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Review

Is speech and language therapy effective at improving the communication of adults with intellectual disabilities?: A systematic review

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Abstract

Background: A significant proportion of adults with intellectual disabilities (ID) experience speech, language and communication difficulties which are associated with poor physical and mental health outcomes. Speech and language therapy (SLT) interventions are an important way to address these communication difficulties, yet there is limited available evidence to provide information about the effectiveness of the different approaches used for this heterogeneous group.
Aims: To review the evidence available for the effectiveness of SLT interventions aimed at improving communication for adults with ID.
Methods & Procedures: A systematic search across relevant databases was performed. Information on methodological details of each relevant study, along with descriptions of the SLT interventions employed, were extracted and the Crowe Critical Appraisal Tool (CCAT) was used to assess quality. Findings were discussed in a narrative synthesis grouped by target communication skill.
Outcomes & Results: A total of 10 relevant studies met the inclusion criteria. These were predominantly interventions aimed directly at adults with ID to improve speech, increase augmentative and alternative communication (AAC) use and develop interaction skills, with one study addressing work with carers. The included studies were all rated as low quality. There is weak preliminary evidence that SLT input can improve the communication skills of adults with ID.
Conclusions & Implications: There is insufficient evidence to draw strong conclusions about the effectiveness of SLT in this population. Further high-level evidence across speech, language and communication domains is urgently needed.

Keywords: intellectual disabilities, speech and language therapy, systematic review.

What this paper adds

What is already known on the subject

- There is limited evidence for community health interventions used with adults with ID. Previous reviews of SLT interventions found a lack of evidence base for this population. Some areas of SLT practice such as AAC have demonstrated potential benefits and other areas including speech work, social communication skills and training for communication partners have some evidence base for children with ID but there is currently insufficient evidence for adults with ID.

What this paper adds to existing knowledge

- The study systematically reviews the current evidence base available when considering the effectiveness of SLT intervention for adults with ID. It provides weak evidence to suggest SLT intervention can improve

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communication in this population and highlights the need for clinically relevant, robustly designed studies to be undertaken in this field.

What are the potential or actual clinical implications of this work?

- The lack of high-quality studies with sufficient power to draw conclusions about effectiveness means SLTs are not able to base their intervention choices on firm evidence. There is an urgent need to conduct robust research into the effectiveness of SLT interventions for adults with ID.

Introduction

Intellectual disability (ID), often referred to as learning disability in UK practice, is defined as a 'significant reduced ability to understand new or complex information, to learn new skills (impaired intelligence), with a reduced ability to cope independently (impaired social functioning), which started before adulthood' (Department of Health 2001: 14–15).

There are an estimated 1.2 million people in England with an ID, of which approximately 1 million are adults (Public Health England 2018). The government recognizes that these individuals are some of the most vulnerable and socially excluded in society (Department of Health 2001). They experience a range of health inequalities which puts them at increased risk of poor physical and mental health outcomes (Emerson and Baines 2010).

Communication difficulties are a significant risk factor in this population being associated with both physical and mental health difficulties (Emerson and Baines 2011). A limited ability to communicate distress or discomfort effectively makes recognition and diagnosis of illness more challenging, additionally issues with understanding and following instructions can impede treatment (RCSLT 2018). Communication impairments increase risks of social isolation (Smith *et al.* 2020) and are associated with poor long-term outcomes across literacy, mental health and employment (Law et al 2009). Bowring *et al.* (2017) further highlight that communication problems are consistently associated with higher risk of challenging behaviours in ID.

Prevalence rates of communication difficulty in the ID population vary depending on the group studied and the communication aspects explored. Smith *et al.* (2020) found almost 60% of participants in their study ($N = 601$) experienced communication difficulties and, in nearly one-quarter of cases the difficulties were severe. More than 50% were found to experience difficulty communicating with professionals and non-familiar partners. Communication difficulties in adults with ID are compounded by the high incidence of additional, often undiagnosed, sensory impairments including vision and hearing (Kerr *et al.* 2003).

Adults with ID are a heterogeneous group and the speech, language and communication needs they experience are wide ranging. Communication challenges associated with ID can occur across the lifespan. There is no single, universally appropriate form of speech and language therapy (SLT) intervention to meet all communication needs. SLT intervention ranges from building capacity in other services and the wider community to specialist intervention at an individual level (RCSLT 2018). Specialist intervention is designed around the individual's presenting needs, may be delivered on an individual basis or in groups in a range of settings, and may also vary in duration and intensity (Baker *et al.* 2010). Intervention can focus directly on an adult with ID's means of communication (pre-verbal, speech, sign, symbol, object, voice output communication aids), expressive or receptive language skills, or conversation/interaction skills. Interventions also frequently address the environmental factors impacting on participation and involve the adult's familiar communication partners including family, friends and paid care staff (Money 2016). Such indirect intervention aims to enable people close to the adult with ID to facilitate communication by supporting shared means and creating reasons and opportunities for skills to be used functionally (Money and Thurman 2002). It is usual for SLTs to liaise with multiple communication partners to ensure that intervention goals are jointly agreed and incorporated into daily life where possible (Enderby *et al.* 2009).

There is no standard definition or definitive list of what constitutes an SLT intervention for communication. SLT provision and intervention varies internationally and regionally within the UK. The ongoing challenges in describing SLT interventions due to the complexity of SLT practice is present across different fields (Morgan *et al.* 2019). In ID services for adults in the UK there is a range of well-known approaches including communication passports and profiles, augmentative and alternative communication (AAC), both aided and non-aided (incorporating signs and symbols, Picture Exchange Communication System (PECS), voice output communication aids), intensive interaction, objects

of reference, narrative approaches (including sensory stories, social stories), staff training, and environmental support and modification (Goldbart *et al*. 2014). Additionally, there are many other related approaches, some of which are specific SLT interventions, whilst others are adopted by SLTs as well as other professionals and carers. This review focuses on SLT interventions that would be accepted within the scope of UK practice.

Due to the long-term and complex nature of communication difficulties associated with ID, SLT for this group can require considerable health service resources. Current estimates are hard to obtain, but previous data indicate one-third of all SLT services in the UK were directed at the ID population (RCSLT 2006). The SLT resource within ID is split between managing communication and dysphagia needs. Findings from a benchmarking project indicate that within adult community ID services 58% of SLT activity relates to communication needs (Money 2018). In an increasingly pressured health system, the effectiveness of all services including SLT are closely examined.

Historically, most of the published work establishing an evidence base for SLT communication intervention in ID has focused on children (Adams *et al*. 2012; Pennington *et al*. 2005; Mulhern *et al*. 2017). Snell *et al*.'s (2010) systematic review, which found evidence supporting SLT intervention for individuals with severe disabilities, notes that the evidence is based on the paediatric population, with 80% of the published studies focusing on participants younger than 12 years.

Several reviews have addressed the effectiveness of specific interventions for people with ID combining data from children and adults. Hutchinson and Bodicoat (2015) found insufficient evidence to establish efficacy of intensive interaction. They highlighted the intensive interaction studies were limited by quality of reporting, but also noted the broader difficulty inherent in conducting good-quality, ethically sound research with participants with profound and multiple ID. Rispoli *et al*. (2010) found some demonstrable benefits for the use of voice output communication aids. Their included studies reported progress across a range of communication skills, including requesting, social or conversational skills, labelling items and receptive language. Of the few reviews which specifically focus on adults, Coppens-Hofman and Maassen (2012) found a lack of evidence base for treating speech difficulties in adults with Down syndrome. Van der Meer *et al*. (2017) found provisional evidence that care staff can be taught to provide effective communication intervention, however not all included studies utilise approaches which would be accepted as SLT interventions within the scope of UK practice.

In recent years there have been numerous studies of SLT intervention for adults with ID, yet the level of empirical effectiveness evidence available remains unclear. To provide accessible evidence for commissioning and planning service delivery, it is important to conduct this review to answer the following clinical question developed using the patient, intervention, comparison and outcome (PICO) format (Dollaghan 2007): For adults (aged 18+ years) with ID and communication difficulties, is SLT intervention effective at improving communication functioning compared with no intervention, non-SLT intervention or usual care?

Objectives

To identify and synthesize the published research evidence on the clinical effectiveness of SLT interventions aimed at improving the communication skills of adults with ID or their familiar communication partners.

Methods

This review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The protocol was registered on the International Prospective Register of Systematic Reviews (PROSPERO CRD42018085792).

Search strategy

A search strategy was developed and refined in conjunction with Nottinghamshire Healthcare NHS Foundation Trust, Library and Knowledge Services using the following concepts: ((speech and language therapy) AND (intellectual disability)). All other terms used historically, in different contexts, were included (see appendix A). The strategy was tested with the addition of the concept (communication) to try to increase specificity by excluding dysphagia-focused studies, but due to the term 'speech' appearing in two themes it did not significantly reduce the number of results. A decision was made to increase the sensitivity of the search by not including potential additional terms (communication and intervention) with the acknowledgement that this had a subsequent pay off of reduced precision and a higher number of non-related articles. The search strategy for the ID part was developed from the systematic reviews published by the Cochrane Developmental, Psychosocial and Learning Problems Group (e.g., Ayub *et al*. 2015) with additional keywords to reflect the current study's particular area of focus. To ensure the final strategy was robust, it was peer reviewed by the team lead of Nottinghamshire Healthcare NHS Foundation Trust, Library and Knowledge Services.

To minimize publication and retrieval bias, the search was not restricted by date or publication status. The search strategy was adapted to the requirements of the databases searched. The following were searched:

Table 1. Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
• Participants are adults (aged 18 years and over) • Participants are adults with intellectual disabilities or their communication partner • Intervention aimed at improving communication skills • Intervention would be accepted as a speech and language therapy (SLT) intervention within the scope of UK practice • Communication is the primary outcome measure • Controlled study	• Participants are children (aged 17 years and younger) • Participants do not have an explicitly mentioned intellectual disability • Communication is not the primary outcome measure • Intervention would not be accepted as an SLT intervention within the scope of UK practice • Non-controlled study • Does not meet What Works Clearinghouse (WWC) standards for a single-subject experimental design (SSED) • Intervention is facilitated communication

Cochrane Central Register of Controlled Trials (CENTRAL, The Cochrane Library) (2018); Medline (Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations and Ovid MEDLINE(R) 1946–present), PsycINFO (Ovid PsycINFO; 1806–December Week 5 2019), Cinahl plus with full text (EBSCOhost Research Databases 1937–present), Scopus (Elsevier), Linguistics and Language Behavior Abstracts (Proquest: 1973–present), and National Institute for Health Research (UK) (www.portal.nihr.ac.uk). A search on PROSPERO was conducted to check for other similar reviews and a hand-search of reference lists for included articles, related literature reviews and the *International Journal of Language and Communication* (1995–present) was completed. A grey literature search was conducted using Opengrey (http://www.opengrey.eu/). The last search was conducted on 9th January 2020. Search results were exported directly to EndNote X8 and duplicates removed.

Inclusion/exclusion criteria

To gain an overview of the evidence for SLT interventions provided to a diverse client group, any controlled study was included, including group and single-case experimental designs, of interventions aimed at improving communication skills, reported in any language. Studies reporting data from adults (aged 18 years and over) with any communication disorders associated with ID, including speech, language and social communication difficulties, or their communication partners were included. No exclusions were made on the basis of additional impairments (physical or sensory impairments, presence of epilepsy, autism) or prior receipt of SLT. Studies delivering any form of SLT intervention that would be accepted within the scope of UK practice, whether provided individually or in groups, in any setting, which measured the primary outcome of communication change, were included. Studies were excluded if participants were children or were adults with a neurodevelopmental disorder (such as autism, language disorder or specific learning difficulties) without explicit mention of a coexisting ID. Non-controlled studies were also excluded and additionally a decision was made to exclude any study focusing on facilitated communication as there is already sufficiently robust evidence that facilitated communication is not a valid communication technique (Schlosser *et al.* 2014). Table 1 summarizes the inclusion/exclusion criteria.

Screening process

Due to the purposely wide search strategy, the first step was for the first author to complete the title screen and remove clearly unrelated articles. Following this, they inspected all the remaining abstracts; the second author independently inspected a randomly selected 25% sample of the abstracts. The authors agreed on 239 out of 245 papers screened. The consensus for inclusion/exclusion of the few abstracts rated differently was reached through discussion. The first author then inspected and identified full texts meeting the inclusion criteria. The second author inspected 25% of these to ensure reliability and reach a consensus for the final included articles. The only exception was for decisions around whether or not the study addressed an SLT intervention. Definitions of communication interventions used in other reviews such as Snell *et al.* (2010) were considered to be too broad for the purpose of this study, which had a specific focus on SLT practice. Therefore, a pragmatic approach using professional judgement was adopted. When a recognized SLT approach, such as signing or PECS, was used in a study, the first author screened them in. When a new intervention or one that did not neatly fit into another category was used, the approach was taken to three clinical lead SLTs, expert in the adult ID field, who considered whether or not it was an SLT intervention which would be accepted within the scope of UK practice. A consensus professional decision on SLT intervention or non-SLT intervention was reached.

Table 2. Single-subject experimental design (SSED) studies excluded due to insufficient control

	Reference	Study design	Reason for exclusion
1.	Bloomberg *et al.* (2003)	Pre/post-single group	No control
2.	Bracken and Rohrer (2014)	Multiple baseline (across subjects)	Insufficient control: fewer than six phases
3.	Brownjohn (1988)	ABA	Insufficient control
4.	Chadwick and Jolliffe (2009)	Independent group design	No baseline data available
5.	Dattilo (1991)	Multiple baseline across subjects	Insufficient control: only two cases
6.	Soto *et al.* (1993)	Multiple baseline across settings with alternating treatment	Insufficient control: one client, two settings
7.	Mahler and Jones (2012)	ABA	Insufficient control
8.	McMorrow and Foxx (1986)	Multiple baseline (across content area)	Insufficient control: one subject
9.	McMorrow *et al.* (1987)	Multiple baseline	Insufficient control: two subjects
10.	Meuris *et al.* (2015)	Pre/post-single group	No control
11.	Purcell *et al.* (2000)	Pre/post-single group	No control
12.	Samuel *et al.* (2008)	Multiple baseline	Insufficient control: insufficient information to establish if What Works Clearinghouse (WWC) criteria were met
13.	Terband *et al.* (2017)	ABA	Insufficient control

Data extraction and analysis

Data were extracted relating to aspects of study design, participant characteristics, intervention, outcome measures and findings. The first author developed and used a data extraction form, which was modelled on the Template for Intervention Description and Replication guidelines (Hoffmann *et al.* 2014) to extract data from the included studies (see the supplemental data online).

The majority of studies were single-subject experimental design (SSED), with the exception of three randomized controlled trials (RCTs). Whilst well-designed SSEDs can offer rigorous, experimental evaluations of intervention effectiveness, unlike RCTs there is 'no gold standard' agreed method to evaluate them (Wendt and Miller 2012) and quality assessment tools for SSED studies have demonstrated significant variability (Zimmerman *et al.* 2018). Due to the mixed designs of the included studies, a general critical appraisal tool, the Crowe Critical Appraisal Tool (CCAT), was selected (Crowe and Sheppard 2011) because it enabled a direct comparison of different research study designs. It incorporated criteria from several critical appraisal tools and had undergone reliability testing (Crowe *et al.* 2011).

Both authors independently assessed the quality of included studies using the CCAT. Final ratings agreement was reached through consensus. Appendix B describes the quality markers obtained for each of the studies across selected domains using CCAT.

Results

The results from the systematic search process are provided in a PRISMA flow diagram shown in figure 1.

The most common reason for exclusion at the title and abstract screen stage was participants being under the age of 18 years. The lack of a controlled design was the most common reason for exclusion at the full-text stage.

Of the full-text articles reviewed, 23 met the initial criteria. All the SSEDs (20) were then quality checked against the What Works Clearinghouse (WWC) criteria for experimental designs (WWC 2008) to establish if they met standards, met standards with reservation or failed to meet standards (figure 2).

All SSEDs that failed to meet the standards were removed (table 2). Several potentially interesting studies (e.g., Terband *et al.* 2018 and Mahler and Jones 2012 both reporting direct SLT intervention to be more effective than no intervention at improving speech) were excluded for failing to meet the WWC standards.

Seven SSEDs (Beck *et al.* 2009, Chambers and Rehfeldt 2003, Kleitsch *et al.* 1983, Lovell *et al.* 1998, Stoner *et al.* 2006, Wells 1981, Ziomek and Rehfeldt 2008) and three RCTs (Bunning 1998, Money 1997, Icht 2019) comprised the final 10 studies included.

Included studies

The studies were conducted in the UK, United States and Israel. All studies except Money (1997) focused solely on direct intervention with adults with ID.

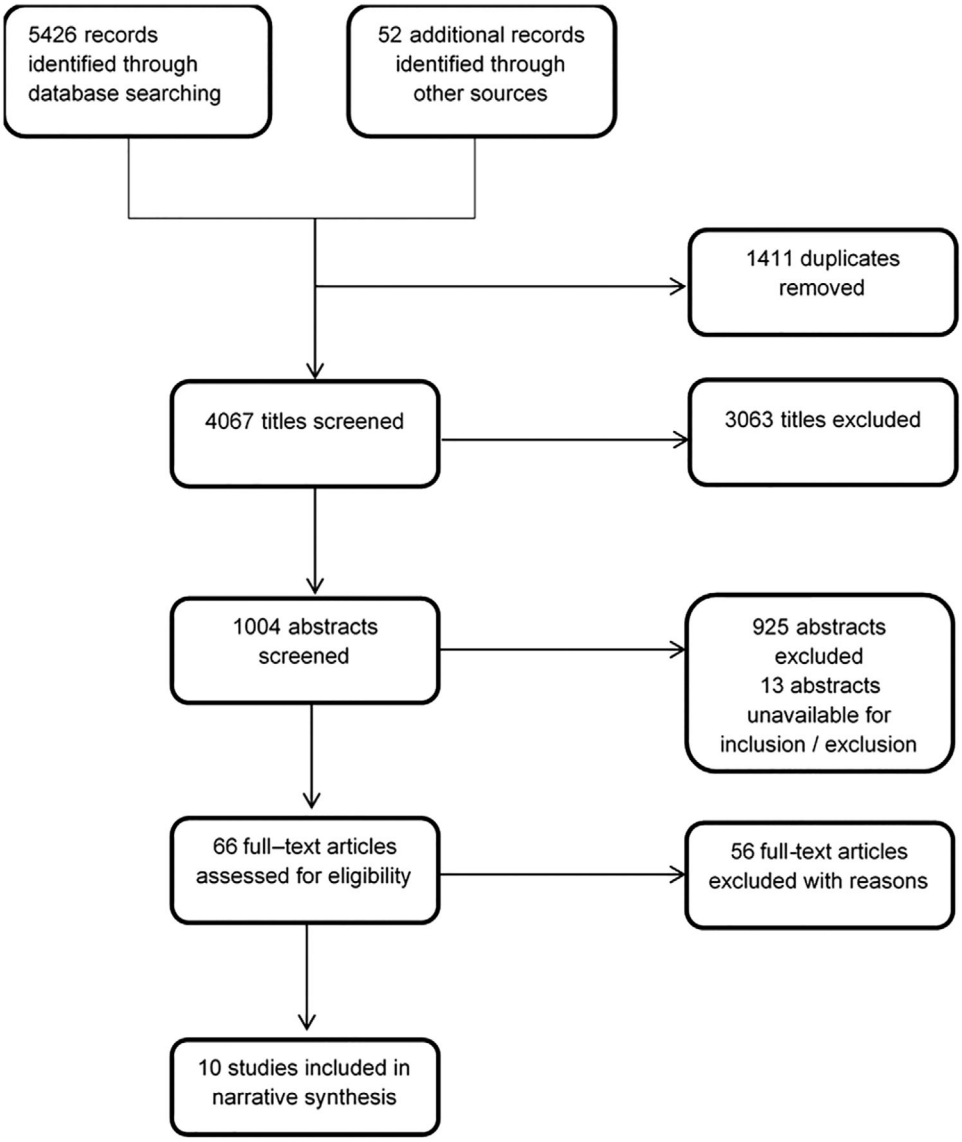


Figure 1. PRISMA flow diagram of the study selection process.

The SSED studies used baseline periods or usual intervention as comparators and a mix of individual therapy (Chambers and Rehfeldt 2003, Lovell *et al*. 1998, Stoner *et al*. 2006, Wells 1981, Ziomek and Rehfeldt 2008) and group-based therapy (Beck *et al*. 2009; Kleitsch *et al*. 1983). Bunning (1998) compared an SLT intervention with a control receiving a placebo treatment; Money (1997) compared a combined intervention with training and usual direct care groups; and Icht (2019) compared a new therapy technique with traditional SLT intervention.

Different SLT interventions were used across the studies covering: individualized sensory environments (ISE), a language group, intensive interaction, direct and indirect approaches to improving functional communication, total communication to improve speech, a beatbox technique (Beatalk), aided language stimulation and the PECS. Each study used different aims and outcome measures. There was no universally agreed outcome measure for improved communication even amongst the studies researching within the same domain. None of the studies provided meaningful data about the impact of changes to participation levels or quality-of-life measures.

The SLT interventions included within this systematic review are frequently targeted at a study population which is relatively low incidence with a high heterogeneity. It is therefore understandable that a high proportion are SSED studies. All the included SSED studies used descriptive statistics, with visual presentation of the data. Statistical calculation is recognized to be under used in SSED studies (Smith 2012), and as there is not

General criteria

To meet standards all SEEDs must have
- Systematic manipulation of the independent variable by the researcher
- More than one assessor measuring outcomes over time with inter-assessor agreement reported in each phase and in 20% of data points in each condition
- Attempts to demonstrate effect over Time and Data Points per Phase

Specific criteria

Design	Meets standards	Meets standards with reservations	Does not meet standards
Reversal / withdrawal	≥4 phases per case (ABAB) with ≥5 data points per phase	≥4 phases per case with 3-4 data points per phase	≤3 phases (AB, ABA, BAB) or ≤2 data points per phase
Multiple baseline / multiple probe	≥6 phases per case with ≥ data points per phase ≥3 cases	≥6 phases per case with 3-4 data points per phase	≤5 phases per case or ≤2 data points per phase ≤3 cases
Alternating treatments	≥5 repetitions per condition 2 treatments compared to baseline or 3 treatments compared to each other	4 repetitions per condition	≤3 repetitions per condition 2 treatments without baseline

Figure 2. Summary of What Works Clearinghouse (WWC) standards for a single-subject experimental design (SSED)

yet an agreed standard effect size metric for this design (Chen *et al*. 2016), it is unsurprising that none of the included studies provided effect size data. There are, however, some quantitative approaches for analysing SSED data that can complement visual analysis and offer significance testing. One such approach, the Tau-U, has shown promise for SSED research within the SLT field (Lee and Cherney 2018). It was not possible to accurately derive all the original data from the included studies to undertake Tau-U calculations for this review; however, this approach to analysis should be considered for use in future SLT SSED studies.

Quality appraisal

The first and second authors independently scored the included studies using CCAT. The percentage agreement between the two scoring authors was calculated with a 73% overall agreement and 96% agreement allowing for 1 point of difference. A consensus was reached on all items. The scores, reported in appendix B, are expressed as both a total score and a percentage, consistent with the CCAT recommendations.

The CCAT does not include qualitative descriptions of scores but identifies specific strengths and weakness across eight categories: preliminaries, introduction, design, sampling, data collection, ethical matters, results and discussion. Studies that demonstrated a robust control element were not later excluded based on CCAT quality scores. Adopting the same approach as Hutchinson and Bodicoat (2015) it was felt that given the small literature base all remaining papers would be critiqued and the deficits in quality used to inform future research recommendations. In a recent systematic review of parent-implemented SLT programmes where the CCAT was used, studies scoring below 80% were classed as poor quality (Tosh *et al*. 2017). For the current review, despite some variability in quality (with percentage CCAT scores ranging from 28% to 65%), no study could be classed as high quality. The majority of the studies were lacking in several critical areas, such as sampling and consideration of bias. Only Icht (2019) reported crucial detail such as inclusion and exclusion criteria; no study provided a rationale for study design, and only Wells (1981) and Kleitsch *et al*. (1983) considered potential bias. Pennington *et al*. (2004) note that although blinding patients and clinicians to the intervention in trials of SLT is rarely practicable, it does leave them open to bias. Additionally, there was little or no mention of ethical issues such as consent, which whilst concerning in the adult ID population should be considered in the context that reporting on ethical approval is a relatively recent phenomenon. Most studies made no mention or provided only minimal detail regarding non-participation, withdrawal or incomplete/lost data.

When the methodological quality of a study is inadequate, it calls the validity of the results into question and the quality of the intervention remains unclear (Higgins *et al*. 2011). The limited number and poor quality of the studies available for inclusion means that confidence in the intervention effects demonstrated has

to be considered as low and findings should be interpreted with caution.

Findings

The studies will be discussed by intervention category: interactions, speech and AAC.

Outcomes of interaction interventions

Four studies targeted different aspects of interaction. Bunning (1998) aimed to achieve purposeful engagement for adults with profound and multiple ID using an 'individualized sensory environments' (ISE) approach. ISE is an intervention designed for adults with ID that incorporates structured sensory stimulation. Sensory stimuli, identified as personally motivating to the individual, is contingent on a participant's response and is used to encourage purposeful interactions rather than non-purposeful engagement (Bunning 1996). Kleitsch *et al.* (1983) aimed to increase participation in social interaction for adults with functional verbal communication and moderate ID using a group-language training procedure with verbal prompts, modelling, behaviour, rehearsal and several generalization strategies. Lovell *et al.* (1998) investigated the effects of intensive interaction on an individual's level of sociability (measured as physical contact, looking at another person, vocalization, joint attention, smiling). Money (1997) focused on direct and indirect approaches to improving functional communication (addressing initiations, responses and modalities). All studies claimed that engagement/communication increased with the intervention compared with the control measures.

Bunning found a significant difference between the treatment and control groups in terms of participant engagement, with only the treatment group showing significant gains in purposeful engagement. However, both groups demonstrated a significant reduction in the level of self-active engagement (e.g., rocking, self-injury) which was attributed to higher levels at baseline and the initial extra attention in the placebo control condition. There is no detail available around sampling and randomization in this study, but the group differences at baseline suggests that the randomization process was not successful in achieving groups which did not differ in any systematic way, leading to potential confounding. This is the only study available on ISE and received the lowest quality score (28%) due to the lack of detail reported. As such, the finding that ISE is effective at increasing purposeful engagement cannot be considered valid.

Kleitsch *et al.* (1983), in a withdrawal of treatment design, found all four participants had a small increase in self-initiated interactions directed to other participants as a result of the language group intervention. One participant showed a marked increase in interactions which was sustained in the generalization and maintenance conditions. The results are visually presented at an individual level and participant characteristics which may have contributed to the level of increase are discussed. The small sample size, however, means it is not possible to draw any real conclusions from this research. The overall quality rating of the study is poor (50%) with a poorly described intervention, limited data analysis and no consideration of the functional impact of the outcome measure. The findings need to be interpreted with caution.

Lovell *et al.* (1998), using an alternating treatments design, found an increase in sociability measures during intensive interaction compared with baseline. This increase was also present, to a slightly lesser extent, in the proximity condition. Self-involved behaviours showed a mixed response to both treatment conditions with a reduction in face covering, but looking at a toy remaining stable. Findings for the one study participant are presented visually and suggest that intensive interaction may be beneficial for some individuals with profound and multiple ID. This is, however, only a preliminary investigation that had to be stopped early due to an unrelated participant injury. The study, containing only one participant, is not sufficiently robust to be able to draw any firm conclusions around effectiveness.

Money (1997) was the only study to address indirect intervention. This RCT compared three different delivery approaches all involving working with paid carers in day service settings: (1) working directly on a one-to-one basis with the person and carer; (2) working indirectly by training carers; and (3) a combination of these two approaches. This study suggested that SLT intervention facilitates communication skills (e.g., decreased nil responses, increased use of additional modalities) with the maximum improvement achieved through combining direct and indirect approaches. There was, however, a high dropout with the subject pairs reducing from 36 to 20 at study completion. Factors such as staff movement, common within ID services, are suggested as the reason for this, but the result is a small sample size. Additionally, there were no fidelity measures, no positive control and the study received a quality rating of 58%, which means the findings have to be interpreted with reservation.

Outcomes of speech intervention

Two studies addressed SLT interventions targeting speech sounds. Wells (1981), using a single-subject alternating treatment design, compared the effect of total communication (referring to signing and speaking) training with speech training (oral musculature exercises

and vocal imitation). The findings suggest greater improvement in articulation when signing was used during training sessions, but these need to be treated with extreme caution as they are based on two participants with severe ID who completed the study with no description of the sampling process or exclusion criteria.

Icht's (2019) RCT implemented a new 'Beatalk' technique based on vocally producing and practising beatbox sounds and rhythms. The group treatment involved the acquisition of basic beatbox sounds followed by individual then group practice. The Beatalk was compared with a traditional speech therapy, referred to as modelling and repetitive verbal and non-verbal exercises with feedback from the therapist. Results indicate improvements on speech variables of articulation accuracy and voice measures in both treatment groups. The findings are presented as showing a greater improvement within the Beatalk treatment group. The available data, however, suggest there were group differences in initial articulation accuracy, which draws into question the sample size and success of the randomization process introducing issues of confounding. The initial statistical analysis appears inappropriate for the data and subsequently group data are summarized for the six participants in each group with no consideration of the possible variation within each group. The quality rating of 65% suggests that the findings offer provisional weak evidence that the Beatalk technique can be effective in improving speech abilities for adults with ID. The author highlights that the findings are in line with Terband *et al.*'s (2017) study, which found tailored training in articulation and listening skills led to a positive treatment effect on speech intelligibility and receptive vocabulary. Terband *et al.* concluded that SLT targeting speech can be effective for adults with ID, however it was excluded from this review due to insufficient control.

Outcomes of AAC intervention

Augmentative and alternative communication (AAC) involves tools and strategies used by individuals to solve communication challenges (International Society for Augmentative and Alternative Communication). It covers a broad range of techniques that support, or replace, spoken or written communication, including: gestures, signing, symbols, pictures and voice output communication aids. Four studies addressed different types of AAC, PECS, signing and Aided Language Stimulation (ALS). All studies reported communication gains with AAC use for some but not all participants.

All these studies used a SSED. Descriptive statistics are used to present results, reporting the percentage of correct trials per block for PECS and signing (Chambers and Rehfeldt 2003, Ziomek and Rehfeldt 2008), percentage of correct requests using PECS (Stoner *et al.* 2006) and mean turns taken using AAC (Beck *et al.* 2009). Despite different outcome measures being used, all focused on communicative competence, an ICF activity level outcome (WHO 2001).

Stoner *et al.* (2006) found PECS to be effective at increasing requesting through picture exchange for three out of five participants. At baseline, no participants were described as having a functional means of requesting preferred items, but three of the participants achieved this following the PECS intervention. The achievement was sustained during the maintenance phase and anecdotal evidence was offered for the transfer of these skills to functional communication use. For the two participants who did not achieve sustained gains this was put down to a lack of skill discriminating at the object level and deteriorating health. The study design was not sufficiently robust to be clear on whether any unidentified confounding factors influenced the results.

Beck *et al.* (2009) found ALS to be effective at increasing the number of turns participants took and the percentage of turns where AAC was used to support communication compared with baseline measures. Limited data in relation to the nature of the turns are available, however, and there are insufficient data for generalization and maintenance, meaning the functional impact of the increased turns is not known. Additionally, this study does not explain why the intervention was delivered across two study groups with each acting as its own control rather than a more robust study design.

Chambers and Rehfeldt (2003) and Ziomek and Rehfeldt (2008) compared the time taken to become competent in requesting using PECS and manual signing. Chambers and Rehfeldt found that all participants (four adults with severe-profound ID) could successfully acquire some requesting skills following training using PECS, and three out of four participants achieved this using signs. PECS requesting was achieved quicker, with better generalization and more success with requesting items out of view than signing. Ziomek and Rehfeldt also found that requesting skills were acquired more rapidly with PECS than signing. They found requests established using PECS generalized more readily across settings and communicative partners and there was some anecdotal evidence of untrained requests emerging using PECS. However, there is a lack of inclusion and exclusion criteria making it impossible to draw conclusions to the wider ID population and there is negligible detail about dropouts across both studies. Further several potential biases are not sufficiently addressed across these studies.

The four studies addressing AAC had quality rating scores between 50% and 58% with significant

weaknesses in the areas of sampling, ethics and results analysis. They all found AAC had some positive effect on communicative skills for some but not all participants. There is insufficient evidence to state whether individual differences, environmental factors or aspects of the interventions cause the variation in treatment success.

Discussion

Findings indicate that SLT interventions with adults with ID are associated with some improvements in communication. Improvements are reported in speech quality, interaction skills and AAC use in individual adults, however the quality of the studies providing this evidence is low. Methodological flaws including a lack of inclusion/exclusion criteria, limited descriptions of interventions, insufficient attention to potential biases alongside small sample sizes prevent any firm conclusions being made and the evidence supporting the effectiveness of SLT interventions to improve communication in adult ID populations remains limited.

The paucity of studies targeting indirect intervention with communication partners meeting this systematic review's inclusion criteria is a significant concern as this is an area of UK practice which has grown considerably in recent years (Baker *et al.* 2010, RCSLT 2018). Current practice for addressing communication needs in adult ID services has moved towards inclusive communication at individual, environment and community levels (Money 2016). The means, reasons and opportunities approach to understanding communication impairment (Money and Thurman 2002) provides a model towards inclusive communication which highlights the two-way nature of communication and promotes the shared responsibility for improving communication between the adult with ID and their communication partner. The promotion of the Five Good Communication Standards (RCSLT 2013) across SLT and wider ID services (Colwill *et al.* 2019, Patel *et al.* 2018) alongside the introduction of the Accessible Information Standard (NHS England 2016) means there is clear recognition that intervention often needs to go beyond the individual to ensure that carers and the wider environment make reasonable adjustments. The current available research fails to reflect this with the majority of studies being targeted solely at the level of the individual with ID.

Several published studies of indirect intervention were identified in this review's search, but these were excluded at the screening stage predominantly because they lacked a robust control element. Excluded studies with exclusion reasons are listed in the supplemental data online. Some supportive evidence for staff training leading to positive communication outcomes is offered by Van der Meer *et al.*'s (2017) systematic review, yet the lack of robust control for the included SLT intervention studies means the suggestive evidence must be interpreted with caution.

Also of note is the fact the research is attempting to study a heterogeneous population without consistent descriptors of the presenting communication difficulty, often insufficient intervention detail and no agreed outcome measures. It is clear that to move forwards in developing an evidence base for SLT interventions, the intervention needs to be clearly defined and described in sufficient detail to enable replication and the outcome needs to be something that is both measurable and meaningful. Currently there is no agreed outcome measure that captures 'improved communication' and the wide-ranging outcomes selected in individual studies targeting different aspects of this ultimate goal make any pooling of results impossible. Clarity of interventions and development of an acceptable outcome measure that captures communication change is something that needs to be addressed going forwards. Some work has begun in this area with the Communication Complexity Scale (Brady *et al.* 2012) providing a score for observed expressive communication levels for individuals in early stages of communication (pre- and early symbolic communication behaviours). This has potential application to research, but further work is needed in this area to capture more complex forms of communication and address the function as well as form.

SSEDs are prominent in disability research (Ganz and Ayres 2018) and offer a pragmatic and useful approach for many SLT intervention studies. SSEDs can include participants with complex and multiple difficulties when RCTs may be much more challenging (Enderby *et al.* 2009). High-quality SSEDs can evaluate single interventions and multiple high-quality SSED studies with positive outcomes can establish evidence-based practices (Ledford *et al.* 2018). The WWC (2014) manual recommends several standards need to be met including a minimum of five high-quality studies examining the intervention (Byiers *et al.* 2012), conducted by different research teams, combining multiple single-design examples. The available SSED evidence in SLT adult ID currently falls significantly short of these standards. Moving forwards, as Hutchinson and Bodicoat (2015) highlight, when SSEDs are used, it is important that researchers make use of the available guidance (Ganz and Ayres 2018, Smith 2012, Tate *et al.* 2008) to improve the quality and strength of the resultant evidence. Ganz and Ayres (2018) provide recommended methodological standards for SSED studies in ID research.

To advance clinical effectiveness and demonstrate to commissioners the value and cost-effectiveness of communication interventions with this client group,

SLT services delivering communication input for adults with ID urgently need robust research to inform clinical decision-making and support evidence-based practice. Studies need to be controlled and provide clear descriptions of participants, inclusion and exclusion criteria, and interventions. They must also include sufficient data to allow calculation of the effect size and to attempt to make use of comparable outcome measures to enable pooling of data for meta-analysis.

Limitations

While this review had a robust methodology and used a systematic search strategy to identify all relevant trials, it does have some limitations. The inclusion criteria for study design requiring a robust control element, deemed essential to determine whether any effects were the result of the treatment, set a high benchmark and led to the exclusion of some interesting studies reporting the use of relevant SLT interventions in adults with ID. People with ID have lifelong communication difficulties and many SLT interventions are used across the lifespan. The inclusion criteria of only adults (aged 18+ years) meant some controlled studies into children with ID, which may have had potential transferability to the adult ID population, were excluded. The challenges of defining what constitutes an SLT intervention in this population meant a pragmatic approach, using professional judgement, was adopted for inclusion/exclusion. The desire to focus specifically on studies that would be accepted as SLT interventions meant research addressing preparatory tasks such as sensory integration or switch access, which SLTs may use, are not included. It also meant that innovative interventions or interventions of potential relevance to SLT practice in non-UK countries may have been excluded.

During the appraisal stage the focus was on reporting quality and authors were not contacted to gain further information about the studies. This could have potentially resulted in overly low-quality rating scores. No limitations were placed on the search in terms of language or date of publication to increase the scope, but this resulted in 13 titles for which it was not possible to locate a full abstract, including four titles without an author. The majority of these were published pre-1980 and none of the titles appeared relevant to this review question, but there was insufficient detail to include or exclude them.

Future research

There are numerous unanswered questions surrounding SLT interventions for adults with ID. Future research must address interventions in common usage today to establish which interventions are effective at improving communication. Consideration should be given to their acceptability to adults with ID and their carers. Research can then move on to comparing the efficacy of two or more interventions to enable evidence-based clinical decision-making and increase accountability across the profession. Small pockets of research in niche areas such as transmission medium on AAC users' requesting behaviour are reported to have reached sufficient levels to permit comparisons among interventions (Schlosser 1999). However, this is not the case for any core SLT interventions used in current UK practice with the adult ID population.

This study has highlighted the lack of high-quality evidence available for direct and indirect intervention. Given the frequency with which indirect intervention is used in clinical practice in the UK, this area of future research should be prioritized. Due to the high turnover of paid care staff in ID services, studies addressing indirect interventions will need to be designed with sufficient sample sizes to address the inherent challenges with retention when including this workforce.

Future research attempting to address questions around intervention effectiveness should consider and report on broader issues such as length of follow-up and outcome measurement tools. Gaining some consensus in these areas would mean that the data captured from different studies could be compared. Further, it must provide full descriptions of participants to allow for the possibility of identifying subgroups of adults who have similar features and who may respond similarly to some types of intervention.

Conclusions

SLT interventions designed to improve communication for adults with ID currently have a weak evidence base. Some positive trends in communication change were shown for the three intervention areas of speech, interaction and AAC, however the evidence across the board was low quality and heterogeneous in terms of interventions and outcomes, preventing any meta-analysis. It is important to highlight that although there is not strong evidence in support of any one SLT intervention, this review did not find SLT was ineffective in this population but rather the current evidence base is not sufficiently developed to draw robust conclusions around effectiveness and efficacy. High-quality research is required to establish the effectiveness and efficacy of interventions commonly used in clinical practice.

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Appendix A

Database: **Ovid MEDLINE**(R) ALL <1946 to January 07, 2020>

Date searched: 9 January 2020

(1) exp Intellectual Disability/(94558)
(2) Mentally Disabled Persons/(3545)
(3) Learning disorders/(14056)
(4) Developmental Disabilities/(19601)
(5) exp Neurodevelopmental Disorders/(176803)
(6) "neurodevelopmental disorder∗".tw. (8738)
(7) (mental∗ adj3 (retard∗ or disab∗ or defici∗ or handicap∗ or impairment∗ or subnormal∗ or sub-normal∗)).tw. (44047)
(8) ((intellectual∗ or learning∗) adj3 (impair∗ or disab∗ or disorder∗ or difficult∗ or subnormal∗ or sub-normal∗)).tw. (41056)
(9) (feeble-minded∗ or moron∗ or imbecil∗ or cretin∗).tw. (2111)
(10) de lange∗.tw. (1073)
(11) Cri-du-chat.tw. (448)
(12) (Wagr adj3 syndrome).tw. (159)
(13) (down∗ adj3 syndrome∗).tw. (21928)
(14) (Rubinstein adj3 Taybi).tw. (673)
(15) (prader adj3 willi).tw. (3544)
(16) (williams adj3 syndrome).tw. (2257)
(17) fragile X.tw. (6736)
(18) ((Martin Bell or FRAXE or FRAXA) adj3 syndrome∗).tw. (209)
(19) (les?h adj3 nyhan∗).tw. (1082)
(20) Adrenoleukodystrophy.tw. (2001)
(21) (Coffin adj Lowry).tw. (228)
(22) Menkes.tw. (1269)
(23) Glycogen Storage Disease.tw. (2480)
(24) Mucopolysaccharidosis.tw. (3644)
(25) Rett∗.tw. (4417)
(26) Pyruvate Dehydrogenase.tw. (6615)
(27) (angelman adj3 syndrome).tw. (1405)
(28) (bardet adj biedl).tw. (1087)
(29) ("brain disorder∗" adj2 metabolic).tw. (19)
(30) "brain disease∗".tw. (5835)
(31) (cockayne adj3 syndrome).tw. (957)
(32) "Congenital hypothyroidism".tw. (3278)
(33) (di-george adj3 syndrome).tw. (103)
(34) ((velo-cardio-facial or Velocardiofacial) adj3 syndrome).tw. (872)

(35) "Duchenne muscular dystrophy".tw. (8915)
(36) "Fetal alcohol spectrum disorder∗".tw. (1590)
(37) (klinefelter adj3 syndrome).tw. (1519)
(38) "Metachromatic leukodystrophy".tw. (1147)
(39) MUCOPOLYSACCHARIDOS?S.tw. (4493)
(40) Phenylketonuri∗.tw. (5994)
(41) Neurofibromatos?s.tw. (13898)
(42) (Smith adj3 Magenis).tw. (405)
(43) (sotos adj3 syndrome).tw. (439)
(44) (sturge adj3 weber).tw. (1516)
(45) "Spinal muscular atrophy".tw. (4665)
(46) (Tuberous adj3 sclerosis).tw. (7557)
(47) (turner adj3 syndrome).tw. (3958)
(48) or/1-47 (341109)
(49) exp Speech Therapy/(6265)
(50) ("speech and language therap∗" or "speech and language patholog∗" or "speech-language patholog∗" or "speech therap∗").tw. (7556)
(51) or/49-50 (11890)
(52) 48 and 51 (1515)

Appendix B

Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Supporting Information

Table B1. Crowe Critical Appraisal Tool (CCAT) consensus quality ratings for included studies

Study ID	Notes	Country	Preliminaries	Introduction	Design	Sampling	Data	Ethics	Results	Discussion	Total/40	Total (%)
Beck *et al.* (2009)	No rationale for two groups, no data for non-participant models	USA	3	4	3	1	3	0	2	4	20	50%
Bunning (1998)	Set up as a randomized controlled trial (RCT) but (1) minimal information is available about the intervention and placebo group; and (2) no information is available on randomization	UK	2	3	1	1	2	0	1	1	11	28%
Chambers and Rehfeldt (2003)	Alternating treatment but only two of four participants fully complete training	USA	4	4	4	1	3	0	3	2	21	53%
Icht (2019)	RCT comparing new 'beatbox' treatment with traditional therapy (lacks control description)	Israel	4	4	4	3	3	3	2	3	26	65%
Kleitsch *et al.* (1983)	Limited data analysis, no ethical considerations and rationale, and the functional impact of outcome measure is not addressed	USA	4	3	3	2	3	0	2	3	20	50%
Lovell *et al.* (1998)	Alternating treatments compared with baseline. Only one participant	UK	4	4	4	1	4	3	2	4	26	65%
Money (1997)	Set up as an RCT with directly being standard practice, but not explicitly stated, and did not use three-group analysis	UK	4	5	4	3	2	0	3	2	23	58%
Stoner *et al.* (2006)	Only evidence for the requesting phases 1–4 of the Picture Exchange Communication System (PECS), not commenting (5–6)	USA	5	4	3	2	3	0	3	3	23	58%
Wells (1981)	Alternating treatment design. No statistical analysis	USA	4	5	4	1	2	0	2	3	21	53%
Ziomek and Rehfeldt (2008)	Alternating treatment but insufficient detail for one of comparators (signing)	USA	3	3	4	1	3	0	3	3	20	50%

Consistent with the Crowe Critical Appraisal Tool (CCAT) user guidelines (http://conchra.com.au/), each article was evaluated using a six-point scale (0–5 points for each aspect), with a total potential score of 40. For this tool, a score of 0 indicates no information or extremely poor quality evidence (e.g., within ethical matters there may be no discussion of informed consent, equity, confidentiality, ethical approval, conflict of interest or subjectivities); a rating of 3 indicates a basic but sound evidence base (e.g., within design there could be a description of a suitable study design, valid and reliable outcome measures but insufficient detail of intervention and only partial consideration of bias); and a rating of 5 is used for aspects that are extremely well addressed within a given study.