Universities of Leeds, Sheffield and York
http://eprints.whiterose.ac.uk/

Systematic review of the literature on barriers and facilitators to use of high technology augmentative and alternative communication devices

Susan Baxter, School of Health and Related Research, University of Sheffield, UK,

s.k.baxter@sheffield.ac.uk, 0114 222

Pam Enderby, School of Health and Related Research, University of Sheffield, UK

p.m.enderby@sheffield.ac.uk,

Philippa Evans, School of Health and Related Research, University of Sheffield, UK

p.evans@sheffield.ac.uk

Simon Judge, Barnsley District General Hospital, Barnsley, UK

s.judge@

Corresponding author:

Susan Baxter

Section of Public Health

School of Health and Related Research

Regent Court

30 Regent Street

Sheffield

S1

Email: s.k.baxter@sheffield.ac.uk

Telephone: 0114

Fax:

Declaration of interest:

Abstract

Background: There has been a rapid growth in recent years of available technologies for individuals with communication difficulties. Research evidence to underpin these interventions is currently under-developed however, with practitioners having a limited body of work to draw on, and the suggestion that devices may have limited functional usage.

Aims: To review the literature reporting views of users, families and staff in regard to high technology augmentative and alternative communication (AAC) devices. The work aimed to combine standard systematic review methods with qualitative synthesis techniques to identify potential barriers and facilitators to provision and ongoing use of this technology.

Main Contribution: The review highlights the range of factors that can impact on provision and use of high tech AAC, which practitioners should consider and address where needed in the intervention process. These include: ease of use of the device; reliability; availability of technical support; the voice/language of the device; the decision-making process; the time taken to generate a message; family attitudes and roles; other people's responses; service provision; and the knowledge and skills of staff. The work outlines how systematic review methods may be applied to the consideration of published material that is not reporting intervention data, and how this may provide valuable information to inform future studies.

Conclusions: Practitioners should be aware of barriers and facilitators to successful use when making recommendations, and have considered how barriers, where present, might be overcome. Aspects of service delivery such as ongoing technical support and staff training may require further consideration. The synthesis of evidence describing views of users and providers, and findings regarding the process of intervention, can provide valuable data to inform intervention studies and outcome measures.

Introduction

Augmentative and alternative communication (AAC) strategies and devices have great potential to improve the lives of individuals with communication difficulties by promoting independence, the development of social relationships and enhancing education (Johnston et al., 2004). While there has been a rapid growth in available options and technologies in recent years it has been reported that practitioners face challenges in successfully implementing AAC. Authors have highlighted that there is a paucity of research evidence to underpin recommendations (Campbell et al. 2002; Schlosser, 2003); and that users may have limited access to available systems or services (McNaughton and Bryan, 2007, National Joint Committee for the Communication Needs of Persons with Severe Disabilities, 2002; Kent-Walsh et al. 2008). Concerns have also been raised that devices may have limited functional usage (Jacobs et al. 2004).

AAC can involve adding to (augmenting) natural speech or writing, or can be utilised as an alternative to spoken communication or writing. It includes unaided modes that rely on a user's body to convey messages; for example gestures, signs and facial expressions. Also, it includes aided communication modes that require additional materials or devices. Within the category of aided AAC there is a commonly-used further subdivision of high technology (high tech) versus low technology (low tech) aided options. Low tech systems or devices encompass communication books or boards (non-electric), written words on paper, photographs, line drawings and pictograms. High tech systems are usually considered to include speech generating devices (SGDs), which are termed voice output communication aids (VOCAs) in the North American literature, and speech generating device software on personal computers or laptops. personal computers or laptops used as a communication aid to provide voice (recorded or synthesised) or written output (Schlosser, 2003); and technology

providing access to personal computers or laptops enabling them to be used as a communication aid.

Reviews regarding the effectiveness of AAC have tended to consider predominantly low tech aids, with evidence suggesting positive outcomes from use of the Picture Exchange Communication System (Bondy & Frost, 1998) in particular. Systematic reviews including high tech aids (for example Schlosser and Blischak, 2001; Schlosser and Wendt, 2008; Sigafoos et al., 2009; Lancioni et al., 2006; Lancioni et al., 2001; Binger and Light, 2008) suggest that these devices can be beneficial, although highlight that much available evidence is inconclusive. Authors emphasise the considerable individual variation in outcomes following intervention, and the weak evidence regarding generalisation and maintenance of usage (Schlosser and Lee, 2000). In addition, Mirenda et al. (2001) highlighted that research is needed to investigate whether high tech aids offer advantages over less expensive options.

Objectives

While high tech AAC technology is a rapidly growing field, the evidence underpinning intervention is currently underdeveloped, with diversity in reported outcomes suggesting a need to further explore this individual variation. If practitioners and potential users are to make informed recommendations and choices, having knowledge regarding the process of implementation and ongoing usage of available technology is essential. This review was therefore undertaken in order to investigate the potential barriers and facilitators to high tech AAC provision and its ongoing use. As the aim of the analysis was to explore process factors rather than effectiveness, the review examined and synthesised data from studies reporting the views and perceptions of AAC users or staff providing the devices. This evidence was in the form of qualitative or survey data.

There is growing recognition of the value of extending systematic review methods to include evidence from sources other than experimental studies (Garrett and Thomas, 2006). Methods of meta-synthesis and thematic synthesis are being developed to address this need to consider wider evidence (Dixon-Woods et al. 2001). In this article, the methodology that was used to search for and identify relevant literature is outlined, together with a description of the process of data analysis. The second section presents a synthesis of the results, followed by a discussion of the method, and implications for service delivery and research.

Methods

Relevant published literature was identified via searching of the Cinahl, Cochrane library, Embase, Medline, Psychinfo, CSA, and Web of Science electronic databases. Search terms used related firstly to conditions (for example learning disability, cerebral palsy, Parkinson's Disease), secondly impairment terms (such as language disorder, communication impairment), together with AAC terms (such as speech generating device, assistive aids) and in addition, commonly used devices (such as Cannon Communicator, Minspeak, Touchtalker). The full search strategy is available from the authors if required. In addition to this electronic database searching, the reference list of included papers and review papers were scrutinised for any additional citations of potential relevance.

The review considered studies carried out in communication impaired populations (excluding solely hearing impaired) published in peer-reviewed journals between 2000 and 2010 that were reported in English. As the review aimed to be a "state of the art review" (Grant & Booth, 2009), rather than standard effectiveness review there were no restrictions in terms of study design or formal quality appraisal. The review encompassed "high technology" communication devices only. For the purposes of this work high technology devices (high tech) were defined by exclusion as those acquired and augmentative

communication methods or devices which cannot be described as low tech. Thus signing, gesture, communication books, communication boards, alphabet boards, writing and drawing, and pictures/symbols not used with a computer were outside the remit. Papers which reported both high and low technology were included, with the data relating to high technology only extracted. The use of computers for a treatment tool/therapy only (rather than as an assistive device), and technology which promotes access to computers/switches to overcome physical disabilities was also outside the scope of the review.
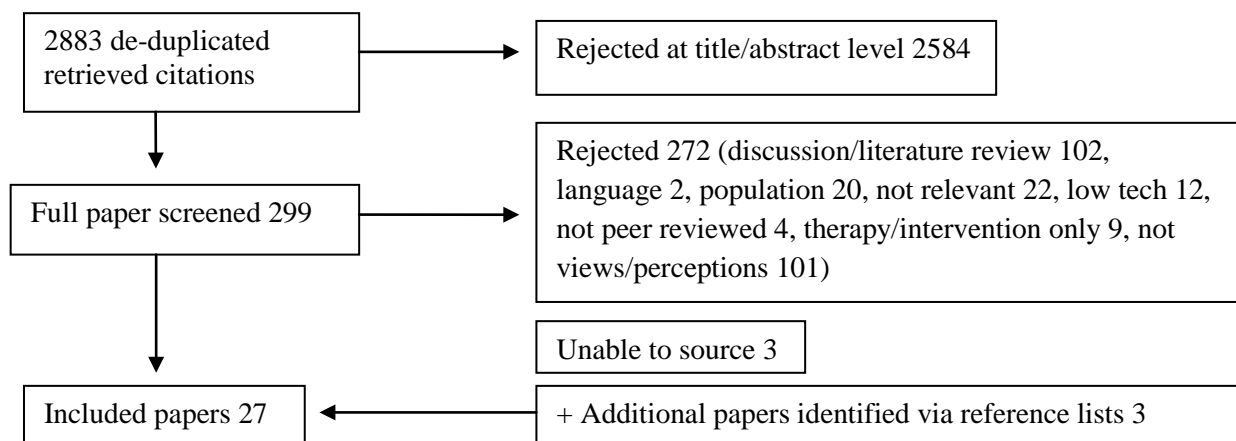
Data were analysed using principles of thematic synthesis (Thomas & Harden, 2008) to establish recurring perceptions across the included papers. In this approach the themes from the included papers form the data to be considered, with these compared and contrasted in a process akin to primary qualitative data analysis. The synthesis may simply highlight recurring findings across the set, or may use the data to develop new interpretations and create meta-themes which were not present in the primary papers.

Results

Selection of publications for review

All the retrieved literature was screened at title and abstract level for relevance, and those that had potential for inclusion were taken through to full paper appraisal and extraction of data. Inclusions and exclusions were checked by a second member of the research team. The searches identified 27 papers which reported AAC users, families of users or staff perceptions regarding barriers or facilitators to provision and successful usage of high tech AAC devices. Figure 1 provides a summary of the process of inclusion and exclusion, indicating how papers of relevance to this review were identified.

Figure 1 Flow chart illustrating the inclusion and exclusion process

```
┌─────────────────────┐         ┌──────────────────────────────────────┐
│ 2883 de-duplicated  │────────▶│ Rejected at title/abstract level 2584 │
│ retrieved citations │         └──────────────────────────────────────┘
└─────────────────────┘
          │                     ┌──────────────────────────────────────┐
          ▼                     │ Rejected 272 (discussion/literature  │
┌─────────────────────┐         │ review 102, language 2, population   │
│ Full paper screened │────────▶│ 20, not relevant 22, low tech 12,    │
│ 299                 │         │ not peer reviewed 4, therapy/        │
└─────────────────────┘         │ intervention only 9, not             │
          │                     │ views/perceptions 101)               │
          │                     └──────────────────────────────────────┘
          │                     ┌──────────────────────┐
          │                     │ Unable to source 3   │
          ▼                     └──────────────────────┘
┌─────────────────────┐         ┌──────────────────────────────────────────────┐
│ Included papers 27  │◀────────│ + Additional papers identified via reference  │
└─────────────────────┘         │   lists 3                                     │
                                └──────────────────────────────────────────────┘
```

The publications reviewed encompassed both findings from qualitative studies and survey data. Table 1 provides a summary of the included studies. Analysis and synthesis of the themes from the primary studies indicated a number of factors impacting on the take up and use of high tech AAC devices. These factors were: ease of use; reliability; technical support; the voice and language of the device; the decision-making process; the role of the family; staff training, the speed of generating a message, responses from other people; and service delivery issues such as staff training, and access to services.

Ease of use

Eight papers highlighted issues regarding the ease of learning and using high tech devices. Bailey et al. (2006) interviewed relatives of AAC users attending junior or high schools with multiple disabilities. The participants described how ease of use and care of the devices was a significant factor in enhancing the AAC user's experiences. The time taken to programme the system was reportedly an important aspect of ease of use. Survey data (Angelo, 2000) found that 25% of parents agreed that their child's device was difficult to use at home (50% disagreed). Hodge (2007) reported views of both parents of children using AAC and adult users. Participants described how devices needed to be secured to a wheelchair in order to

use them successfully, with physical impairments also making usage slow or inefficient leading to frustration. Rackensperger et al. (2005) echoed this, reporting how for some users physically operating a device was a challenge, with devices difficult to use apart from when seated in a customised wheelchair.

McCord and Soto (2004) interviewed young people with Cerebral Palsy (CP) who had used AAC for at least one year. The authors reported a perception that the technology was mysterious and complex. Similarly McNaughton et al. (2008) described views of parents and a user that a lack of confidence with technology influenced attitudes to it. Respondents identified that learning how to programme a device was a major challenge. Parents of users described the benefits of learning from other parents, with the provision of Help functions in devices described as being valuable. Marshall and Golbart (2008) found that parents expressed concerns that high tech aids were effortful, and had experience of difficulties with systems. Adult AAC users with CP in the Smith and Connolly (2008) paper reported that their own limited knowledge and skills presented a significant barrier to usage.

Reliability

Eleven papers described the limited reliability of devices. Bailey et al. (2006) identified the time taken to repair AAC systems and described poor reliability as a key barrier. Participants in the Cooper et al. (2009) study reported issues with the battery running out, devices being broken or not working, or devices not being set up properly. Of the parents surveyed by Angelo (2000) 11% agreed that the system needed repair too often, however 60% disagreed. Opinion voiced by young people using AAC (Clarke et al. 2001a) was that systems were heavy, complex and broke down frequently. Dattilo et al. (2007) also reported frustrations when systems were not available or not working.

Adult AAC users in the O'Keefe et al. (2007) paper identified the improved performance of devices as being a research priority. These experiences of device breakdown and time taken to repair were also described by teachers in the Kent-Walsh and Light (2003) study. A survey (Hetzroni, 2002) provided figures of 47% of parents of child AAC users describing breakdowns as "all the time", 17% "usually, 13% sometimes, 10% "hardly" and 13% "never". Users in the Rackensberger et al. (2005) paper described how technology breakdowns made it difficult for them to make progress in learning to use devices, and how device breakdowns were "a disaster". Similarly, Hodge (2007) found that technical problems were a common cause of frustration, particularly with the more sophisticated devices.

Technical support

The barrier of limited availability of technical support was outlined in papers by Bailey et al., (2006); Dattilo et al. (2007); Hodge, Smith and Connolly (2008); Rackensberger et al. (2005); Parette et al. (2000); and Soto et al. (2001). Family members described their own limitations in regard to technical aspects of equipment, with support needing to be readily available (Bailey et al. 2006; Parette et al. 2000). A study in America (Datillo et al. 2007) identified a particular issue with getting devices repaired or maintained via the Medicare system. Users in the Smith and Connolly (2008) work reported that few had assistance for programming or maintenance when they were provided with their devices. Of 18 adults with CP in Ireland who completed this survey, seven reported that they contacted their speech and language therapist for maintenance, and six reported that they had no one to contact (no details of other participant responses). Teachers in the Soto et al. (2001) paper, identified back up services and support being in place as essential requirements for successful introduction and use of AAC. They described technophobia amongst some staff as a barrier to introduction, together with a lack of loan devices when systems were broken and being repaired.

Voice/language of the device

Six papers described limitations of systems in terms of the quality or appropriateness of the voice or words being generated. McCord et al. (2004) investigated the perceptions of Mexican-American families and found that the language of the device was the primary barrier to use at home. Also, it was reported that the speech synthesiser was difficult to understand by some family members who did not speak English as a first language. Lund and Light (2007) similarly highlighted cultural issues, with the lack of devices having two languages available being a limiting factor for some users. Bailey et al. (2006) reported limited vocabularies as being an obstacle to effective usage. Also, the frustration when spelled words were mispronounced by speech generating devices. Datillo et al. (2006) described the challenge of using devices out of doors when they cannot be heard above background noise. Clarke et al. (2001) reported the perception of some young people that it was embarrassing when a device didn't use their own voice.

Making decisions

Four papers described views regarding the involvement of users and user's families in decisions regarding an AAC device. McNaughton et al. (2008) reported a perception of failure to include parents in selection of a device. Parette et al. (2000) highlighted the importance of involving families in decision-making. A survey of family members' perceptions (Bailey et al. 2006) found that the role of participants in decision-making varied. Expectations regarding how much involvement they should have were also described as varying. In one paper adult users described how they benefitted from taking a lead role in decision-making (Rackensberger et al. 2005).

Time generating a message

Five papers identified negative perceptions regarding the time that AAC devices take to formulate a message. The slowness of communication was raised in particular by those using text-based devices in the Hodge (2007) study. Adult users in the Cooper et al. (2009) and Dattilo et al. (2007) papers described how the time taken to formulate a message was a major challenge in using devices. Family members in another study (McCord & Soto, 2004) reported that they often chose to communicate via other methods due to the inherently slow response of AAC devices. Lund and Light (2007) echoed these views, describing the need for technology that was faster, and could keep pace with a user's thoughts.

Family

Nine papers highlighted the significance of the family members in successful implementation of an AAC system. Rackensberger et al. (2005), Lund and Light (2007), and Parette et al. (2000) reported a need for family support. McNaughton et al. (2008) identified the important role of parents in teaching usage of a device. Speech and language therapists in the Iacono and Cameron (2009) and Johnson et al. (2006) studies perceived that family attitudes could act as a barrier to implementation. Marshall and Golbart (2008) described positive family support, with none of the parents in this study expressing concern over the introduction of AAC with some preferring that had been introduced earlier. The paper by Angelo (2000) explored perceptions of family role and responsibilities in regard to AAC. In this survey, more than half the families reported that one parent (most often the mother) had the majority of the AAC device-related roles and responsibilities, with this impacting on personal time availability. Only 7% however agreed or strongly agreed that the device was a burden. Parents in the Golbart and Marshall (2004) paper perceived that there were demands on

parents to fund AAC resources themselves, with a requirement also to build up high levels of specialist or technical information.

Other people's responses

Five studies described how other people's responses and attitudes could impact on use of an AAC device. Marshall and Golbart (2008) reported parental perceptions that familiar adults were generally considered to respond positively and be willing to interact with an AAC user, however interactions with other people could be less positive. McNaughton et al. (2008) suggested that it is important for users to have skills of asking questions, not just answering them. The authors recommended that users should have a means of introducing the system to others; be taught to a variety of means to deal with breakdowns; and that there should be education for people who may interact with a user. Rackensberger et al. (2005) described a need for "social and strategic knowledge" to make use of a device, for example how to gain attention and how to introduce the device to unfamiliar people. The Smith and Connolly (2008) study identified that the communication partner was the factor most likely to influence use of an aid. Participants with aphasia (True et al. 2009) reported that the audience (along with the content of the message and their mental and physical state) could make communication more or less challenging.

Other factors

One survey paper (Johnson et al. 2006) provided a detailed analysis of factors perceived by speech and language therapists relating to success or abandonment of AAC systems. This work developed a survey tool via focus group input that was returned by 275 members of an AAC special interest group in the USA. The study outlined a rank order for the top 20 factors for success and abandonment. It further carried out factor analysis to group these attributes into constructs. Constructs for success were: support from family, team and outside

consultants; attitude of realism, ownership and valuing the system; and finally the system characteristics and fit between user abilities and system.

Service provision

Lund and Light (2007) outlined a perception of a lack of availability of local AAC services, and in particular a lack of services for adult users. Difficulties in accessing a specialist evaluation were also described by parents and AAC users in the McNaughton et al. (2008) study. Nine papers were found that described other aspects of service provision. Five of these investigated the delivery of services in a school setting. Clarke et al. (2001a) reported that provision in the UK in terms of the amount of therapy, seemed related to educational placement rather than individual needs. Children in mainstream school received fewer hours of therapy provision than those in special schools (p<0.001). The study also found that 42% of direct therapy took place in classrooms, and in special schools this was 87% group work. This study also found that children using VOCAs received more therapy (median 85.8 hours) than those using low tech aids (median 38.2 hours). This finding was identified by the authors as probably due to practice and provision in one particular special school however, the clinician views data supported that high tech aids might require more therapy due to them being more complicated.

Staff training

The need for staff to have an adequate level of skills and knowledge was highlighted by six papers. Soto et al. (2001) carried out focus groups with teachers, teaching assistants and parents. They reported lack of training for staff was a significant barrier to successful implementation of systems. A lack of expertise in schools was also echoed by Hodge (2007). Lund and Light (2007) outlined limited expertise of local professionals, a lack of collaboration between professionals, and the need for training for families and teachers. They

also described a negative attitude towards AAC amongst some professionals. Golbart and Marshall (2004) described how parents often reported that professionals did not have sufficient experience or expertise in the area of AAC. Clarke et al. (2001b) analysed school records and described the amount of official training of staff by communication specialists as "minimal". Parette et al. (2000) found that family members appreciated professionals being honest about their level of knowledge, and wanted clear, accurate and trustworthy information including accurate timelines regarding the process of acquiring equipment.

Iacono and Cameron (2009) found wide variation in speech and language therapists' (SLTs) reported knowledge and skills in AAC. Wormnaes and Malek in Egypt (2004) reported that 14 of the 30 SLT respondents felt that they had no or some knowledge about AAC, while 13 described themselves as quite knowledgeable. Four respondents identified that a lack of AAC knowledge and skills would preclude them from using AAC with a client. In the UK, Mathews (2001) surveyed 320 speech and language therapists in various clinical settings. This study found that 57% reported experiencing training in AAC as part of pre-qualification training and 60% had accessed training since qualification (mostly on signing). The majority of respondents categorised their skills in high tech AAC as none (31%) or general knowledge/awareness (37%). Forty nine percent identified that it would be useful to access AAC training, with training aimed at a whole SLT team in a locality with ongoing support from a trainer.

Two papers explored whether providing specific AAC training to school staff could have positive impacts. Schlosser et al. (2000) evaluated training for staff who were involved in supporting a ten year old male with CP who had used a dynamic display VOCA, low tech symbols and a personal computer. The authors concluded that that the training was effective in promoting the integration of technology resulting in increased participation of the student in the literacy and maths curriculum. There was also a reduction in perceived barriers, and it

was described as useful by participants. McMillan (2008) also evaluated the impact of a training package. This study carried out in Australia provided a "teacher professional development package" to four staff working with four students who used SGDs. The author found an increase in student initiations using the high tech aid following training, but no impact on level of responses.

Kent-Walsh and Light (2003) examined the perceptions of teachers who had AAC users in their mainstream class. The participants described the importance of a team approach to inclusion with good communication, group planning and problem-solving and a specific need for careful transition planning. External specialists such as speech and language therapist and technology consultants were identified as crucial assistance required. They identified the need for a positive attitude, the important role of classmates and realistic curriculum goals. In another study, school participants in the Soto et al. (2001) paper echoed the importance of team collaboration, with AAC training and administrative support also being pre-requisite conditions for successful integration of AAC users.

Discussion

The purpose of this systematic review was to identify and describe the current state of knowledge regarding factors which may impact on the provision and ongoing use of high-tech AAC devices. Analysis and synthesis of the literature indicates that the provision and use of high tech AAC devices is subject to a wide variety of factors, which may act as barriers or facilitators to successful outcomes. These factors encompass: ease of use of the device; device reliability; availability of technical support; the voice/language of the device; the process of making decisions regarding choice of a device; the time taken to generate a message; family attitudes, perceptions and roles; other people interacting with an AAC user; service provision; and the knowledge, skills and attitudes of staff. The results of the review

indicate that these elements are important for practitioners to consider and address where needed in the intervention process.

The review also highlights the complexity which must be unravelled by researchers endeavouring to evaluate and compare outcomes from intervention studies. The range of factors identified by this review may go some way towards explaining the differences in individual outcomes reported in the experimental literature. If the evidence base regarding potential benefits from AAC intervention is to be strengthened, there is a need for high quality studies including the use of controlled designs. Pring (2006) however discusses the limitations of many controlled clinical outcome studies due to poor definition of the therapies being studied, clients receiving different therapies and amount of therapies, and poor definition or heterogeneity of the treated clients. This review further emphasises the challenge of conducting high quality effectiveness studies (conducted under clinical rather than ideal conditions) by outlining the wide range of elements impacting on outcomes. Reviews such as this that explore and report evidence regarding implementation of interventions are required in order to ensure comparison across different arms of a study.

This work has illustrated how evidence from studies which are not reporting effectiveness data can be synthesised using systematic review methods. Increasing recognition of the value of qualitative research has led the drive for wider evidence to be considered in systematic reviews, with influential organisations such as The Cochrane Collaboration investigating ways of combining different forms of data in reviews. The work outlined in this article used the method of thematic synthesis to analyse qualitative and survey data in order to identify factors underpinning the provision of therapy interventions. We argue that systematic review of this type of evidence has been able to provide further understanding of studies investigating clinical effectiveness, and can be a useful contribution to the exploration of intervention process factors.

This study was intended to be a "state of the art review" considering all available evidence. We therefore did not carry out a formal quality appraisal of papers as is usually the case for standard systematic reviews. The critical appraisal of qualitative studies is an area of considerable debate. Some authors argue that it may not be feasible or appropriate to construct hierarchies for qualitative designs (Dixon-Woods et al., 2001) however many frameworks are in existence (Lewis et al., 2006) and may be considered by future reviews of this type.

A reasonable body of evidence was found describing the views and perceptions of AAC users, parents and family of users, staff providing services and also teaching staff. These data are an important supplement to quantitative outcomes data, however would not have been considered in a traditional systematic review. Writers (Lund and Light, 2006) have highlighted the debate concerning how AAC intervention outcomes should evaluated. Short-term outcomes (such as the number of communication utterances made using a device pre and post intervention) offer a temptingly measurable evaluation. However, ongoing usage for communication in real-life settings may be the only outcome that is of importance. This review has indicated the range of factors which underpin whether a device is functionally useful, such as how often it is working and whether it meets the needs of families for whom English is a second language. These elements may be a helpful contribution to the consideration of functional usage outcomes.

In addition to providing information for researchers, the review suggests that aspects of high tech AAC service delivery may need addressing. Concerns were reported regarding the availability of specialist provision and knowledge and skill levels of practitioners. There was some evidence that providing training for school staff, and working practices such as team working could positively influence usage of a device. Further work evaluating the impact of service delivery on the provision of devices would be helpful. Other aspects of

AAC service delivery that seem worthy of further consideration are: the need for ongoing advice regarding technical issues; maintenance and repair; and the influence of attitudes and responses from those interacting with AAC users.

Conclusions

The implementation of high tech AAC interventions may be affected by a range of factors that can be barriers or facilitators to successful outcomes. Practitioners should be aware of these elements when making recommendations, and have considered how barriers, where present, might be overcome. The review has also suggested that aspects of service delivery such as ongoing technical support and staff training may require further consideration. It has been argued that the synthesis of evidence describing views of users and providers, and the process of intervention, can provide helpful data to inform intervention studies and outcome measures, and forms a valuable supplement to standard systematic review methods.

Table 1 Studies included in the review

Reference	Research question	Design	Technology	Study participants
Angelo, 2000	What is the impact of AAC on families?	Survey	Not specified	100 parents of AAC users, USA
Bailey et al. 2006	What are the perceptions of AAC users' families	Interviews		6 relations of 7 M AAC users attending junior or high school with moderate, severe or multiple disabilities (4 parents, sister, grandmother) USA
Clarke et al. 2001a	What is the SLT provision available to children using AAC?	Record analysis	Low tech + 6 users of VOCA	23 children mean aged 12 range 3-16 9 F 14 M, 13 CP, 9 spastic quadriplegia, 1 Rubenstein-Taybi syndrome, UK
Clarke et al. 2001b	What are the views of young people who use AAC?	Focus groups & interviews	Not specified	6 young adults and 17 children using AAC, degenerative conditions, or social communication disorder excluded, UK
Cooper et al. 2009	What are the loneliness experiences of AAC users?	Interviews	Speech generating device (no further details)	6 Adults aged 24-30 CP, 5 F 1 M, Australia
Dattilo et al. 2008	What are the perceptions of AAC users regarding their leisure experiences?	Online discussion group	Not specified	8 adults aged 27-44 4 F 4 M , CP, USA
Goldbart & Marshall, 2004	What are the views of parents regarding their child's AAC?	Interviews	Not specified/any	11 Parents/carers of 11 children using AAC, UK
Hetrozoni, 2002	What are the perceptions of families of AAC users in Israel?	Survey	VOCAs, computers	69 families of children (aged 2-21) using AAC and potential users of AAC, Israel

Hodge, 2007	What are the experiences of AAC users?	Interviews	VOCAs – single message (BIGmack), static multi-message device, dynamic multi-message device (DynaMyte, DynaVox), text-based device (Lightwriter), Voice amplifier.	31 individuals. 12 children (parents of younger children interviewed), 19 adults (often with a communication partner present), users of a communication aid lending library, UK
Iacono & Cameron, 2009	What are the knowledge and perceptions regarding AAC of SLTs working with pre-school children?	Interviews	Not specified	14 SLTs, Australia
Johnson et al. 2006	What are the factors contributing to success of AAC use?	Interviews + survey	Not specified	Focus groups – 28 SLTs Survey – 275 SLTs (271 with special interest in AAC), USA
Kent-Walsh & Light, 2003	What are the experiences of teachers in regard to children using AAC in mainstream classrooms?	Interviews	Not specified	11 teachers, USA
Lasker & Garrett, 2006	Does a screening test enable optimum decision-making regarding choice of AAC device?	Case studies	Stored message systems (eg contextual messages on digitised voice output aid, communication notebook)	4 participants, 1 F 3 M aged 54-65 years of age. Aphasia due to haemorrhagic infarct (1), CVA (3), USA
Lund & Light, 2007	What factors may be important in outcomes for AAC users?	Interviews	Low tech + computer software - Co:Writer, Write:OutLoud, WiVik WiVox, Speaking Dynamically Pro + DecTalk speech synthesiser, Lightwriter, Dynavox 3100	7 M CP aged 19-23 years users of AAC systems for at least 15 years + 10 family members & 13 professionals who worked with participants USA

Marshall & Goldbart, 2008	What are the experiences of parents who have children using AAC?	Interviews	Low + high tech aids	10 mothers + 1 father of children using AAC + 2 long term foster carers. Children (11) aged from 3-10, 9 CP, 6 intellectual disabilities, 2 impaired hearing, 1 epilepsy, UK
Matthews, 2001	How knowledgeable are SLTs regarding AAC?	Survey	All	320 SLTs working in any field, UK
McCord & Soto, 2004	What are the perceptions of AAC amongst Mexican-American families?	Interviews and observation	DeltaTalker, Dynavox	4 Mexican-Americans 3 CP 1 post-meningitis aged 7, 20,15, 14 who used AAC for at least one year and their families, USA
McMillan, 2008	Can training teachers impact on student use of SGDs	Before & after	"SGD system" with symbols	4 M aged 8-12, autistic spectrum disorders. 4 F teachers in special classrooms for students with intellectual disabilities, 3-57 years teaching experience in SEN, Australia
McNaughton et al. 2008	What are parents' perceptions of learning AAC technology?	Internet focus group	Low + Dynavox, Liberator with Unity, Pathfinder, AlphaSmart with word prediction	7 parents, user age 6-30 CP, USA
O'Keefe et al. 2007	What are AAC user views regarding research priorities?	Focus groups	Communication display, LightWrighter, Text to speech laptop, Pathfinder, Liberator	5 M 1 F aged 31-34, Cerebral palsy + spinal cord injury. 5 F 2 M facilitators (spouse, attendant, parent or worker), Canada
Parette et al. 2000	What are the views of families on AAC device decision-making?	Focus groups and interviews	All AAC devices	58 participants, 23 family members of AAC users, 14 family members on non AAC users, + 21 "multicultural" participants, USA

Rackensperger et al. 2005	What are user views of AAC technologies?	Internet focus group	SGD devices – Dynavox 3100, Pathfinder, Liberator, all participants had used at least 4 low tech or high tech systems at some point	7 adults CP, aged 21-41 years, USA
Smith & Connolly, 2008	What are the views of adult AAC users?	Survey completed online/in person	DeltaTalker, Laptop PC, Lightwriter, Dynavox, Alphatalker, Pathfinder, BigMak + communication board	18 adults with CP, aged 19-42, Ireland
Schlosser et al. 2000	Does training the school staff have benefits for an AAC user's participation?	Before & after, 4 months + survey + foucs group	Boardmaker, Overlay Maker for Intellikeys, Click-It screen scanning software, word prediction programme, utilities for enhancing operating systems, Discover Switch	Teacher, 2 assistants, programme support teacher, SLT, OT, library resource teacher, parent involved with a 10 year old M with CP, Canada
Soto et al. 2001	What are the issues surrounding the inclusion of AAC users in mainstream schools?	Focus groups	All (not specified)	30 participants, 7 support teachers, 4 parents, 7 SLTs, 6 teachers, 6 teaching assistants, range of experience with AAC from 3 to over 11 years, USA
True et al. 2009	What are the perceptions of users of SentenceShaper To Go?	Interviews	SentenceShaper To Go	7 participants with aphasia following CVA, 5 F 2 M aged 45-77, USA
Wormnaes & Malek, 2004	What are the perceptions of SLTs in Egypt regarding AAC?	Survey	All	30 SLTs working with individuals with intellectual impairments or complex communication needs, Egypt

References

ANGELO, D., 2000, Impact of Augmentative and Alternative Communication Devices on Families. Augmentative and Alternative Communication, 16, 37-4.

BAILEY, R. L., PARETTE, H. P., STONER, J. B., ANGELL, M. E. and CARROLL, K., 2006, Family Members' Perceptions of Augmentative and Alternative Communication Device Use. Language, Speech, and Hearing Services in Schools, 37, 50-60.

BINGER, C. and LIGHT, J., 2008, The morphology and syntax of individuals who use AAC: research review and implications for practice. Augmentative and Alternative Communication, 24, 123-138.

BONDY, A. and FROST, L., 1998, The picture exchange communication system. Seminars in Speech and Language, 19, 373-389.

CAMPBELL, L., BALANDIN, S. and TOGHER, L., 2002, Augmentative and alternative communication use by people with traumatic brain injury: a review. Advances in Speech Language Pathology, 4, 89-94.

CLARKE, M., MCCONACHIE, H., PRICE, K. and WOOD, P., 2001, Speech and language therapy provision for children using augmentative and alternative communication systems. European Journal of Special Needs Education, 16, 47-54.

CLARKE, M., MCCONACHIE, M., PRICE, K. and WOOD, P., 2001, Views of young people using augmentative and alternative communication systems. International Journal of Language and Communication Disorders, 36, 107-115.

COOPER, L., BALANDIN, S. and TREMBATH, D., 2009, The loneliness experiences of young adults with cerebral palsy who use alternative and augmentative communication. Augmentative and Alternative Communication, 25, 154-164.

DATTILO, J., ESTRELLA, G., ESTRELLA, L. LIGHT, J., MCNAUGHTON, D. and SEABURY, M., 2008, "I have chosen to live life abundantly": perceptions of leisure by

adults who use augmentative and alternative communication. Augmentative & Alternative Communication, 24, 16-28.

DIXON-WOODS, M., FITZPATRICK, R. And ROBERTS, K., 2001, Including qualitative research in systematic reviews: opportunities and problems. Journal of Evaluation in Clinical Practice, 2, 125-133.

GARRETT, Z. and THOMAS, J., 2006, Systematic reviews and their application to research in speech and language therapy: a response to T. R. Pring's "Ask a silly question: two decades of troublesome trials (2004). International Journal of Language and Communication Disorders, 41, 95-105.

GOLDBART, J. and MARSHALL, J., 2004, "Pushes and Pulls" on the Parents of Children who use AAC. Augmentative and Alternative Communication, 20,194-208.

GRANT, M. and BOOTH, A. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies, Health Information and Libraries Journal, 26, 2, 91-108.

HETZRONI, O., 2002, Augmentative and alternative communication in Israel: Results from a family survey. Augmentative and Alternative Communication, 18, 255-266.

HODGE, S., 2007, Why is the potential of augmentative and alternative communication not being realized? Exploring the experiences of people who use communication aids. Disability & Society, 22, 457-471.

IACONO, T. and CAMERON, M., 2009, Australian speech-language pathologists' perceptions and experiences of augmentative and alternative communication in early childhood intervention. Augmentative and alternative communication, 25, 236-249.

JACOBS, B. D., 2004, Augmentative and Alternative Communication (AAC) for adults with severe aphasia: Where we stand and how we can go further. Disability and Rehabilitation, 26, 1231-1240.

JOHNSON, J., INGLEBRET, E., JONES, C. and RAY, J., 2006, Perspectives of speech language pathologists regarding success versus abandonment of AAC. Augmentative & Alternative Communication, 22, 85-99.

JOHNSTON, S. S., REICHLE, J. and EVANS, J., 2004, Supporting augmentative and alternative communication use by beginning communicators with severe disabilities. American Journal of Speech-Language Pathology, 13, 20-30.

KENT-WALSH, J. S., 2008, Tales from school trenches: AAC service-delivery and professional expertise. Seminars in Speech and Language, 29, 146-154.

KENT-WALSH, J. S. & LIGHT, J., 2003, General Education Teachers' Experiences with Inclusion of Students Who Use Augmentative and Alternative Communication. Augmentative and Alternative Communication, 19, 104-124.

LANCIONI, G., O'REILLY, M. & BASALI, G., 2001, Use of microswitches and speech output systems with people with severe/profound intellectual or multiple disabilities: a literature review. Research in Developmental Disabilities, 22, 21-40.

LASKER, J. and GARETT, L., 2006, Using the Multimodal Communication Screening Test for Persons with Aphasia (MCST-A) to guide the selection of alternative communication strategies for people with aphasia. Aphasiology, 2, 217-232.

LEWIS, J., SPENCER, L., RITCHIE, J. And DILLON, L., 2006, Appraising quality in qualitative evaluations: approaches and challenges. In J. Popay (ed), Moving Beyond Effectiveness in Evidence Synthesis: methodological issues in the synthesis of diverse sources of evidence (London: National Institute for Health and Clinical Excellence), pp 61-72.

LUND, S. K. and LIGHT, J., 2007, Long-term outcomes for individuals who use augmentative and alternative communication: Part III -contributing factors. Augmentative and alternative Communication, 23, 323-335.

LUND, S. K. and LIGHT, J., 2006, Long-term outcomes for individuals who use augmentative and alternative communication: part I--what is a "good" outcome? Augmentative & Alternative Communication, 22, 284-299.

MARSHALL, J. and GOLDBART, J., 2008, 'Communication is everything I think.' Parenting a child who needs Augmentative and Alternative Communication (AAC). International Journal of Language & Communication Disorders, 43, 77-98.

MATTHEWS, R., 2001, A survey to identify therapists' high-tech AAC knowledge, application and training. International Journal of Language & Communication Disorders, 36 Suppl, 64-69.

MCCORD, M. and SOTO, G., 2004, Perceptions of AAC: An Ethnographic Investigation of Mexican-American Families. Augmentative and Alternative Communication, 20, 209-227.

MCMILLAN, J. (2008). Teachers Make It Happen: From Professional Development to Integration of Augmentative and Alternative Communication Technologies in the Classroom. *Australasian Journal of Special Education,* 32, 199-211.

MCNAUGHTON, D., RACKENSPERGER, T., BENEDEK-WOOD, E., KREZMAN, C., WILLIAMS, M. and LIGHT, J., 2008, "A child needs to be given a chance to succeed": parents of individuals who use AAC describe the benefits and challenges of learning AAC technologies. Augmentative & Alternative Communication, 24, 43-55.

MCNAUGHTON, D. and BRYEN, D., 2007, AAC technologies to enhance participation and access to meaningful societal roles for adolescents and adults with developmental disabilities who require AAC. Augmentative & Alternative Communication, 23, 217-229.

MIRENDA, P., 2001, Autism, augmentative communication and assistive technology: what do we really know? Focus on Autism and other Developmental Disabilities, 16, 141-151.

NATIONAL JOINT COMMITTEE FOR THE COMMUNICATION NEEDS OF PERSONS WITH SEVERE DISABILITIES, 2002, Adults with learning disabilities: Access to

communication services and supports: Concerns regarding the application of restrictive eligibility policies (Rockville: American Speech-Language Hearing Association).

O'KEEFE, B., KOZAK, N. and SCHULLER, R., 2007, Research priorities in augmentative and alternative communication as identified by people who use AAC and their facilitators. Augmentative & Alternative Communication, 23, 89-96.

PARETTE, H., BROTHERSON, M. and HUER, M., 2000, Giving families a voice in augmentative and alternative communication decision-making. Education & Training in Mental Retardation & Developmental Disabilities, 35, 177-190.

PRING, T., 2006, Systematic reviews require a systematic approach to therapy research: a reply to Garrett and Thomas (2005). International Journal of Language and Communication Disorders, 41, 107-110.

RACKENSPERGER, T., KREZMAN, C., MCNAUGHTON, D., WILLIAMS, M. and D'SILVA, K., 2005, "When I first got it, I wanted to throw it off a cliff": The challenges and benefits of learning AAC technologies as described by adults who use AAC. Augmentative and Alternative Communication, 21, 165-186.

SCHLOSSER, R. and WENDT, O., 2008, Effects of augmentative and alternative communication intervention on speech production in children with autism: a systematic review. American Journal of Speech-Language Pathology, 17, 212-230.

SCHLOSSER, R., 2003, Roles of speech output in augmentative and alternative communication: Narrative review. Augmentative and Alternative Communication, 19, 5-27.

SCHLOSSER, R. and BLISCHAK, D., 2001, Is there a role for speech output in interventions for persons with autism? Focus on Autism and other Developmental Disorders, 16, 170-178

SCHLOSSER, R., MCGHHIE-RICHMOND, D. BLACKSTIEN-ADLER, S., MIRENDA, P., ANTONIUS, K. and JANZEN, P., 2000, Training a school team to integrate technology Journal of Special Education Technology, 15, 31-44.

SIGAFOOS, J., GREEN, V., SCHLOSSER, R., O'REILLY, M., LANCIONI, G., RISPOLI, M. And LANG, R., 2009, Communication Intervention in Rett syndrome: a systematic review. Research in Autistic Spectrum Disorders, 3, 304-318.

SOTO, G., MULLER, E., HUNT, P. and GOETZ, L., 2001, Critical Issues in the Inclusion of Students Who Use Augmentative and Alternative Communication: An Educational Team Perspective. Augmentative and Alternative Communication, 17, 62-72.

THOMAS, J., and HARDEN, A., 2008, Methods for the thematic synthesis of qualitative research in systematic reviews. BMC Medical Research Methodology, 8, 45. doi: 10.1186/1471-2288-8-45.

TRUE, G., BARTLETT, M., FINK, R., LINEBARGER, M. and SCHWARZ, M., 2010, Perspectives of persons with aphasia towards SentenceShaper To Go: a qualitative study. Aphasiology, 29, 1032-1050.

WORMNAES, S. and MALEK, Y., 2004, Egyptian Speech Therapists Want More Knowledge about Augmentative and Alternative Communication. Augmentative and Alternative Communication, 20, 30-41.