1990s by the federal government in the United States of America with autism included as a special education category^[13], as well as the DSM expanding the definition of autism to include Asperger syndrome. The search was also limited to English language articles only. Secondary searches outside the official databases listed above were undertaken of relevant government and not for profit organisation websites, and ancestral searches were undertaken of the reference lists and reverse citations of included studies.

Searches were undertaken using a combination of the following descriptors: Autism, ASD, pervasive developmental disorder, pdd-nos, ASD, Asperger's syndrome, school transition, school readiness, school preparation, school adjustment, school engagement school entry, school based intervention, elementary school, primary school, kindergarten, preschool, educational interventions, early education, learning/mathematics/reading/literacy ready, learning/mathematics/reading/literacy achievement, learning/mathematics/reading/literacy acquisition and learning/mathematics/reading/literacy development. This broad range of keywords was used in an attempt to capture all articles relevant to the school transition process for children with autism.

Inclusion and exclusion criteria

Inclusion eligibility was based on the following seven criteria. First, only studies that specifically examined children with autism were included. Second, the age for starting school varies from country to country but generally is between 3 and 8 years. Any articles outside of this age range were excluded. Articles with children over 8 years were included if it was a longitudinal study with a baseline within the appropriate age range or if the study was cross-sectional with a younger age group identified and examined as a separate condition within the appropriate age range. Third, survey and interview studies must have targeted parent and teacher views of school transition experiences or school readiness experiences. Fourth, studies assessing and/or monitoring functioning and adjustment in the first year of school were included. Fifth, school based intervention studies in the first year were included if they targeted school readiness or school transition. Intervention studies did not need to discuss school transition specifically but had

to be school based with outcome measures that targeted school transition factors (*e.g.*, general academic progress and/or social development). Intervention studies in first years of school only targeting very narrow and specific outcome measures (*e.g.*, word learning) were excluded. Intervention studies prior to school commencement must have used specific school readiness outcome measures and school readiness needed to be assessed at critical time point. Sixth, single-subject studies with small sample sizes (< 5) were excluded. Finally, PhD dissertation studies that had not been subsequently published as a peer reviewed journal article were included (dissertations that had been rewritten as a published manuscript were excluded).

Data extraction and synthesis

The titles and abstracts of the initial search were screened to identify potentially relevant articles. The first and second authors independently assessed the full-text of these publications for eligibility and any disagreements about inclusion were resolved through discussion and consensus. Study characteristics, number of participants, participant data including diagnosis, age range, intervention, and outcome measures were extracted and recorded on a data extraction form.

RESULTS

Studies identified and included

The initial search identified 1575 publications (excluding duplicates). After screening, 137 were identified for full-text review and of these, 20 met the selection criteria and were included in this review (Figure 1). These articles were grouped according to four criteria: School readiness ($n = 4$); parents' and teachers' school transition expectations and experiences ($n = 4$); individual factors affecting school transition ($n = 5$); and school based interventions ($n = 7$). An overview of the included articles is presented in Table 1.

School readiness

Three studies examined school readiness in children with ASD. However, there was substantial heterogeneity in the study designs and outcome measures. Nonetheless, these studies appear to indicate that while children with ASD show basic academic school readiness, they do not appear to be ready in the areas of social skills and daily living skills. A study by Crane^[14] demonstrated that children with ASD enrolled in special education in pre-school through second grade had significantly poorer self-help skills, self-control and relationships than children with learning disabilities, speech/language impairments, emotional difficulties, and health problems. Moreover, a recent study by Klubnik *et al.*^[15] examined understanding of school-based concepts and self-/social awareness concepts in children with ASD and Intellectual Disability (ASD/ID) and ID. Results revealed that when controlling

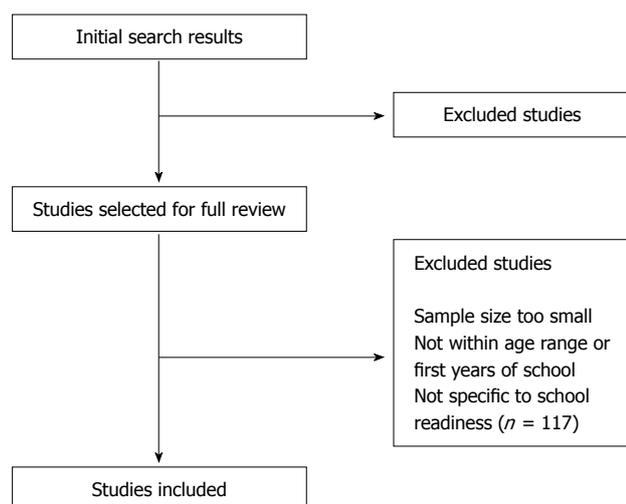


Figure 1 Search flow chart.

for age, IQ and communication skills, children with ASD/ID had significantly poorer understanding of self-/social awareness concepts than children with ID. Additionally, within the ASD/ID group, understanding of academic concepts (*e.g.*, numbers, letters) exceeded understanding of self-/social awareness concepts by more than one standard deviation, suggesting that although children with ASD may have a relative strength in academic readiness, they appear to be significantly behind their non-ASD peers in terms of social readiness.

Matthews^[16] examined the link between early childcare experiences, friendship quality, Theory of Mind (ToM), and school readiness in children with ASD and their typically developing peers, and found poorer positive friendship quality, ToM, and school readiness in children with ASD. For all children, more positive friendship quality was associated with higher social-emotional school readiness and self-help school readiness, and was positively related to ToM in children with ASD, but negatively related ToM in controls. Child care experiences were not associated with ToM in either group. In fact, more time spent in child care was associated with poorer school readiness for children with ASD. Finally, ToM was also positively related to cognitive/motor school readiness, mediated by receptive language ability, for children with ASD.

Waddington and Reed^[17] was the only study found that looked specifically at an intervention that prepared children with ASD for school. This study examined the Preschool Inventory of Repertoires for Kindergarten (PIRK; Greer and McKorkle, 2003 as cited in^[17]) to determine its effectiveness in transitioning children to primary school. Specifically, they investigated whether using the PIRK teaching program had an impact on skills and behaviour and enabled children to transfer from special to mainstream schools. Children's progress in the PIRK program, a program based on Applied Behaviour Analysis (ABA) targeting individual children's specific curriculum deficits, was compared with the

progress of children with ASD in an education as usual group, which had eclectic intervention approaches. Children in the PIRK program displayed improved communication and daily living skills. Importantly these improvements facilitated the transition process and continued in mainstream schools for these children. However, the children's social skills did not appear to improve as a result of the PIRK program^[17].

Overall, these studies indicate that children with ASD are less school ready in social-emotional areas than both typically developing and developmental delayed peers. In addition, there is a preliminary suggestion that interventions targeting school readiness can improve communication and self-help skills. However, further intervention targeting social skills may be required.

Parents and teachers school transition expectations and experiences

In total, four autism-specific studies investigating teachers' and parents' perspectives of children with ASD on particular transition practices were identified in the literature. The elements for successful transition to school were fairly consistent across these studies^[1,2,4,18]. These centred around the following themes: "Child visit, parent information, teacher sharing, placement identification, decision support, sending teacher, support identification, evaluation administrator, visit support, and peer preparation"^[18] (p. 135). These studies also consistently showed that parents, carers, preschool and primary school teachers strongly endorse all of these practices for transitioning children with ASD into primary school^[1-3,18]. Unfortunately, while all the relevant stakeholders consider these practices important, teachers report that few of these practices are actually implemented in real-life settings^[1,3,4]. Quintero and McIntyre^[1] surveyed 96 parents and teachers of children with disabilities, 19 of whom had ASD. They found that teachers had substantially more concerns about children with ASD regarding transition to kindergarten than they had for children with other disabilities. While parents and teachers, particularly preschool teachers, were highly involved in the transition process for all children with a disability, transition practices were generic and rarely individualised to each child's particular needs^[1]. Parents reported kindergarten teachers engaged in some settling practices at the beginning of the school year but did not implement transition practices with on-going transition programs nor regular meetings^[1].

One particular transition process highlighted in the literature, as being particularly important, is regular and detailed communication between the relevant stakeholders. Quintero and McIntyre^[1] reported that this process rarely occurs between preschool staff and kindergarten teachers. Preschool teachers reported concerns about the lack of collaboration with kindergarten staff for children with disabilities leading up to school entry and during the transition process. Equally important is parent-teacher communication. There also appears to

Table 1 Summary of studies examining school transition for children with autism spectrum disorder

Author (yr)	Country	Sample	Intervention	Measures	Findings
School readiness Crane ^[14] (2010)	United States	91 children with ASD; 1338 children with ASD and other disabilities	Children received special education services	(DECA; LeBuffe and Naglieri, 1999); (LAP-D; Nehring, Nehring, Bruni and Randolph, 1992), Early Learning Accomplishment Profile (ELAP; Glover, Preminger and Sanford, 2002), (SRUSS), ESI-K, DIBELS, SAT-10	Children with ASD (and developmental delay group) showed the slowest gains over time in the language, cognitive and fine motor domains. Children with ASD had significantly lower scores on the initiative, self-control and attachment scales than all groups except the developmental delay group
Klubnik, Murphy, Campbell, Reed and Warner-Metzger ^[15] (2014)	United States	Exp group: 76 children with ID and ASD, M = 53.60 mo. Comp Group: 47 children with ID, M = 59.25 mo		Stanford-Binet Intelligence Scales, Fifth Edition (SB5; Roid, 2003), Childhood Autism Rating Scale, Second Edition (CARS-2; Schopler, Van Bourgondien, Wellman, and Love, 2010), Vineland Adaptive Behaviour Scale, Bracken Basic Concept Scale- Third Edition: Receptive (Bracken, 2006)	Receptive understanding of self-/social awareness concepts was significantly lower for the ASD/ID group. ASD/ID group had significantly higher school readiness scores than the ID group. The ASD/ID group's the School Readiness Composite was greater than their Self/Social-Awareness subtest
Matthews ^[16] (2014)	United States	Exp: 63 children with a parent-reported diagnosis of ASD, M = 5.16 yr (4-6 yr). Comp Group: 33 TD children, M = 5.35 yr (4-6 yr)		Background information; History of child care; Friendship quality; School readiness - parent report of social-emotional and self-help school readiness; Theory of Mind (ToM Developmental Scale (Wellman <i>et al</i> , 20016; Wellman and Liu, 2004); Appearance-reality (Wellman and Liu, 2004); Second-order false belief (Tager-Flusberg and Sullivan, 1994); School readiness - Cognitive/motor (Cognitive: Concept tasks; Cognitive: Language tasks; Motor tasks); Verbal ability [Peabody Picture Vocabulary Test-III (Dunn and Dunn, 1997)]	Children with ASD, experiencing centre-based care was not associated with cognitive/motor school readiness, social-emotional school readiness, or level of self-help school readiness. Children with ASD who demonstrated more advanced ToM performance had higher cognitive/motor school readiness and levels of self-help school readiness. Both groups, children with more positive friendship quality had higher levels of social-emotional school readiness and self-help school readiness
Waddington and Reed ^[17] (2009) (Study 2)	United Kingdom	Exp group (PIRKS): 12 children with ASD, Baseline, M = 6.7 yr (4.3-10.5 yr), Comp Group (Treatment as usual (TAU)): 15 children with ASD, Baseline, M = 9.1 yr (5.2-15.0 yr)	PIRKS prepare children for inclusion in a mainstream kindergarten; based on ABA; 5 skill areas: Academic literacy, communication, listening, speaking, social self-management, school self-sufficiency, community, physical/motor. Individualised. Teaching takes place 1:1 or small groups	Gilliam Autism Rating Scale (GARS; Gilliam, 1995), Vineland Adaptive Behavior Scale, Mainstreaming Social Skills Questionnaire (MSSQ; Salend and Lutz, 1984), Strengths and Difficulties Questionnaire (SDQ; Goodman, 1987)	Children who had experienced PIRKS prior to attending mainstream schools demonstrated improvements in communication, socialisation, and daily living skills (not compared with comparison group just significant improvements within group) with these skills continuing at mainstream school
Parents'/teachers' views/experiences of school transition process Beamish, Bryer and Klieve ^[18] (2014)	Australia	91 intervention and advisory (specialised preschool) teachers		Transition practices online survey: 36 practices items identified from review of literature (including Forest <i>et al</i> , 2004). Themes: Child visit, Parent information, Teacher sharing, Placement identification, Decision support, Sending teacher, Support identification, Evaluation administrator, Visit support, Peer preparation	All 36 practices highly endorsed
Denkyirah and MAgbeke ^[2] (2010)	United States	Exp group: 306 preschool teachers. Comp group: 82 preschool		Survey developed from Forest <i>et al</i> , 2004. Themes: Timing for planning and preparation; Sharing information with family; Discussing placement with family; Helping families fin school	All themes endorsed by teachers in both countries

		teachers from Ghana	and community resources; Preparing and receiving school and teachers; Relationships between sending and receiving schools; Assistive technology; Home visit; Parent taring	
Fontil and Petrakos ^[4] (2015)	United States	Parents of 10 children (aged 53.8-87.4 mo) with or suspected of having ASD	Interview questions adapted from Kindergarten Transition Parent Interview - Preschool (Pianta and Kraft-Sayre, 2003). Themes: child's experiences at school, their peer contact, their activities at home, and parents' personal activities with the school. Measure of Processes of Care (MPOC-20; King, King and Rosenbaum, 2004) Time 1 - end of preschool; Parents: Family Experiences and Involvement in Transition (FEIT; McIntyre <i>et al.</i> , 2007); Preschool teachers: Teachers' Perceptions on Transition (TPOT), Open Ended Questions in TPOT. Time 2 - kindergarten entry; Parents: Family Experiences and Involvement in Transition (FEIT; McIntyre <i>et al.</i> , 2007)	Empathy, Caring, and Understanding: Relationships with preschool teachers more positive than with kindergarten teachers. Knowledge and Expertise: More sharing of information with parents at preschool than school. Less educational opportunities and resources at school than preschool Teachers' Perceptions on Transition: Teachers significantly more likely to report higher concerns (some, many, or very many concerns) for children with ASD than children with DD. Teachers endorsed visiting students' assigned kindergarten classroom more for children in the ASD group than the DD group. Parent Involvement: Parents of DD group reported participating in a transition planning meeting significantly more than parents in the ASD group. Parents of DD group reported to have received written communication regarding the transition from the kindergarten program significantly more than parents in the ASD group
Quintero and McIntyre ^[1] (2011)	United States	Exp group: Parents and teachers of 19 children with ASD (M = 58.84 mo). Comp group: Parents and teachers of 76 children with Developmental Difficulties, M = 58.66 mo		
Protective and risk factors in first year of school Charman <i>et al.</i> ^[19] (2004)	United Kingdom	Cohort 1: 73 children with ASD, Cohort 2: 52 children with ASD; Baseline both cohorts M = 56.6 mo	Vineland Adaptive Behavior Scales-Screen Version (VABS-S; Sparrows, 2000), Social Communication Questionnaire (SCQ; Berument <i>et al.</i> , 1999), Autism Treatment Evaluation Checklist (ATEC; Rimland and Edelson, 1999)	Group made more rapid development progress in the 11 mo in school than they had preschool. Pattern of change on the ATEC was mixed. On the social, language and communication subscale the scores did significantly reduce over time. The best developmental progress was made by children with better communication skills at the outset High externalising behaviour predicted poor STR and was not moderate by cognitive abilities.
Esienhower, Blacher and Bush ^[12] (2015)	United States	166 children with ASD (M = 5 yr 8 mo, 4-7 yr) and one parent per child	Demographics, ADOS, abbreviated WPPSI-II, Student-Teacher Relationship Scale (STRS; Pianta, 2001), Caregiver-Teacher Report Form and Teacher Report Form (CTRF and TRF; Achebach and Rescoria, 2000, 2001)	
Jahromi, Bryce and Swanson ^[20] (2013)	United States	Exp group: 20 children with HFASD, M = 58.95 mo. Comp group: 20 typically developing children, M = 50.20 mo	Measures: Preschool Language Scale 4 (PLS-4; Zimmerman, Steiner, and Pond, 2002), Differential Abilities Scale II (DAS-II; Elliot, 2007), Autism Diagnostic Interview-Revised (ADI-R; Lord <i>et al.</i> , 1994), Social Communication Questionnaire (SCQ; Rutter <i>et al.</i> , 2003), Emotion Regulation Checklist (ER Checklist; Shields and Cicchetti, 1997), Day/Night Task (Gerstadt, Hong, and Diamond, 1994), Behavior Rating Inventory of Executive Function-Preschool Version (BRIEF-P; Gioia, Isquith, Guy, and Kenworthy, 2000), Parent-child joint engagement states and child-initiated joint engagement (Bakeman and Adamson, 1984), Child Behavior Questionnaire-Short Form (CBQ-SF; Putnam and Rothbart, 2006; Rothbart, Ahadi, Hershey, and Fisher, 2001), School Liking and Avoidance Questionnaire (Ladd <i>et al.</i> , 2000), parent-report version of the Teacher Rating Scale of School Adjustment (Buhs and Ladd, 2001), Child Behavior Scale (CBS; Ladd and Profflet, 1996)	Children with HFA were rated significantly lower in emotion regulation and effortful control than their typically developing peers. Behavioural engagement: children with HFA had significantly less cooperative and independent participation. Emotional engagement: Executive function emerged as the significant predictor of emotional school engagement. For children with HFA, effortful control promoted greater prosocial behaviour with peers

Prino, Pasta, Giovanna, Gastaldi and Longobardi ^[23] (2016)	Italy	Exp group: 14 children with ASD, M = 85.75 mo; 18 children with Down Syndrome, M = 85.75 mo, teacher or teaching assistant per child (<i>n</i> = 32). Comp group: 128 TD children (classmates), M = 78.54 mo ¹		Student-Teacher Relationship Scale (STRS; Pianta, 2001)	No difference between teachers' perceptions of children with Down Syndrome and their TD classmates. Teachers' reported significantly higher conflict scores and significantly lower closeness scores for children with ASD than their TD peers
Sparapani <i>et al</i> ^[21] (2016)	United States	196 children with ASD, M = 6.36 yr		ADOS, Standford-Binet Intelligence Scale - 5 th Ed (SB-5; Roid, 2003), Peabody Picture Vocabulary Test - 4 th Ed (PPVT-4; Dunn and Dunn, 2007), Expressive One Word Vocabulary Picture Test - 4 th Ed (EOWVPT-4; Brownwell, 2000), Social Skills Rating system (SSRS; Gresham and Elliott, 1990), Teacher Report Form (TRF; Achenbach and Rescorla, 2001), 60-min classroom observations. Five themes: Emotional Regulation, Classroom Participation, Social Connectedness, Initiating Communication, and Flexibility	No difference between children in general education and special education classes. Students spent less than 50% of time in a well-regulated state, productively and independently participating in classroom activities. Students only responded to half of verbal bids for interaction, infrequently directed communication, and rarely used generative language
Grindle <i>et al</i> ^[10] (2012)	United Kingdom, 4-5 yr	Exp group (ABA): 11 children with ASD, baseline: Age range 43 to 68 mo (M = 58.2 mo). Comp group [Education as usual (EAU)]: 18 children with ASD baseline: Age range 54 to 72 mo (M = 63.89 mo)	School-based comprehensive behavioural intervention features: (1) Parents generalize skills at home; (2) One-to-one intervention at desks in a shared classroom; (3) Education for a maximum of 6 h per day for 38 wk of year; (4) Matched school timetable; (5) Generalise skills to mainstream classes; and (6) based on the United Kingdom National Curriculum	IQ: Standford-Binet Intelligence Scale -Fourth Edition or Leiter International Performance Scale-Revised; Vineland Adaptive Behavior Scale-Survey Form (VABS); ABLLS/ ABLLS-R assesses skills such as effective social and communicative functioning, imitation, and cooperation	Positive changes were observed for the majority of children enrolled in the ABA class - moderate to large-sized effects found for standardized test outcomes after 1 yr of intervention. Outcomes for ABA class were positive compared with the treatment as usual
Kamps <i>et al</i> ^[11] (2015)	United States	Exp group (Peer Networks Intervention): 56 children with ASD, baseline: Age M = 5.8 yr. Comp group (EAU): 39 children with ASD baseline: Age M = 5.8 yr	Peer network intervention: peer training and direct instruction. Five skills: (1) Requests and shares; (2) Comments about one's own play; (3) Comments about others' play; (4) Niceties, <i>e.g.</i> , please, thank-you; and (5) play organizers, <i>e.g.</i> , to give ideas about setting up games and rules	Dependent measures from direct observations consisted Clinical Evaluation of Language Fundamentals-4, Core Language Scores (CELF-4; Semel <i>et al</i> 2003); the Vineland Adaptive Behaviour Scale Teacher Report-Communication subtest (VABS; Sparrow <i>et al</i> 2006); and teacher ratings of classroom social behaviours [The Teacher Impression Scale (TIS); Odom and McConnell, 1997]	Peer intervention group improved more in initiations to peers during non-treatment social probes and during generalization probes in natural settings than the comparison group participants. Standard scores for language performance and communication (teacher report), and teachers ratings of peer network participants social communication behaviours greater for peer intervention group than for comparison group children
Locke <i>et al</i> ^[26] (2014)	United States	192 children with ASD, M = 6.1 yr (5-8 yr),	Strategies for Teaching based on Autism Research	ADOS, Differential Ability Scales-Second Edition (DAS-II; Elliott, 2009), Adaptive Behavior Assessment System-Second	Modest increases in global cognitive ability scores. Negligible changes in social functioning

		grades Kindergarten to second	(STAR), which incorporates discrete trial training (DDT, Smith 2001, from ABA), pivotal response training (PRT; Koegel <i>et al.</i> , 1989) and functional routines	Ed (ABAS-ii; Harrison and Oakland, 2003), Pervasive Developmental Disorder Behavior Inventory (PDDBI; Cohen and Sudhalter, 2005)-Teacher Form	
McKeating ^[28] (2014)	United States	Exp group: 39 children with ASD, M = 6.21 yr (5-7 yr). Comp Group: 39 children with other disabilities, M = 6.26 yr (5-8 yr) (Footnote: 73 teachers of children in sample)	Children received Itinerant, supplemental or full-time special education services	Inclusive Classroom Profile (ICP; Soukakou, 2010), Autism Evaluation Treatment Checklist (AETC; Rimland and Edelson, 1999), Teacher Perception Survey (TPS)	Children receiving full time special education services made substantially greater progress in sociability and behaviour, but not in communication, sensory or cognitive abilities, than children receiving supplemental and itinerant services. All children, regardless of placement achieved higher sociability scores at post-test. Teacher perceptions of inclusion predicted higher ATEC scores
Pellecchia <i>et al.</i> ^[25] (2016)	United States	152 children with ASD, M = 6.0 yr (5-8 yr), grades Kindergarten to second	Strategies for Teaching based on Autism Research (STAR), which incorporates discrete trial training (DDT, Smith 2001, from ABA), pivotal response training (PRT; Koegel <i>et al.</i> , 1989) and functional routines.	ADOS, Differential Ability Scales-Second Edition (DAS-II; Elliott, 2009), Adaptive Behavior Assessment System-Second Ed (ABAS-ii; Harrison and Oakland, 2003), Pervasive Developmental Disorder Behavior Inventory (PDDBI; Cohen and Sudhalter, 2005)-Teacher Form, Child Symptom Inventory-4 (CSI-4; Gdaow and Sprafkin, 2002)	Modest mean change in DAS GCA scores. Several measures of adaptive behaviour; functional academics, health and safety, self-direction, social skills, and the overall adaptive composite predicted changes in DAS scores. Social anxiety symptoms predicted changes in DAS scores. Higher social anxiety symptoms and increase in student age significantly predicted a decrease in DAS scores
Sainato <i>et al.</i> ^[27] (2015)	United States	Exp group (Inclusive kindergarten program): 41 children with ASD, baseline: Age M = 75.7 mo. Comp group (Eclectic intervention): 21 children with ASD, baseline: Age M = 74.1 mo	Experimental group participated in general education classroom taught by trained teachers. Curriculum addressed core deficits of children with ASD using evidence-based strategies and behaviour management	Leiter International Performance Scale-Revised (Leiter-R; Roid, and Miller, 2002); Kaufman Test of Educational Achievement, Second Edition (KTEA-II; Kaufman and Kaufman, 2004); The Test of Language Development (TOLD-P: 3; Newcomer and Hammill, 1997); Vineland Adaptive Behavior Scales-Classroom Edition (Sparrow, Balla, and Cicchetti, 1985)	Experimental group made significant gains in nonverbal intelligence, academic achievement, and language scores compared with comparison group. Comparison group exhibited either no improvement or decreases. Both model and comparison groups demonstrated similar improvement in pre- and post-test outcomes on the Vineland Adaptive Behavior Scales-Classroom Edition (Sparrow <i>et al.</i> , 1985)
Whalen <i>et al.</i> ^[24] (2010)	United States	Exp group (preschool and K-1 students): 22 children with ASD, range 3 to 6 yr. Comp group (preschool and K-1 students): 25 children with ASD, range 3 to 6 yr	TeachTown: Basics', a CAI program that includes computer lessons and natural environment activities (Connection Activities) for developmental ages 2-7 yr. The student is taught in a discrete trial format where they receive reinforcement for correct responses. Treatment group used TeachTown: Basics for approximately 20 min a day on school days over three months	Peabody Picture Vocabulary Test, 3rd Edition (PPVT; Dunn and Dunn), Expressive Vocabulary Test (EVT, Williams, 1997), The Brigance Inventory of Early Development (Brigance, 2004), Childhood Autism Rating Scale (CARS), Ongoing Automatic Data Collection (TeachTown: Basics)	Children in the TeachTown: Basics group performed better across all language and cognitive outcome measures than the children in the control group. Additionally, students who used TeachTown: Basics demonstrated significant progress overall in the software and those students who used the program for more time demonstrated larger gains within the software and in outcome measures

¹Footnote: Other research populations examined separately not reported in this systematic review. DECA: Devereux Early Childhood Assessment; LAP-D: Learning Accomplishment Profile-Diagnostic; SRUSS: School Readiness Uniform Screening System; ASD: Autism spectrum disorder.

be a dramatic decrease in parent-teacher communication in kindergarten (formal primary school), as well as this contact being more negative compared to the supportive

environments of specialized preschools^[4]. Therefore, differences between preschools and mainstream primary schools are amplified for parents of children with ASD

through reduced explanatory communication and collaborative decision-making occurring between parents and teachers.

Individual factors affecting school transition

In total, five studies were included that examined the characteristics of children with ASD that may influence their adjustment to school in the first years. Three studies examined the functioning of children with ASD as well as their school and social engagement. Charman *et al.*^[19] assessed the functioning of children with ASD on entry to school and then again the end of their first year. They found that as a group the children's symptom severity did not change over the first year regardless of educational setting. Encouragingly, their language and communication improved, but there was no improvement in their sociability, sensory issues, cognitive development, or behaviour. In terms of the individual characteristics associated with change over time, children with better communication skills and lower symptom severity made more positive changes in their daily living skills in their first year of school^[19].

Jahromi *et al.*^[20] explored individual differences in self-regulation in 20 children with ASD compared with 20 of their typically developing peers, and how self-regulation related to their school and peer engagement in the first year of school. Prior to starting school, children's self-regulation and autism symptoms were assessed. The children's behaviour was assessed at the end of the year. The authors found that children with ASD had significantly less emotion regulation and effortful control than their typically developing peers. They also scored lower than their typically developing peers on many important components for school success, such as cooperative and independent class participation and prosocial peer engagement. For children with ASD, greater effortful control was associated with better prosocial behaviour^[20]. This suggests that these children might have a protective factor that will allow them to form better relationships with their teachers and peers, and perhaps therefore experience a smoother transition to the school environment.

Sparapani *et al.*^[21] developed a more generalised measure, the Classroom Measure of Active Engagement (CMAE) that addressed five areas of active classroom engagement including emotion regulation, classroom participation, social connectedness, initiating communication and flexibility^[21]. The authors reported that the children with ASD had substantial difficulties with active engagement in class and that this was not helped by participation in a special education class as opposed to a general education program^[21]. Observational data revealed that children with ASD spent less than half of the time in an emotionally-regulated state, being time productive and independently participating in classroom activities. Children rarely directed communications or used generative language and were only able to shift their attention to new tasks following verbal requests

about 50% of the time^[21]. One area where they showed greater flexibility was shifting to different materials. Children with better social skills had more positive active engagement in almost all areas measured, while externalising behaviours and higher repetitive and restricted behaviours were associated with less flexible classroom behaviour^[21]. Therefore, as a group, children with ASD had much difficulty with active classroom engagement, and children with poorer social skills and more repetitive and restrictive behaviours, and more externalised behaviours had the most difficulty with active engagement^[21].

Two studies were identified that examined the quality of student-teacher relationships in children with ASD. These studies indicated that children with ASD had substantially higher conflict and lower closeness with their teachers than typically developing or intellectually disabled peers^[22,23]. Eisenhower *et al.*^[22] examined the relationship between student-teacher relationship quality and externalizing behaviour problems for children with ASD in the first years of school. They found that children with ASD appeared to have poorer student-teacher relationships than those reported among typically developing children. Children in their study continued to have poor student-teacher relationships in new classrooms with new teachers, suggesting that the children's behaviour might be the more significant contributor to the student-teacher relationship. Prino *et al.*^[23] also found that teachers' relationships with children with ASD were more difficult than those they form with typically developing children, finding teachers reported higher conflict and less closeness with their students with ASD.

Overall, this research indicates that children with ASD appear to have externalising behaviours and self-regulation difficulties that affect their school engagement and their relationships with their teachers.

School-based interventions

Seven studies were identified that investigated the impact of school-based programs in the first years of school on children's functioning. Five of these studies examined ABA-based and teacher trained interventions in school. Whalen *et al.*^[24] examined discrete trial format Computer Assisted Instruction intervention; "TeachTown: Basics". This study found that children with ASD in the intervention program had higher language and cognitive skills than those who did not receive the intervention. However, this study did not examine broader social and behavioural skills.

Two studies evaluated the effectiveness of an ABA-based behavioural school-based intervention program called Strategies for Teaching based Autism Research (STAR) which involves intensive teacher training and support with the intervention focusing on three processes; discrete trial training, pivotal response training, and teaching within functional routines^[25,26]. This program also targeted language, academic, social

skills, and adaptive daily living skills. Locke *et al.*^[26] found that while children in the program had a modest improvement in their cognitive abilities, there was no improvement in their social functioning. Pellicchia *et al.*^[25] examined child characteristics that were associated with these cognitive gains. They reported that children in the program who had social anxiety symptoms, such as social avoidance and social fearfulness, made the least gains in their cognitive abilities. Given the fact that ASD and anxiety commonly co-exist, the authors suggested that it is important to identify children at risk of poor school adjustment and ensure that school-based intervention practices incorporate an anxiety-focus^[25].

Sainato *et al.*^[27] examined a school-based intervention with fully trained teachers that centred on full inclusion of children with ASD with their typically developing peers without individually assigned teaching aides. They developed a model kindergarten classroom that was organised to support a wide range of diverse learning needs for all children. Both children with ASD and typically developing peers experienced the same learning environment, curriculum and behaviour management. Children with ASD in the model classrooms made significant gains in a number of areas including performance IQ, academic achievement and language, while children in mainstream classrooms either did not improve or in some cases their scores decreased^[27]. However, there were no significant differences between the groups in adaptive behaviour and socialisation.

Another school-based ABA intervention program was evaluated by Grindle *et al.*^[10]. This program specifically focused on targeting socialisation in the second year of the intervention. Eleven children with ASD were in ABA-supported classrooms that approximated the mainstream timetable integrating children with their typically developing peers during breaks and extra-curricular activities. Children in the ABA-based intervention group made considerable gains in almost all areas except for socialisation in their first year^[10]. However, the focus of the intervention shifted in the second year to socialisation and communication, with the majority of children spending more time in mainstream classrooms. Children in the ABA-based program displayed a substantial improvement in daily living skills and socialisation skills in the second year, while their IQ remained stable. Overall, children in the ABA-based intervention made significantly more progress in their daily living and socialisation than children in the comparison group. However, there was no significant difference between the groups in academic progress. Nevertheless, after two years in the intervention program children with ASD remained predominately in the specialised support classrooms, only spending at most 6 h a week in mainstream classes^[10].

Consequently, it seems that children with ASD may require more than instruction and inclusion to improve their social skills and interactions with their typically developing peers. Only one study was identified that examined school-based interventions that used

combination of direct instruction and peer-mediated approaches. Kamps *et al.*^[11] randomised controlled study found that children from the intervention group were observed in natural settings to make more social initiations and frequency of communication with their peers than children in the education as usual group. Children in the intervention group also appeared to make greater gains in all areas of their language, communication and social skills than children in the comparison group^[11]. Therefore, it appears that children with ASD may make the greatest gains in their socialisation when they have direct and structured interactions with their typically developing peers that generalise out to other settings.

One final study was identified that looked at special education services in the first years more generally. McKeating^[28] found that children with ASD who attended full-time special education services made the largest gains in their behaviour and sociability, but not in communication, sensory or cognitive domains.

Therefore while school-based behavioural interventions appear to improve many skills and behaviours such as cognitive, language and daily living skills, children with ASD need to adjust and develop in the school environment, these interventions alone do not improve socialisation and peer inclusion for these children. There is a preliminary suggestion from Kamps *et al.*^[11] that school-based interventions incorporating direct instruction and peer-mediated interactions can assist children with ASD in developing vital social skills for a positive transition to the school environment.

DISCUSSION

Currently, there is a lack of systematic longitudinal studies evaluating the success of evidence based school transition programs for children with ASD. There are number of reasons for this. First, research on the school transition process for children with ASD is sparse and disparate, particularly in relation to school readiness. Only one study based on ABA specifically examined a school readiness intervention program^[17]. This study suggested that behavioural-based intervention programs in preschool may not provide children with ASD with the social skills they need to socialise with their peers in primary school. This was also evident in school based intervention programs in the early years of school. However, while these behavioural and instructional school-based intervention programs appear to improve skills in a number of areas for school success, such as learning and cognition, behaviour and adaptive living skills, they do not appear to target peer inclusion and socialisation^[10,25,26]. The results of one study suggested that peer modelling and instruction in the first year of school may help children with ASD form positive relationships with their peers and improve their socialisation^[11]. Therefore, incorporating peer modelling and social instruction into behavioural interventions may provide the best support for children with ASD when

transitioning to school.

Children with ASD present with unique social and communication deficits and behavioural difficulties, which can present unique learning and adjustment challenges^[21]. However, few studies have specifically investigated the impact of these difficulties on transitioning to school and engaging in the school environment. The few studies that have evaluated this suggest that children with ASD have poorer relationships with their teachers, poor self-regulation and difficulty being actively engaged in the classroom. This literature also established some individual child characteristics that may present as risk factors for poorer transition to school. Repetitive and restricted behaviours, social anxiety, less effortful control, poor social skills, and dislike of school appear to be associated with greater difficulty settling and engaging in school. The need for on-going and individualised school based interventions was also emphasised

Implications for school transition best practice

To date, no studies have specifically evaluated the success of a school transition program specifically for children with ASD. However, survey studies that have examined opinions of parents and teachers on best practices for school transition identified a number of key areas: (1) Transition team established; (2) parent involvement in planning; (3) child and parent visit to school; (4) visit support; (5) placement identification; (6) parent communication and information; (7) teacher sharing between preschool and kindergarten teacher; (8) child preparation (*e.g.*, social stories); (9) decision support; (10) support identification; (11) transition administrator to supervise and evaluate the transition; and (12) peer, classroom and school preparation^[18].

The authors of these studies identified these relevant practices from the literature as well as government guidelines. Many school transition policies and guidelines are generic and rarely individualised to the child's particular needs^[1]. As can be seen from this review, children with ASD experience specific social, behavioural and communication difficulties that result in them being particularly vulnerable to a poor school transition. Additionally, teachers are more concerned about the ability of children with ASD to successfully transition to school than other children with disabilities. Therefore, children with ASD require comprehensive and individualised transition plans specifically tailored to suit their needs^[1]. However, there are elements that should also potentially be incorporated into all transition plans for children with ASD based on the current evidence. For example, while children's learning and academic development is currently monitored in most Australian schools through learning plans, social skills, communication and behaviour may not be adequately monitored. Therefore, transition plans for children with ASD should include regular monitoring and evaluation of a broad range of areas including active engagement,

socialisation and student-teacher relationships. Also, behavioural interventions with peer modelling may need to be incorporated into transition plans for these children. Finally, these programs need to be developed and implemented while children are in preschool and continue through the first year of school.

Implications for future research

There is a paucity of empirical studies that examine transition to school for children with ASD, particularly in longitudinal monitoring from specific school readiness preparation through to the end of the first few years of school^[22]. While a number of recent studies have examined specific school-based interventions, existing research on the process of primary school transition has tended to adopt cross-sectional survey based methodology^[2-4,18] rather than longitudinal designs with specific measurement of children's social-emotional, adaptive, and cognitive/academic progress. A large number of school transition practices have been identified and endorsed from these survey studies. However, the adequacy of these practices has not been established. There is a need for further research aimed at developing evidence-based strategies to enhance the school transition process and these strategies need to be formulated into guidelines and policies specifically for children with ASD due to their unique needs and difficulties. Additionally, while the academic progress of children is monitored through systems such as learning plans, for children with ASD more systematic monitoring of developmental and behavioural progress, using standardised instruments is needed to measure the effectiveness of well-developed, evidence-based individualised, long-term transition programs^[19].

Limitations

There were a number of limitations to this systematic review. The main limitation was the small number of studies available and the vast variability in the research design and quality of the studies included. The studies included were also from a limited number of countries, with papers predominantly from the United States. Given that school transition practices can vary substantially, different approaches and outcomes may not be addressed and examined in this systematic review. Additionally, publications that were not in English and single-subject case study design studies were excluded, therefore, some relevant studies may have been overlooked.

This systematic review suggested that children with ASD face more challenges, particularly in relation to social-emotional development and active engagement, when starting school than their typically developing peers and even their peers with disabilities. Like many systematic reviews there was substantial variation in the quality of studies and research design of the primary studies. Additionally, the number of studies investigating the school transition process for children with ASD

was disparate and sparse. Nonetheless, it appears both parents and teachers agree that structured and individualised transition plans are needed for children with ASD when starting school, but also during the first years. More structured processes at school and communication between schools, teachers and parents is needed to assist these children and their families adjust to the new school environment. This review also suggests that children with ASD experience more difficulty actively engaging in the classroom and forming positive relationships with their teachers and peers than their typically developing and developmentally delayed peers. Preliminary evidences suggests that individualised intervention programs targeting social skills, incorporating peer modelling, both prior to starting school but also school-based programs in the first years would assist children with ASD to adjust to and succeed in the school environment.

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COMMENTS

Background

Increasingly children with autism spectrum disorder (ASD) attend mainstream schools. Children with ASD experience social, communication and behavioural difficulties unique to their disability. The presence of these deficits indicates that children with ASD have greater risk of poor school outcomes. Children who experience a positive start to school are more likely to experience academic and social success.

Research frontiers

There is a paucity of empirical studies examining the transition to school for children with ASD. The research available is not disseminated and there is a lack of synthesis of the available studies. Thus there is a great need to establish and consolidate the current evidence on how and when children with ASD adjust to the new school environment.

Applications

This review can be used to guide practices during the school transition process for children with ASD.

Terminology

The terms used to describe early education programs (e.g., preschool, nursery school) and the first year of school (e.g., reception, prep, kindergarten) vary throughout the world. As the authors of this paper are situated in New South Wales, Australia, the term "kindergarten" is used to describe the first year of school and the term "preschool" is used to describe early education programs.

Peer-review

This is a well written and comprehensive review.

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