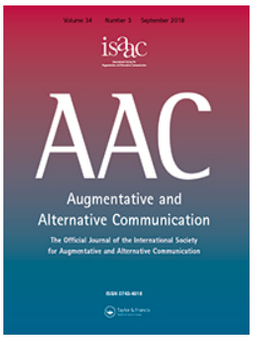

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RESEARCH ARTICLE

A critical synthesis of barriers and facilitators to the use of AAC by children with autism spectrum disorder and their communication partners

Cynthia Donato, Elizabeth Spencer and Michael Arthur-Kelly

Faculty of Education and Arts, School of Humanities and Social Sciences, The University of Newcastle, Callaghan, Australia

ABSTRACT

The aim of this review was to critically synthesize barriers and facilitators to the use of AAC systems by children with autism spectrum disorder (ASD) and their communication partners. Qualitative data related to barriers and facilitators were synthesized from 42 studies located using a systematic search. A diverse range of studies was examined in order to identify the span of barriers and facilitators reported in the literature. Included studies comprised quasi-experimental, non-experimental, and qualitative study designs. The full range of unaided, low-tech aided, and high-tech aided AAC systems were reported across the included studies. The critical synthesis identified 5 themes to which barriers and facilitators are related: (a) Intervention Services and Service Providers, (b) AAC Systems and Technologies (c), Communication Partners of Children with ASD, (d) Parents of Children with ASD, and (e) Children with ASD. The findings suggest that barriers and facilitators to the use of AAC vary across individuals, AAC modalities, and environments. By identifying barriers and facilitators to the use of AAC experienced by children with ASD and their communication partners, service providers might be better equipped to support these children and their communication partners. Clinical implications and future research directions are discussed.

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Autism spectrum disorder (ASD) is a neurodevelopmental disability that involves impairment of social-communication skills and restricted and repetitive behaviors or interests (American Psychiatric Association [APA] 2013). According to the APA, there are three key areas of deficit within the social-communication domain of development linked to an ASD diagnosis: emotional reciprocity, difficulty using or understanding nonverbal communication, and significant difficulties in forming and sustaining relationships with others. ASD, however, is highly heterogeneous in presentation, and the communication profiles of these individuals are varied. As Mirenda and Iacono (2009) described, "Depending on the child's developmental age and disability severity, communication profiles may range from unintelligible speech and/or echolalic speech to a very limited number of words (e.g., fewer than 10) or no words at all" (p. 221). Many children with ASD display language skills significantly below what would be expected of their cognitive and/or developmental level, and it is estimated that between 10 and 25% of children with ASD will remain minimally verbal into their later childhood years (Lord, Risi, & Pickles, 2004; Norrelgen et al., 2015).

For children with ASD who lack functional speech, early intervention should capitalize on the use of augmentative and alternative communication (AAC) to support their expression and/or comprehension of spoken language (Ganz, Rispoli, Mason, & Hong, 2014). There are a wide range of AAC systems available, and there is some variability in the evidence base underpinning interventions using AAC (Iacono, Trembath, & Erickson, 2016). In general, intervention research has shown the use of AAC to range from effective to highly effective for increasing the ability to request wants and needs (Iacono et al., 2016). Nevertheless, a systematic review of communication partner training research in AAC found only a moderate effect size in facilitating communication gains for these children in contrast to a relatively large effect size found for children with apraxia of speech, cerebral palsy, developmental or intellectual disability, and multiple disabilities (Kent-Walsh, Murza, Malani, & Binger, 2015). According to Kent-Walsh et al. communication partner instruction in AAC may be less effective in promoting outcomes for children with ASD due to their difficulties in social reciprocity. It has been established that the social-communication difficulties of speaking children with ASD have compounding effects on the quality of interactions that occur between children and their parents in natural environments, and thus on their language and communication development (Venker, McDuffie, Weismer, & Abbeduto, 2012). There has been limited research into communication partner training in AAC for children with ASD (only six studies, identified by Kent-Walsh et al., 2015) and there has been little focus in the literature on the specific challenges communication

CONTACT Cynthia Donato cynthia.donato@uon.edu.au Faculty of Education and Arts, School of Humanities and Social Sciences, University of Newcastle, University Drive, Callaghan, NSW, 2308, Australia

Supplemental data for this article can be accessed here.

partners experience when interacting with children with ASD who rely on AAC. A timely review of broader research involving children with ASD who use AAC and their communication partners could help to identify specific barriers and facilitators to the use of AAC by children with ASD.

The aim of this review was to present a critical synthesis of factors identified as barriers and facilitators to the use of AAC by children with ASD and their everyday communication partners (i.e., parents, peers, educators and therapists within their natural environments). The specific research questions were: (a) What factors pose barriers to the use of AAC by children with ASD and their communication partners? and (b) What factors enhance or act as facilitators to the use of AAC by children with ASD and their communication partners? The findings of the critical synthesis may be used to help identify ways to improve the implementation of AAC to optimize communication outcomes for children with ASD.

Method

A qualitative, critical-synthesis methodology was chosen because the aim of this review was to identify the reported barriers and facilitators to the use of AAC by children with ASD rather than to present a meta-analysis of research outcomes. A critical, interpretive synthesis methodology enabled the authors to interpret new meanings from a broad and diverse body of literature. Consistent with Entwistle, Firnigl, Ryan, Francis, and Kinghorn's (2012) critical interpretive synthesis of patient experiences of health care delivery, this was a broad-based review with a maximally varied sample of communication partners and environments (i.e., home, early intervention, preschool, and school settings). The objective was to reflect "… the range of experiences … rather than to accumulate multiple mentions of similar concepts or to estimate how much particular experiences matter" (Entwistle et al., 2012, p. 72). As is typical in qualitative research, the aim was to capture the range and diversity of participants' experiences, not to place weight on any one theme over another.

Search Procedure

The first author conducted a comprehensive search of scientific databases in June 2014 and again in October 2016 to identify current studies that investigated the use of AAC by children with ASD and their communication partners. Search terms were chosen to focus on the use of AAC by children with ASD in natural environments. A search of all fields was conducted in Academic Search Complete, CINAHL Complete and MEDLINE (via EBSCOhost) and PsycINFO (via OVID). A search of topic was performed in Web of Science. The search combined the following three groups of search terms: (a) "ASD" or "Asperger" or "autism" or "autism spectrum disorder" or "autistic" or "developmental disability" or "developmental disabilities" or "pdd" or "pervasive developmental disorder", and (b) "AAC" or "augmentative and alternative communication" or "communication board" or "communication book" or "gesture" or "ipad" or "ipod" or "iphone" or "key word sign" or "picture communication" or "picture exchange" or "PECS" or "makaton sign" or "manual sign" or "SGD", "speech-generating device or "speech output" or "symbol" or "voice output" or "VOCA", and (c) "communication partner" or "educator" or "mother" or "parent" or "peer" or "sibling" or "teacher" or "community" or "home" or "natural environment" or "natural setting" or "preschool" or "real world" or "school."

The search was limited to 2004–2016 to focus attention on the period in which mobile technologies such as the iPad©[1] were introduced, given that these technologies may have changed the way that AAC intervention was delivered (AAC-RERC, 2011). Focusing on this time frame allowed for the identification of barriers and facilitators reported most frequently by children with ASD and their communication partners. The search of Academic Search Complete, CINAHL Complete, MEDLINE, and PsycINFO databases was limited to peer-reviewed journal publications. The search located a total of 6,550 titles. The first author used Endnote to store the studies and to remove 2,696 duplicates, 37 studies that were not journal publications, 268 studies that were not original research (i.e., literature reviews, meta-analyses, aggregate studies), and 162 studies that were relevant to adults and not children or adolescents. The remaining 3,387 studies were screened against the inclusion criteria for this review.

Inclusion Criteria

Studies were selected for inclusion in this review based on their relevance to the research question, not their methodological rigor. The inclusion criteria were: (a) original research written in English; (b) published between 2004 and 2016 in a peer-reviewed journal; (c) included at least one participant aged between 0 and 18 years with a diagnosis of ASD, or a natural communication partner (i.e., parent, sibling, educator, peer, allied health professional, or other therapist) of a participant between 0 and 18 years with a diagnosis of ASD; (d) the setting of AAC implementation was a participant's usual environment (i.e., preschool/school, usual therapy setting, or home environment) as opposed to a setting attended solely for the purpose of participating in research (e.g., a research room used to conduct clinical trials); and (e) the study reported at least one factor that was identified as a barrier or a facilitator to the use of AAC for or by a child with ASD (this criterion was added after data extraction).

Allied health professionals and other therapists were deemed to be natural communication partners, provided that they were the participant's usual treating therapist and not a therapist recruited for the purpose of conducting the research. Excluded studies were those in which a research investigator delivered intervention and the natural communication partner was only involved for the purpose of measuring generalization. Studies with a literacy focus (i.e., reading, reading comprehension, and writing) were also excluded

[1]The iPad is a product of Apple Computers Inc., Cupertino, CA. www.apple.com

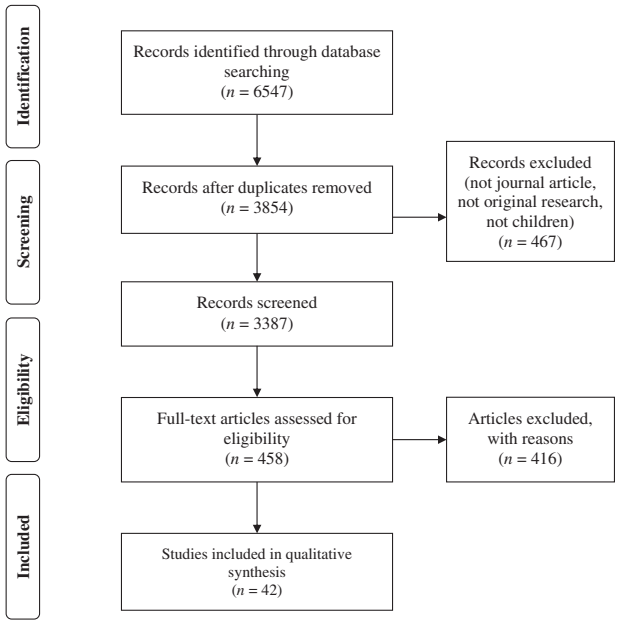

Figure 1. Flow diagram of the search and application of the inclusion criteria.

because literacy instruction is outside the scope of a review focused on communicative interactions.

Study Selection

The first author read the title or abstract of studies to exclude studies that were identified as not meeting the inclusion criteria. The full texts of 458 studies were then retrieved and assessed against the first four inclusion criteria. A total of 66 studies were then reviewed against the final criterion. Review against the final criterion took place during the data extraction process to ensure the papers were thoroughly checked for barriers and facilitators (see the below section for details of data extraction). A further 24 studies were excluded on the basis of not reporting a barrier or facilitator to the use of AAC by individuals with ASD. Although review papers were excluded, the reference lists of review papers were checked for further potentially relevant studies that were not captured using the search procedure. No further studies were included using this strategy. Figure 1 displays a flow diagram of the procedure to arrive at the final 42 studies included in this review. A list of the 42 included studies is provided as a supplemental file.

An independent speech-language pathologist who was experienced in the implementation of AAC for children with ASD was recruited to perform reliability checks for study inclusion/exclusion, which was checked against a random 20% sample of studies retrieved in the search. Because there were 6,484 excluded studies and 66 studies that were assessed against the final criterion for inclusion, a random 5% sample of excluded studies ($n = 324$) and a random 15% sample of the 66 potential studies ($n = 10$) were selected to ensure that (a) the sample comprised both included and excluded studies, and (b) the independent rater did not need to assess all studies for the final criterion, which occurred at the data extraction stage. The independent rater was provided with the inclusion criteria, and an example of an included and excluded paper, with reasons provided for exclusion. A percentage of agreement (calculated by dividing the number of agreements by the total number of agreements plus disagreements, multiplied by 100) of 98% was achieved. Consensus on disagreements was reached after further discussion between the first author and the independent rater. As a second stage of reliability checks, the independent rater was given 10 randomly selected included studies as well as 10 studies that were excluded only on the basis of criterion (e): no barrier or facilitator reported in the paper. This procedure, which was time-intensive, was not performed on the majority of studies. An inter-rater reliability of 100% was achieved for inclusion/exclusion based on the final criterion.

Data Extraction

In order to give context to the review findings, the first author extracted data related to study characteristics from the Methods sections of the included studies. Study aims, participants, procedures, settings, and types of AAC systems used by participants with ASD were extracted and summarized, and each study was assigned a level of evidence category. In order to address the research questions, the first author extracted data segments that were descriptive statements about factors that impacted either negatively (barriers) or positively (facilitators) upon the use of AAC by children with ASD from the findings sections of included studies. For studies in which children with other diagnoses (e.g., cerebral palsy, Down's syndrome) and/or the communication partners of children with other diagnoses participated, only data that was reported explicitly for children with ASD or communication partners of children with ASD was extracted.

The reliability of data extraction was checked against a randomly selected 20% of the 42 included studies ($n = 8$). The same independent rater who was recruited for checking of the inclusion procedure was provided with instructions to highlight all segments of data where a barrier (highlighted in red) or facilitator (highlighted in green) to the use of any type of AAC system by a child with ASD and their communication partners was identified. In order to train the independent rater, one example of a barrier and one example of a facilitator was provided. The independent rater also read a prior research study about barriers and facilitators to the implementation of a visual language program (Donato, Shane, & Hemsley, 2014). This study was included in this review but was not used for inter-rater reliability checks. An inter-rater agreement of 92% was achieved for the data extraction procedure. Disagreements arose from instances where the independent rater highlighted data that could be identified as barriers and facilitators to the use of AAC, but could not be ascertained as being specified for children with ASD. This was further discussed, and consensus on all data was reached.

Coding and Synthesis of the Findings

Extracted data segments varied in length from specific words or sentences to a number of sentences that were identified

as forming a single unit of meaning. Each identified unit of meaning was coded according to the type of barrier or facilitator described. Codes were generated in the process of reading and reviewing the literature and, using thematic analysis methodology, the author identified trends in the meaning conveyed by the language used (Guest, Macqueen, & Namey, 2012). The initial codes were grouped according to related content, and formed into subthemes of barriers and facilitators. Subthemes were grouped according to high-level themes for the purpose of presenting the findings. The coding and analysis procedure is demonstrated in treatment of the following raw data extracted from Anderson, Balandin, and Stancliffe's (2014) study: "Three parents described instances where they had abandoned the device in the absence of steady professional guidance and encouragement" (p. 78). This data segment was coded as: Device Abandonment and Lack of Professional Support. These codes were later grouped with other codes that were related in content to form the subthemes of barriers: AAC system not available to child and Lack of support from service providers. These subthemes were later organized as barriers related to the respective high-level themes: Intervention Services and Service Providers and AAC Systems and Technologies.

The reliability of the coding of barriers and facilitators was checked on a randomly selected 20% of the extracted data. In order to perform the reliability check on the coding of qualitative data, the full list of codes used by the first author was given to a different independent rater, who was instructed to identify all codes that were applicable to each data segment. The first author demonstrated the procedure to the independent rater using one data segment that was not included in the reliability check. Agreement was defined as each of the first author's codes being identically matched by any of the codes applied by the rater on each data segment. There were 113 possible codes. The rater could apply as many codes as desired to a single data segment. However, the maximum number of codes the rater applied to any single data segment was six, which suggests that consensus was reached by the rater's careful consideration of the applicability of codes to data segments and not by over-application of codes. An inter-rater agreement of 90% was achieved for the coding procedure. Disagreements generally arose from the independent rater not having enough contextual information (i.e., not having the full text paper from which the data segment was extracted) to apply the most appropriate code. Once given access to the full text, the rater agreed with the first author's codes on all occasions.

Characteristics of Included Studies

Data relevant to the aims, participants, settings, research designs, and methods of each included study were extracted and put into a spreadsheet. The types of AAC systems reported to be used by participants with ASD were also extracted from the Methods and Results sections of the studies. AAC systems were coded according to four categories: unaided (e.g., natural gestures and manual signing), low-tech aided (i.e., communication boards, communication books, and tangible objects and pictures) and high-tech aided AAC systems (i.e., dedicated speech-generation devices and mobile devices such as the iPad©), as well as The Picture Exchange Communication System (PECS; Bondy & Frost, 2001). As PECS was the only manualized protocol for the implementation of AAC and was frequently reported in the research, the PECS code was applied when the research explicitly reported the use of this intervention. The aims of the included studies were to explore (a) outcomes of communication partner training and/or implementation of AAC intervention ($n = 20$), (b) communication partner views and experiences of using AAC ($n = 17$), and (c) interactions between participants and communication partners in natural environments ($n = 5$).

Participants

Studies included both children and their communication partners, or communication partners only. The number of participants with ASD within the included studies ranged from, a minimum of one to a maximum of 83. The second highest number of individuals with ASD participating in any one study was 34. In terms of participants with diagnoses other than ASD, numbers ranged from a minimum of one and a maximum of 40 in any single study. Communication partners comprised parents (20 studies; one-65 participants), educators (26 studies; one-446 participants), peers (five studies; five-six peers), allied health professionals (i.e., speech-language pathologists, occupational therapists; five studies; two-14 participants), and music therapists (two studies; six-187 participants). A number of studies included more than one type of communication partner (e.g., parents and educators), which explains why the number of studies reported here exceeds the total number of studies included in the review. Not all of these communication partners reported data in relation to children with ASD; however, only barrier and facilitator data that was explicitly reported for the participants with ASD was included in the review.

Settings

Several studies were performed via online survey, interview or focus group research. It was determined that all studies were conducted within or otherwise discussed the use of AAC within children's education settings (i.e., early intervention, preschool and school), home environments, or therapy sessions.

Research designs and methods

The level of evidence of each of the 42 included studies was rated using Johns Hopkins Nursing Research Evidence Appraisal Tool (Dearholt & Dang, 2012). The included studies comprised Level II Quasi-experimental ($n = 19$), Level III Qualitative ($n = 13$), and Level III Non-experimental ($n = 10$) study designs. Research methods comprised multiple baseline ($n = 6$), mixed methods case study ($n = 6$), interviews ($n = 5$), observations ($n = 5$), focus groups ($n = 4$), alternating treatment ($n = 3$), multiple qualitative methods ($n = 3$),

Table 1 Barriers and facilitators to the use of AAC by children with autism spectrum disorder.

High-level themes	Barrier subthemes	Facilitator subthemes
Intervention Services and Service Providers	Families had difficulty accessing services due to policy and financial/funding limitations	Services were family-centered and met the individual needs of children
	Service providers did not have training in order to use a particular AAC system*	Children received an increased intensity of AAC intervention
	Service providers had difficulty accessing training	Service providers had expertise in AAC*
	Service providers found it difficult to measure, monitor, and document children's progress in using AAC	All members of the service provision team worked in collaboration to provide a consistent service to the child and their family
	Families received inconsistent advice from different service providers	
Example data segments	"… The main problem [was] that nobody [at the early intervention service] was PECS trained … " (Anderson et al., 2014, p. 78).	'Most service providers spoke of the benefits of sessions in which ASD-specific resources, strategies and ideas were discussed with someone "who's a specialist, someone in the know" … ' (Ashburner et al., 2016, p. 7).
AAC Systems, Tools, and Technologies	Technical competence, training, and time was required in order to prepare and implement AAC*	AAC systems were available for children to use in all of their natural environments*
	High-tech modes of AAC were limited by their battery span, difficult to navigate, and often only suited to specific communication purposes	AAC systems were easy for children and their communication partners to use
	Low-technology modes of AAC were limited in portability when large numbers of images were stored	Devices had a variety of functions including photo and video technology, electronic recording of children's progress, and adaptation of vocabulary as children's needs changed
	AAC systems were not available to children within and across their different environments	The iPad© and other mobile technologies reportedly reduced the stigma associated with children needing additional support
	Vocabulary needed to be prepared ahead to use AAC within an activity	Mobile technologies were reported to be more portable than traditional dedicated AAC devices
	There was a need to plan vocabulary ahead of time before being able to implement AAC in interactions	A range of different types of AAC could be used to support a child
	It was difficult to coordinate the use of an AAC system for interactions during everyday activities such as storybook reading	
Example data segments	"… It took a lot of effort and concentration and determination … just to take it on board and take on all that hard work is sort of daunting" (Anderson et al., 2014, p. 78).	"From [the mother's] perspective, her child represented a successful user of an AAC device, because he used the device in multiple priority settings such as home, church, and school, as well as temporary settings such as camp" (Townsend et al., 2012, p. 87).
Factors Related to Communication Partners of Children with ASD	Communication partners had no prior training in AAC intervention*	Children's communication partners were interested in and perceived the benefits of using AAC
	Communication partners were not always present to facilitate children's use of AAC	Communication partners were trained in AAC
	Children did not receive models of AAC by their peers	Communication partners used strategies such as modeling and prompting to support children's engagement in AAC*
		The presence of communication partners increased the likelihood that children would use AAC systems for their intended purpose
Example data segments	"The data suggest that if one has not had additional training in aided AAC, outside of one's music therapy coursework, then one is less likely to utilize aided AAC in his/her music therapy sessions with clients with ASD" (Gadberry, 2011, p. 79).	"He wanted to use the VOCA as soon as I asked the first question" (Checkley et al., 2012, p. 252).
Factors Related to Parents of Children with ASD	Parents perceived AAC as replacing or hindering their children's spoken language development*	Parents perceived that AAC would support their children's natural speech development, behavior, and attention*
	Parents found it difficult to fulfil the many responsibilities that using AAC in interactions with their children incurred	Parents were a link between children's different environments and could therefore promote the consistent use of AAC across environments
		Parents could direct their own learning about AAC systems via the internet and by speaking to other parents who had used AAC with their children
Example data segments	"The most serious concern for [the mother] was that her son would become lazy and only use pictures, which in her view represented the simplest and least abstract form of communication, instead of making an effort to speak … " (Jonsson et al., 2011, p. 109).	'[The mother] had used manual signs for a couple of years and felt that signing had stimulated her daughter's speech development' (Jonsson et al., 2011, p. 109).
Factors Related to Children with ASD	Children with ASD were reported to lack the attention, interest or motivation required to engage in AAC	Children with ASD were interested in and motivated to use AAC*
	Children with ASD had difficulties initiating or engaging in spontaneous communication using their AAC system*	Children with ASD showed positive outcomes, and thus communication partners were likely to continue using AAC with them
	Children's anxiety, inflexible or challenging behavior, and fine motor skill difficulties also created barriers to their use of AAC	Children used AAC systems independently for spontaneous communication
		AAC systems were introduced during children with ASD's early language development
Example data segments	"I have to prompt [my child] to use his signs … " (Wiley et al., 2013, p. 46).	'Most parents demonstrated a preference for mobile technologies when communicating with their children and that such devices were highly motivating … ' (Donato et al., 2014, p. 120).

Note. The respective barrier or facilitator theme to which a specific data segment relates is marked by an asterisk (*).

AB ($n = 2$), surveys ($n = 2$), qualitative case study ($n = 2$), pre-post ($n = 1$), changing criterion ($n = 1$), multiple probe ($n = 1$), and longitudinal cohort study ($n = 1$).

Types of AAC systems

Different types of AAC systems used by the participants were reported in the following studies: high-tech aided systems ($n = 22$), PECS ($n = 19$), natural gesture and sign ($n = 13$), and low-tech aided systems other than PECS ($n = 9$). The number of studies reported here exceeds the total number of included studies because more than one type of AAC system was reported in a number of studies.

Results

This review included 42 studies in which barriers and/or facilitators to the use of AAC by children with ASD in natural environments were reported. Thematic analysis of qualitative data in the included studies revealed subthemes of barriers and facilitators that were organized according to five high-level themes: (a) Intervention Services and Service Providers, (b) AAC Systems and Technologies (c), Factors Related to Communication Partners of Children with ASD, (d) Factors Related to Parents of Children with ASD, and (e) Factors Related to Children with ASD. The identified subthemes of barriers and facilitators are presented in Table 1. It is important to highlight that these subthemes were identified through thematic analysis and are grounded in the data (Guest et al., 2012) and therefore may not necessarily align with other models describing barriers and facilitators to the use of AAC, such as the Participation Model (Beukelman & Mirenda, 2013).

Barriers

Intervention services and service providers

Barriers that related to intervention services and service providers were reported across nine studies. Intervention services included services provided for education and therapy purposes. Service providers comprised allied health professionals, educators, paraprofessionals, and education administrators. Reported barrier themes related to families' difficulties in accessing intervention services for their children (Anderson et al., 2014; Donato et al., 2014). Access barriers related to policies that restricted children's access to services and/or funding schemes once they reached a certain age. Furthermore, funding limitations and the financial burden associated with the longevity of children's support needs were barriers to families' access to AAC services (Anderson et al., 2014; Donato et al., 2014).

An additional barrier theme identified in the research was that service providers did not have the training needed in order to use a particular AAC system a family wished to use with their child (Anderson et al., 2014; Ashburner, Vickerstaff, Beetge, & Copley, 2016). Furthermore, service providers who worked in rural and remote locations had limited access to training and professional development in ASD and AAC more broadly (Ashburner et al., 2016). In one study, (Brock, Huber, Carter, Juarez, & Warren, 2014), some service providers were reported to have little interest in attending training in AAC. The workload associated with AAC service provision, which included the need to measure, monitor and document children's progress in using AAC, was identified as a barrier (Chung & Douglas, 2015; Hayes et al., 2010). The final barrier theme that related to service provision was the inconsistent advice given to families by different service providers (Anderson et al., 2014; Myck-Wayne, Robinson, & Henson, 2011). For example, a family might have been encouraged to use AAC with their child by one service provider, but discouraged by another. Service providers had different knowledge and understanding of evidence-based practice, which might have contributed to this barrier (Stahmer, Collings, & Palinkas, 2005).

AAC systems and technologies

Barriers related to AAC systems and technologies were reported across 12 studies. Barriers included the technical competence, training, or time required to create or program AAC systems (Anderson et al., 2014; Chien et al., 2015; Gadberry, 2011; Hayes et al., 2010; Jonsson, Kristoffersson, Ferm, & Thunberg, 2011; McEwen, 2014). For example, a parent in Anderson et al. (2014) whose child used a speech-generating device reported that they "… would stay up all night once a week… programming the thing" (p. 78). High-tech aided systems required battery power to operate, and uncharged batteries reportedly restricted children's access to AAC at times (De Leo, Gonzales, Battagiri, & Leroy, 2011). It was also reported that high-tech systems were difficult to navigate (Chung & Douglas, 2015; McEwen, 2014) and often only suitable to use for specific communication purposes (Hayes et al., 2010). However, it was also time-consuming to locate, print, and laminate images to create tangible picture cards (Chien et al., 2015) and low-tech systems such as communication books were limited in portability when large numbers of images were stored (Hayes et al., 2010).

Another barrier was that AAC systems were not always available or accessible to children within and across their different environments (Chung, Carter, & Sisco, 2012; Gadberry, 2011; Serpentine, Tarnai, Drager, & Finke, 2011). This barrier was related to families' not having access to the tools and technologies required in order to implement AAC as recommended for their children (Jonsson et al., 2011) as well as to families' leaving AAC systems at home when children were at school (Finke, McNaughton, & Drager, 2009). For some systems, vocabulary needed to be prepared ahead for an activity, which was a barrier to using AAC in interactions in real time as they occurred (Chien et al., 2015). It was also reported to be difficult to coordinate the use of an AAC system for interactions during everyday activities such as storybook reading (Thunberg, Ahlsen, & Sandberg, 2007; 2011).

Factors related to communication partners

Barriers that related to communication partners and their interactions with children with ASD were reported across

four studies. One identified barrier was that communication partners had no prior training in AAC intervention. Without training, communication partners were less likely to use strategies to facilitate AAC (Barker, Akaba, Brady, & Thiemann-Bourque, 2013; Brock et al., 2014; Gadberry, 2011). Communication partners were not always present to facilitate children's use of AAC, and children might not have known how to use an AAC system without communication partner support (King, Thonrieczek, Voreis, & Scott, 2014). Furthermore, children did not receive models of AAC being used by their peers (Barker et al., 2013).

Factors related to parents of children with ASD

Barriers to the use of AAC by children with ASD that related to the parents of the children were reported across seven studies. One identified barrier was that parents perceived AAC as replacing or hindering their children's spoken language (speech) development (Jonsson et al., 2011; Serpentine et al., 2011; Townsend, Harris, & Bland-Stewart, 2012). As a parent in Townsend et al. (2012) expressed, "I'm afraid that [my child] will rely on [the AAC system] so much that he won't use his words … " (p. 87). Parents also found it difficult to fulfil the many responsibilities that using AAC in interactions with their children incurred (Anderson et al., 2014; Checkley, Hodge, Chantler, Reidy, & Holmes, 2010; Jonsson et al., 2011; Jurgens, Anderson, & Moore, 2012; Serpentine et al., 2011; Townsend et al., 2012; Wiley, Gustafson, & Rozniak, 2013). This barrier was expressed in a parent excerpt from Anderson et al. (2014): " … It took a lot of effort and concentration and determination. And particularly when you know that there's not a lot of support … to take it on board and take on all that hard work is sort of daunting" (p. 78).

Factors related to children with ASD

Participant-related barriers to the use of AAC were reported across 10 studies, and included their lack of the attention, interest, or motivation required to engage in AAC (Checkley, Reidy, Chantler, Hodge, & Holmes, 2012; De Leo et al., 2011; Hayes et al., 2010; Jonsson et al., 2011; McEwen, 2014; Serpentine et al., 2011; Townsend et al., 2012). When a participant's did success in AAC was limited, this in turn created a barrier by impacting communication partners' attitudes to using AAC. Another barrier was that children with ASD had difficulties initiating or engaging in spontaneous communication using their AAC system and therefore depended on their communication partners' prompts to use their AAC system (Brady, Herynk, & Fleming, 2010; Checkley et al., 2010, 2012; Wiley et al., 2013). Anxiety, inflexible or challenging behavior, and fine motor skill difficulties also created barriers to the use of AAC (Checkley et al., 2010; Chien et al., 2015; De Leo et al., 2011; McEwen, 2014).

Facilitators

Intervention services and service providers

Facilitators that related to intervention services and service providers were reported across eight studies. One facilitator was that services were family-centred and met the individual needs of children (Anderson et al., 2014; Chien et al., 2015; Finke et al., 2009; Hayes et al., 2010). Further facilitators included an increased intensity of AAC intervention (Cardon, 2012) and support being provided to families by service providers who had expertise in AAC (Anderson et al., 2014). Service providers alike reported the benefits of discussing ASD-specific supports with " … a specialist, someone in the know" (Ashburner et al., 2016, p. 7). Consistency of implementation across communication partners and environments was beneficial and was achieved when all members of the service provision team (parents, educators, and allied health professionals) worked in collaboration (Donato et al., 2014; Finke et al., 2009; Hayes et al., 2010; Iacono & Cameron, 2009).

AAC systems and technologies

Facilitators that related to use of AAC systems and technologies were reported across 14 studies. One facilitator was that AAC systems were available for children to use in all of their natural environments (Ashburner et al., 2016; Checkley et al., 2010; Chung et al., 2012; Gadberry, 2011; Hayes et al., 2010; Jonsson et al., 2011; Townsend et al., 2012). Another was that AAC systems were easy for children and their communication partners to use (Chien et al., 2015; De Leo et al., 2011; Desai, Chow, Mumford, Hotze, & Chau, 2014; Mancil, Lorah, & Whitby, 2016; McEwen, 2014). The use of AAC was also facilitated when devices had a variety of functions including photo and video technology, electronic recording of children's progress, and adaptation of vocabulary as children's needs changed over time (Anderson et al., 2014; Checkley et al., 2010; Chien et al., 2015; Hayes et al., 2010; McEwen, 2014). The iPad and other mobile technologies reportedly reduced the stigma associated with children needing additional support (Checkley et al., 2010; Hayes et al., 2010). Furthermore, mobile technologies were reported to be more portable than traditional dedicated AAC devices (Mancil et al., 2016). The final facilitator within this overarching theme related to a multimodal approach to AAC implementation, which was described as using a range of different types of AAC to support a child (Townsend et al., 2012; Wiley et al., 2013).

Factors related to communication partners

Facilitators that related to communication partners and their interactions with participants with ASD were reported across 21 studies. One facilitator was that communication partners were interested in and perceived the benefits of using AAC (Chung & Douglas, 2015; Jonsson et al., 2011; Park, Alber-Morgan, & Cannella-Malone, 2011; Serpentine et al., 2011; Strasberger & Ferreri, 2013; Townsend et al., 2012). Another was that communication partners were trained in AAC (Finke

et al., 2009; Gadberry, 2012; Ganz et al., 2013; Hill, Flores, & Kearley, 2014; Homlitas, Rosales, & Candel, 2014; Nunes & Hanline, 2007; Park et al., 2011; Trottier, Kamp, & Mirenda, 2011). A further facilitator was that communication partners used strategies such as modeling and prompting to support engagement in AAC (Anderson et al., 2014; Carre, Le Grice, Blampied, & Walker, 2009; Checkley et al., 2010; Chiang, 2009; Gadberry, 2011; Hayes et al., 2010; Jonsson et al., 2011; Sonnenmeier, McSheehan, & Jorgensen, 2005; Trottier et al., 2011; Wiley et al., 2013). The presence of communication partners to facilitate use of AAC increased the likelihood that participants would use AAC systems for their intended purpose (Chung et al., 2012; King et al., 2014).

Factors related to parents of children with ASD

Facilitators that related to parents of children with ASD were reported across seven studies. One facilitator was that parents perceived that AAC would support their children's natural speech development (Checkley et al., 2010; Jonsson et al., 2011; Serpentine et al., 2011). Parents' perceiving improvements in other areas such as their children's behavior and attention following AAC implementation was also a facilitator (Checkley et al., 2010; Serpentine et al., 2011). Parents were a link between children's different environments and could therefore promote the consistent use of AAC across environments (Anderson et al., 2014; Townsend et al., 2012). Parents could also direct their own learning about AAC systems via the Internet and by speaking to other parents who had used AAC with their children (Anderson et al., 2014; Serpentine et al., 2011; Townsend et al., 2012).

Factors related to children with ASD

Facilitators that related to children with ASD were reported across 12 studies. Children's interest in and motivation for using AAC systems (including device preferences) facilitated AAC implementation (Checkley et al., 2010, 2012; Chien et al., 2015; Donato et al., 2014; Hayes et al., 2010; Jonsson et al., 2011; Lorah, 2016; Mancil et al., 2016; Stahmer et al., 2005; Townsend et al., 2012). A facilitator to the ongoing use of AAC systems was that children showed positive outcomes, and thus communication partners were likely to continue using AAC with them (Checkley et al., 2010; Desai et al., 2014; Stahmer et al., 2005). Another facilitator identified arose when children could use AAC systems independently for spontaneous communication (Checkley et al., 2012; Jonsson et al., 2011). A final facilitator was that AAC systems were introduced during children's early language development (Checkley et al., 2010; Stahmer et al., 2005; Townsend et al., 2012).

Discussion

The aim of this paper was to identify the range of barriers and facilitators to the use of AAC by children with ASD and their communication partners reported across a broad and diverse body of literature. By identifying barriers and facilitators to the use of AAC experienced by children with ASD and their communication partners, service providers might be better equipped to support these children and their communication partners. The number of studies in which the natural communication partners of children with ASD participated is a positive indication that researchers recognize the central role of communication partners in children's early language development, and in promoting children's generalization of skills to meaningful contexts (Harjusola-Webb & Robbins, 2012; Kent-Walsh et al., 2015). The full range of unaided, low-tech aided (including PECS), and high-tech aided AAC systems were reported across the studies included in this review. This diversity suggests that whilst there is growing clinical research to support the use of high-tech devices, namely speech-generating device applications on mobile technologies (e.g., Lorah, Parnell, Whitby, & Hantula, 2015), unaided and low tech aided AAC strategies including manual signs and the traditional PECS protocol are still used to support communication for children with ASD in everyday environments.

Each overarching theme identified in this review was associated with both barriers and facilitators. Therefore, the findings suggest that barriers and facilitators to the use of AAC vary across different people, AAC modalities, and environments. In some cases, barriers were directly comparable with facilitators within the same overarching theme. For example, negative parental views of AAC posed a barrier to children's use of AAC, whereas positive parental views facilitated its use. Negative and positive views were specifically based on the notion of AAC either hindering or enhancing spoken language development, respectively. There is growing research evidence to suggest that AAC does not hinder spoken language development for children with ASD, and that it may in fact promote gains in spoken language for this population. A randomized controlled trial conducted by Kasari et al. (2014) studied the effect of a blended intervention with an SGD versus without an SGD component with 61 minimally verbal participants with ASD aged 5 to 8 years. The intervention extended over 6 months with a further 3-month follow-up. Results indicated that participants in the group where an SGD was incorporated into intervention showing significantly greater gains in spoken language (Kasari et al., 2014). In relation to clinical practice, this means that service providers must disseminate research evidence to families of children with ASD in order to facilitate families' adoption of AAC as an intervention for their children; however, the onus is on service providers to keep up to date with current research that informs their AAC practice. The findings of this review suggested that service providers had different levels of knowledge and understanding of evidence-based practice (Stahmer et al., 2005).

Some of the factors identified in the current review as affecting the use of AAC by children with ASD might be dissimilar to the use of AAC by children with other diagnoses (Kent-Walsh et al., 2015). One example was children with ASD having difficulties maintaining attention in order to engage in AAC. The unfortunate consequence may be that the opportunity to implement AAC may be missed or the timing of intervention may be delayed, while communication

partners await children's attainment of prerequisite skills such as joint attention. Delaying the introduction of AAC prolongs the time the child spends without a sufficient means to engage in interactions that can promote their development. As Singh, Iacono, and Gray (2011) expressed, "an AAC system will provide the child with a means of developing early communication skills, while delays will cause continued reliance on pre-symbolic modes, with increased potential for frustration given communication at this level is often difficult to read" (p. 395; see also Iacono & Cameron, 2009). Another barrier reported for children with ASD was their overreliance on communication partners' prompts to use their AAC system. Prompt dependency is a common characteristic of ASD (Clark & Green, 2004). Further exploration of this barrier is needed because an individual child may show an inability to initiate communication or to respond to communication bids; alternatively, their communication partner might not allow them the appropriate time that would enable them to respond to a communication bid independently. Indeed, the level of skill of parents and other communication partners in facilitating the use of AAC by children with ASD appears to be a more important consideration than others identified in this review, as it is largely up to communication partners to overcome identified challenges (Kent-Walsh et al., 2015). Allied health professionals, and particularly speech-language pathologists, require specialized knowledge of AAC intervention as well as intervention for children with ASD more broadly, in order to provide support to families, educators and other communication partners.

Augmentative and alternative communication is an area of practice that may be driven by parents or other key communication partners (e.g., educators) within the context of barriers and facilitators identified by this review. For example, decisions around the type of AAC system to implement often depends upon what is available and affordable to a family, as opposed to what an assessment reveals would be most appropriate in supporting their communication (AAC-RERC, 2011). It therefore seems to be important that speech-language pathologists are skilled in identifying barriers and facilitators that are present for individual children and that they consider the impact these barriers and facilitators might have, so that they may support families to make informed intervention decisions.

Limitations and Future Directions

The findings of this review must be interpreted with caution, given a number of limitations. First, the number of variables examined in this review increases the likelihood of human error in the inclusion or exclusion of studies, as well as data extraction and analyses. Because data reported in studies were re-analyzed using a different methodology, it is possible that the original meaning of the data may have been misinterpreted. The aim of this critical interpretive synthesis was to derive new meanings from the existing research, in order to identify novel future research directions (Dixon-Woods et al., 2006). In order to increase transparency, example data segments were provided in order to demonstrate the way in which the interpretations were grounded in the data, and that the findings of this review were supported by other sources of evidence on AAC interventions for children with ASD (Dixon-Woods et al., 2006).

The included studies clustered at Level III (Dearholt & Dang, 2012) qualitative research, which may also be viewed as limiting the reliability of the findings. It was determined, however, that qualitative studies would be highly suited for determining barriers and facilitators to the use of AAC in everyday environments. In previous research, qualitative methodologies have been used to answer research questions that were concerned with intervention use rather than effectiveness (e.g., Baxter, Enderby, Evans & Judge, 2012). However in some cases, data relating to as few as one participant were included in the synthesis for the current review. This raises questions as to the generalizability of the findings, particularly in relation to barriers and facilitators that were shown to vary among different individuals, interventions, and AAC systems used.

The aim of this paper was to determine not generalization but rather the range of barriers and facilitators to the use of AAC by children with ASD and their communication partners as a first step. Further research is needed in order to (a) verify and expand upon the barriers and facilitators identified by this review, and (b) identify which themes of barriers and facilitators have the most significant impact upon the implementation of AAC. For example, a survey could be distributed inviting parents, educators, and service providers to select the barriers and facilitators they have experienced, and which in their experience had the most impact on the use of AAC by children with ASD. Future research energies may then be focused on the areas that will have the most impact on improving communication outcomes for children with ASD who use AAC.

Further observations of interactions between children with ASD and their communication partners would help to conceptualize the nature of barriers and facilitators, as discussed in the previous example that described how to determine whether a child's prompt dependency relates more to the interaction style of the communication partner. No studies exploring interactions occurring between children with ASD and their siblings were identified in this review of barriers and facilitators. Research should aim to fill this gap, as siblings might be good candidates for training and coaching in facilitating the use of AAC, and it would be useful to have information on what barriers and facilitators to the use of AAC might be present during interactions between children with ASD and their siblings. Finally, the findings of this review may inform future communication-partner training research. As a part of training, communication partners should be encouraged to voice their initial concerns and practise problem-solving potential barriers and ways to overcome them. In this way, they may be better prepared for what is involved in implementing AAC with children who have ASD, and may begin their training with a mindset focused on finding solutions as opposed to succumbing to the challenges involved.

Conclusion

The AAC field "… is expanding rapidly, requiring that speech pathologists are aware of resources, and regularly reappraise

their own skills in order to keep pace with these developments" (Speech Pathology Australia, 2012, p. 30). It is therefore of priority to focus research efforts towards identifying effective programs of professional training and coaching in AAC at the university level. Speech-language pathologists may then disseminate their training to all other members of the transdisciplinary team they work within, and potentially increase the dissemination of knowledge in the field. Furthermore, research programs aimed at increasing awareness of AAC in the broader community might help to (a) reduce the stigma of AAC, and (b) increase the responsivity of communication partners to children with ASD who use AAC in the community. Increased community awareness might provide further opportunities for children with ASD who use AAC to engage in quality interactions that in turn promote their language growth (Venker et al., 2012).

Author Note

Cynthia Donato, Faculty of Education and Arts, School of Humanities and Social Sciences, Speech Pathology Discipline, University of Newcastle, Australia; Elizabeth Spencer, Faculty of Education and Arts, School of Humanities and Social Sciences, Speech Pathology Discipline, University of Newcastle, Australia; Michael Arthur-Kelly, Faculty of Education and Arts, School of Education, Education Department, University of Newcastle, Australia.

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Cynthia Donato, Faculty of Education and Arts, School of Humanities and Social Sciences, Speech Pathology Discipline, University of Newcastle, Australia; Elizabeth Spencer, Faculty of Education and Arts, School of Humanities and Social Sciences, Speech Pathology Discipline, University of Newcastle, Australia; Michael Arthur-Kelly, Faculty of Education and Arts, School of Education, Education Department, University of Newcastle, Australia.

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