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RESEARCH REPORT

Attributes of communication aids as described by those supporting children and young people with AAC

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Abstract

Background: Those supporting children and young people who use augmentative and alternative communication (AAC) contribute to ongoing complex decision-making about communication aid selection and support. Little is known about how these decisions are made in practice and how attributes of the communication aid are described or considered.

Aims: To understand how communication aid attributes were described by those involved in AAC recommendations and support for children and young people, and how these attributes were described as impacting on AAC use.

Methods & Procedures: A secondary qualitative analysis was completed of interview and focus group data from 91 participants involved in the support of 22 children and young people. Attributes of communication aids described by participants were extracted as themes and this paper reports a descriptive summary of the identified software (non-hardware) attributes.

Main Contribution: Decisions were described in terms of comparisons between commercially available pre-existing vocabulary packages. Attributes related to vocabulary, graphic representation, consistency and intuitiveness of design, and ease of editing were identified. Developmental staging of vocabularies, core and fringe vocabulary, and vocabulary personalization were attributes that were described as being explicitly considered in decisions. The potential impact of graphic symbol choice did not seem to be considered strongly. The physical and social environment was described as the predominant factor driving the choice of a number of attributes.

Conclusions & Implications: Specific attributes that appear to be established in decision-making in these data have limited empirical research literature. Terms used in the literature to describe communication aid attributes were not observed in these data. Practice-based evidence does not appear to be supported

by the available research literature and these findings highlight several areas where empirical research is needed in order to provide a robust basis for practice.

KEYWORDS
AAC devices, communication aids, decision-making, speech-generating devices

What This Paper Adds

What is already known on the subject

Communication aid attributes are viewed as a key consideration by practitioners and family members in AAC decision-making; however, there are few empirical studies investigating language and communication attributes of communication aids. It is important to understand how those involved in AAC recommendations and support view communication aid attributes and the impact different attributes have.

What this paper adds to existing knowledge

This study provides a picture of how communication aids are described by practitioners and family members involved in AAC support of children and young people. A range of attributes is identified from the analysis of these qualitative data as well as information about how participants perceive these attributes as informing decisions.

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

This study provides a basis on which practitioners and others involved in AAC support for children and young people can review and reflect on their own practice and so improve the outcomes of AAC decisions. The study provides a list of attributes that appear to be considered in practice and so also provides a resource for researchers looking to ensure there is a strong empirical basis for AAC decisions.

INTRODUCTION

Augmentative and alternative communication (AAC) consists of strategies, tools and equipment that support the communication of those with complex communication needs. Unaided AAC methods are those that involve no external equipment whilst aided AAC methods to involve communication aid equipment that may be powered or unpowered. Aided methods may represent language using text or use graphic representations of concepts and words to enable those who are pre-literate or with emerging literacy to access a communication method. Graphic representations may include ideographic symbols and picture communication referents as well as combining them with written words (Smith & Murray, 2016; Tenny, 2016).

Considering the most appropriate communication aid, as with all AAC systems, involves decision-making with the individual and those supporting the individual, including family members and a range of professionals (Batorowicz & Shepherd, 2011; King et al., 2008). It is recognized that this decision-making is challenging and inconsistent and that little is known about how practitioners make decisions in practice (Murray et al., 2019; Theodorou & Pampoulou, 2022). Schlosser and Raghavendra (2004) explored the principles of evidence-based practice through an AAC lens, highlighting the influence on decision-making of communication aid attributes, and concluding that practitioner's expertise and system preference had a greater influence on decision recommendations than individual (patient) preference or research evidence. The potential influence of practitioner knowledge and experience of particular communication aids is also highlighted in the review carried out by Judge et al. (2019) which concluded that there was very limited empirical research investigating specific attributes of communication aids on which practitioners could form decisions. Dietz et al. (2012)

also concluded from their interview study with speech and language therapists (SLTs) that practitioner experience has an effect on the quality of AAC assessment.

In a qualitative study of specialized practitioners, an explanatory model of practitioners' decision-making proposed by Murray et al. (2019) describes factors considered in communication aid recommendations. The I-ASC (Identifying appropriate symbol communication aids for children who are non speaking) model incorporates (1) competing considerations relating to organizing themes of communication aid attributes, child characteristics and access features, as well as (2) cultural and contextual influences relating to organizing themes of ways of working, transitions and available resources. This explanatory model was developed from the primary analysis of focus group data which are part of the data of which a secondary analysis is reported here. Findings from two related I-ASC studies also provide quantitative experimental insight into the stated content of practitioners' decision-making. The first experiment provided relative importance scores for a set of 18 communication aid attributes, the attributes assigned above average importance were: the chosen vocabulary or language package(s); the consistency of layout and navigation; the ease of customization; system durability and reliability; the type of vocabulary organization; and the number of key presses required to generate symbol or text (Webb et al., 2019b). The second study looked at a smaller set of five communication aid attributes and established baseline preferences of practitioners for: vocabulary sets over no pre-installed vocabularies; a consistent vocabulary layout with a pragmatic organization method; and up to 1000 symbols using photographs or pictographs (rather than ideographs). This study demonstrated that participants changed their stated preference for communication aid attributes depending on the child characteristics—finding a number of significant interactions between some stated child characteristics and communication aid attributes (Webb et al., 2019a). These findings reinforce those from other studies: Thistle and Wilkinson (2015) surveyed practitioners to explore approaches to building AAC displays and identified a range of attributes stated by practitioners as considered, including identifying a relevant core vocabulary and the types of word class, the type of display layout and consistency in page-to-page display design; while Lund et al. (2017) interviewed specialist SLTs about their assessment rationale and identified themes relating to high/low tech, vocabulary, array size, layout and symbols.

This paper describes how communication aids were considered using the words of participants involved in AAC recommendations and support. As such this work attempts to be independent of specific terminology, taxonomy or brand names. However, it is impossible to report these data without some use of terms. The conceptualization of a communication aid used in the description of these data is that of a communication aid that may run or draw upon an AAC software platform to display a vocabulary of graphic representations; the arrangement of vocabulary items in the vocabulary may be part of a predetermined organization method, may be distributed across several pages and may be provided as a predetermined vocabulary package. The communication aid may or may not be powered and have a voice output, for example, it may be a paper-based communication book, and is typically used as part of an individual's overall total communication system.

This study took place in the UK between 2016 and 2019. In 2014 AAC service delivery in the UK changed significantly with national commissioning in England, Wales and Northern Ireland of specialized AAC services. These services were commissioned to provide specialized communication aids, leaving local services providing AAC support and non-specialized communication aids. Within Scotland, a different system was instigated in 2016 where a rights-based approach was adopted and legislation put in place which required local services to provide all communication aids and AAC support, with additional support from two national specialized providers. In all these UK contexts, funding for symbol communication aids should thus have been achieved through statutory provision routes, although this cannot be considered universal or guaranteed due to the variance in the timescales of implementation, service delivery and acceptance criteria. The provision of communication aids was not from an approved procurement list and each service (local or specialized) had flexibility in which communication aids were recommended and provided, including flexibility around the device, AAC software, vocabulary package, language system or graphic representation type.

Light et al. (2019) highlight the proliferation of AAC apps since the advent of tablet-based devices and Lund et al. (2017) suggest 'rapid changes in technology' (56) as one of the factors making AAC decisions challenging. The AAC market and distributors in the UK at the time of this study were relatively vibrant with a range of pre-made vocabulary packages representing a range of different fundamental language representation systems.

The study described in this paper aimed to investigate two research questions:

- How are communication aid attributes described by those involved in AAC recommendations and on-going AAC support for children and young people?
- How are these attributes then described as impacting on AAC use?

METHOD

A phenomenological approach (Elliott & Timulak, 2015) was taken to this study in seeking to understand the experiences of those supporting a child and young person. Secondary qualitative analysis was carried out of the interview and focus group data from participants involved in real-life AAC situations.

Participants

The secondary analysis reported here covers data from 91 participants in total discussing AAC recommendations and support relating to 22 children and young people. Participants were parents or guardians of children and young people who used communication aids as well as tertiary and local professionals involved in the process of AAC recommendation, provision and implementation. This included speech and language therapists, occupational therapists, therapy assistants, clinical scientists, teachers and teaching assistants, key/support workers and personal assistants. Participant demographics, including the AAC use of children and young people, are summarized in Tables 1 and 2.

Data collection

Ethical approval was obtained from North West-Lancashire NHS Research Ethics Committee (REC reference 16/NW/0165).

Participants were recruited in two distinct data collection phases of the I-ASC research project, with an opportunity to contribute to either focus groups or interviews. Participants were purposively sampled to achieve a spread in UK geography and participant characteristics of the children and young people using AAC. The recruitment of participants is fully described by Murray et al. (2020: 41–53).

Each interview or focus group reported in these data related to a specific child or young person who used or was considering using a communication aid. In both interviews and focus groups, discussions centred around considerations of and assessment for powered (voice output) communication aids. The use of communication aids was considered in the context of multi-modal communication by children and young people and so participants also discussed other AAC systems including non-powered communication aids.

Focus group participants were recruited from the team of individuals involved in a specialized communication aid assessment for a specific child. Six focus groups were conducted including 31 specialized and local AAC professionals discussing the AAC assessments of seven children or young people. Five of the six focus groups occurred immediately after the assessment visit and were structured around discussing the specific decision-making, the sixth focus group took the form of a prescription review type discussion, held by a specialized service provider.

Interview participants recruited were from the AAC team around a specific child or young person and included parents/guardians. A total of 60 participants were recruited and interviewed having supported 15 children or young people in their use of AAC. These data were collected across all countries of the UK.

Data analysis

Data were transcripts from focus groups and interview discussions. The primary data were the transcripts and coding from the organizing theme of *Communication Aid Attributes* of the primary inductive thematic analysis (Murray et al., 2019). Secondary analysis of these primary data was carried out by the first author using framework analysis (Ritchie et al., 2013). Using the definitions of Elliott and Timulak (2015), this analysis was both descriptive, in establishing what way attributes were described, and interpretive, in investigating how these attributes were described as impacting AAC use.

The robustness and validity of the analysis were addressed through the second author completing coding and descriptive summary validation. Specifically:

- The primary data were imported into NVivo 11.
- Data were reviewed by re-reading the extracts coded in the primary analysis within the original transcripts.
- Data were iteratively coded by the first author into sub-themes representing concepts participants used to describe the software (non-hardware) attributes of a communication aid.
- For each sub-theme a descriptive summary was developed and representative quotes extracted by the first author.
- The second author checked the coding consistency of the representative quotes ($n = 132$) and the descriptive summary. Coding agreement was 92%, and areas of disagreement in the description were resolved through discussion.
- A final pass of the coding and descriptive summary incorporated a small number of changes resulting from the consistency checking.

TABLE 1 Child and young person participants

Recruitment route	Identifier (gender)	Age (years)	Diagnosis	AAC
Focus group	P1 (female)	5	Cerebral palsy	Assessment for first communication aid—ambulant, direct access
Focus group	P2 (female)	5	Physical disability and medical condition	Assessment for first communication aid—wheelchair user, direct access
Focus group	P3 (female)	18	Learning disability, autism features	Assessment for new communication aid following experience with a number of communication aids—wheelchair user, direct access
Focus group	P4 (male)	7	Cerebral palsy	Assessment for a second communication aid—wheelchair user, indirect access
Focus group	P5 (male)	9	Medical condition	Assessment for a new communication aid following experience with a number of communication aids—wheelchair user, direct access
Focus group	P6 (male)	4	Cerebral palsy, autism features	Assessment for first communication aid – wheelchair user, partner-assisted scanning and eye gaze access
Focus group	P7 (male)	5	Cerebral palsy, hearing impairment	Assessment for first communication aid – wheelchair user, partner-assisted scanning and eye gaze access
Interview	P8 (female)	9	Global developmental delay, moderate learning disability	PODD book. Direct access
Interview	P9 (male)	4	Cerebral palsy, cognitively able	PODD 70; Tobii I12 with Picture WordPower B. Partner-assisted scanning and eye gaze access
Interview	P10 (male)	7	Cerebral palsy, mild learning disability	Communication book; Accent 800 (Liberator Ltd) with easyChat 16 (Liberator Ltd). Direct access
Interview	P11 (female)	11	Cerebral palsy, mild learning disability	Accent 1400 (Liberator Ltd). Access via two head switches
Interview	P12 (male)	10	Cerebellar atrophy, moderate learning disability	Accent 1000 (Liberator Ltd) with easyChat 60 (Liberator Ltd)
Interview	P13 (male)	4	Global developmental delay	Grid Pad (Smartbox Assistive Technology, Malvern, UK) with Symbol Talker A (Smartbox Assistive Technology)
Interview	P14 (female)	12	Acquired brain injury, learning disability	Accent (Liberator Ltd) with Grid 3 (Smartbox Assistive Technology)
Interview	P15 (male)	15	Cerebral palsy, cognitively able	NOVA chat 8 (Liberator Ltd). Direct access
Interview	P16 (male)	7	Cerebral palsy, learning disability	Grid Pad with Grid 3. Eye gaze access
Interview	P17 (male)	11	Autism spectrum condition, severe learning disability	iPad (Apple Inc., Cupertino, CA, USA) with Clicker Communicator Core 2 (Crick Software Ltd, Northampton, UK). Direct access
Interview	P18 (female)	19	Autism spectrum condition, severe learning disability	iPad with Grid Player Smartbox Assistive Technology on Symbol Talker A. Direct access
Interview	P19 (male)	36	Cerebral palsy, cognitively able	Accent 1400 with NuEye (Prentke Romich Company, Wooster, OH, USA). Eye gaze access
Interview	P20 (female)	7	Cerebral palsy, mild learning disability	Communication book; Grid Pad with the Grid and an iPad with Grid Player; both on Symbol Talker A. Direct access
Interview	P21 (male)	18	Cerebral palsy, moderate learning disability	PODD book; iPad with Clicker Communicator. Direct access
Interview	P22 (female)	21	Cerebral palsy, moderate learning disability	Alphabet board; iPad with Grid Player; ECO™2 (Liberator Ltd) with LLL 128. Direct access

TABLE 2 Practitioners and family member participants

Recruitment route (linked child or young person participant)	Number of participants	Professional background
Focus group 1 (P1)	4	1 independent SLT
		1 specialist SLT
		2 teaching assistants
Focus group 2 (P2, P3)	13	5 specialist SLTs
		4 specialist clinical scientists
		3 specialist occupational therapists
		1 therapy assistant
Focus group 3 (P4)	3	1 specialist SLT
		1 specialist occupational therapist
		1 specialist healthcare scientist
Focus group 4 (P5)	5	1 local SLT
		1 local occupational therapist
		1 local physiotherapist
		1 specialist SLT
		1 specialist occupational therapist
Focus group 5 (P6)	4	2 local SLTs
		1 specialist SLT
		1 specialist occupational therapist
Focus group 6 (P7)	2	1 local SLT
		1 specialist SLT
Interview 1 (P8)	4	Parent (mother)
		Specialist SLT
		Local SLT
		Key worker
Interview 2 (P9)	5	Parent (mother)
		Teacher
		Teaching assistant
		SLTs ($n = 2$)
Interview 3 (P10)	5	Parent (mother)
		Teacher
		Teaching assistant
		Specialist SLT
		Local SLT
Interview 4 (P11)	6	Parent (mother)
		Teacher
		Teaching assistant
		Local occupational therapist
		Specialist SLT
		Local SLT
Interview 5 (P12)	5	Parent (mother)
		Teacher
		Teaching assistant
		Local SLT
		Local occupational therapist

(Continues)

TABLE 2 (Continued)

Recruitment route (linked child or young person participant)	Number of participants	Professional background
Interview 6 (P13)	4	Parent (mother) Teacher Teaching assistant Assistive technology coordinator
Interview 7 (P14)	3	Parent (mother) Specialist SLT Specialist occupational therapist
Interview 8 (P15)	3	Parent (mother) Specialist SLT Local SLT
Interview 9 (P16)	3	Parent (mother) Specialist SLT Local SLT
Interview 10 (P17)	4	Parent (mother) Teacher Local SLT AAC officer
Interview 11 (P18)	4	Parent (mother) Teacher Local SLT Assistive technology coordinator
Interview 12 (P19)	2	Parent (mother) Personal assistant
Interview 13 (P20)	4	Parent (mother) Local SLT Support workers ($n = 2$)
Interview 14 (P21)	5	Parent (father) Specialist SLT Local SLT Local occupational therapist Local clinical scientist
Interview 15 (P22)	3	Parent (mother) Parent (father) Local SLT

RESULTS

Results are presented as sub-themes organized under the a-priori organizing theme of communication aid attributes (Table 3). Due to space constraints this paper presents the analysis relating to communication aid software attributes, and does not include analysis of the hardware attribute theme from the primary analysis.

Quotes included are illustrative and have been edited for readability and to ensure anonymity (unedited anonymous quotes are available in the additional supporting information).

Software vocabulary

Use of pre-existing vocabulary packages, staged vocabulary packages, vocabulary organization methods, vocabulary navigation, organization of core and fringe vocabulary, personalized vocabulary, and the amount of

TABLE 3 A priori organizing themes and sub-themes developed from the analysis

A priori organizing themes—communication aid theme	Sub-themes developed
Hardware aesthetics	*(Not included in this paper)*
Hardware reliability	
Hardware data storage and processing	
Software vocabulary	Use of pre-existing vocabulary packages
	Staged vocabulary packages
	Vocabulary organization method
	Vocabulary navigation
	Organization of core and fringe vocabulary
	Personalized vocabulary
	Amount of vocabulary
Software graphic representation	Software graphic representation
	Text
	Photos
Software consistency and intuitiveness of design	Consistency between communication aids
	Consistency of vocabulary item location
Software ease of editing	Software ease of editing
	Preference for specific AAC software or operating system

vocabulary all emerged as attributes related to software vocabulary.

Use of pre-existing vocabulary packages

A wide range of pre-existing vocabulary packages used on both powered and paper-based communication aids were described by participants. Packages were described by their brand name and were also often described in conjunction with the AAC software platform or device on which they were available. In some cases, these terms were used interchangeably, that is, the name of an AAC software was used to describe a vocabulary package, or an AAC device name was used to describe a vocabulary package, etc. 'package', 'layout', 'language', 'system', 'set' and 'type of vocabulary' were used as terms.

Adjectives of 'full' and 'dynamic' were used to describe some vocabulary packages. On some occasions, other attributes identified in this analysis were also used to describe packages, with packages described as having vocabulary staging, specific organizational methods and core and fringe vocabulary.

Choice of vocabulary package appeared to be established as an explicit decision-making concept with decisions frequently described as being based on comparisons of best fit between alternative vocabulary packages, and/or between different stages of a vocabulary package.

> We tell ourselves, look we've got what we've got, we are going to have to choose one because those perfect vocabs are just not there. 0702OT (specialized OT)

The ultimate choice of vocabulary package was oftentimes described as a decision influenced entirely by the environment (e.g., the school) that the child or young person was in.

Staged vocabulary packages

Staged vocabularies were described as sets of pre-prepared vocabularies with different amounts of vocabulary available and intended to be introduced sequentially over time. Terms such as 'levels' and 'stages' were used along with proprietary names of different pre-prepared staged vocabulary packages—the indicator of the level was often the number of cells on a page within the vocabulary (e.g., Package Name 36), designatory letters (a, b, c, d), or descriptive terms (such as 'advanced' and 'basic').

There was considerable discussion of staged vocabularies. In these data staging was most frequently described in terms of changing between predefined levels, some participants also discussed 'hiding' vocabulary items (and later releasing access to these) within a package as a form of refined or personalized staging. Which level of a specific vocabulary package to use was the only

vocabulary attribute that was described as being considered in a number of discussions.

> We looked at what language levels we thought he was at. But our experience was that most of the children who seemed to be functioning at a similar level to [Child] when we started them off coped with it, not on the full 144 but on the 45-location. So we really just went with it. LSLT01103 (local SLT)

The use of staged vocabularies was described in terms of decisions relating to 'progression' and 'development' of the child. Matching the level of the vocabulary to the child and their perceived level of language development and language potential was the only rationale discussed for choosing staged vocabularies or specific levels of vocabularies. Some participants considered and provided a rationale for not staging a vocabulary and using the full vocabulary package from the start.

> We think about what level they're at and then we go a few levels above that, so that the people around the child are able to model and develop their language past the point of what they're already at, rather than just picking one that will meet their needs now but doesn't really have any scope. Also with motor planning, you don't want to be changing the layout and the location of things too often, really. SSLT02203 (specialist SLT)

Vocabulary organization method

Vocabulary organization was described by participants using: package brand names; specific organization methods of 'topical', 'categorical', 'pragmatic branch', 'pragmatic', 'contextual', 'visual scenes' and 'visual metaphors'; with terms such as 'categories', 'folders', 'laid out', 'books with chapters' and 'themes'; and in some cases as having no explicit organizational method.

Methods using literacy were also described such as 'alphabetically organized symbol dictionaries' and methods based on phonics/speech sounds. Some participants described vocabulary organization in terms of grammatical features including 'being grammatical', 'sentence building', 'sentence order', 'English word order' and having the ability to conjugate verbs.

> At the time he was using a low-tech communication book: it had some core vocabulary on the left and some fringe vocabulary on the right, and it was a pragmatic branch style layout so it has categories such as something's wrong, I want to go somewhere, that kind of thing. SSLT02203 (specialist SLT)

Specific organization methods were used almost exclusively to describe vocabulary packages rather than methods of retrieving vocabulary from an AAC system being directly described or implicated in driving decision-making.

Vocabulary navigation

Navigation within AAC vocabularies was described as the process of making sequential selections from predetermined routes through the AAC vocabulary in order to select a vocabulary item. Navigation was described in three ways, summarized as (1) the action ('navigating', 'drilling down', 'sequencing'); (2) the navigational structure through which vocabulary could be retrieved ('pathways', 'menus and submenus', 'pages', 'page turns', 'levels', 'layers' and 'maps', 'dynamic screen'); and (3) the operation of navigating ('selections', 'clicks' and 'hits').

The action of navigating was described in terms of 'finding' and 'hunting' for vocabulary items or being 'lost'. Navigation structure was described in relation to the underlying organizational method of a vocabulary and linked to the complexity and number of page levels of a package, it was also described in value terms such as being 'easy' or 'difficult' or 'good'.

Navigation was described as being influenced by the number of vocabulary items displayed at one time and the access method an individual might use. The ability to achieve motor planning was also discussed in some cases as linked to navigation.

> That's the thing though, if you make it too big, she's going to have to go through lots more pages. I know you have to do two hits on the expanding thing but you still have it all there as one page to look at at the beginning, and she's already got the motor patterning for her to do the big hit in that group. 1502SLT (SLT)

The need for navigational/non-vocabulary items to support vocabulary access (back, more, home, menu, page, etc.) was also discussed as a consideration by some participants.

Organization of core and fringe vocabulary

The terms 'core vocabulary' and/or 'core and fringe' vocabulary arose frequently within the data as well as other

variants including 'core and topic', 'core and main' and 'core boards'. Core and fringe vocabulary was discussed in terms of vocabulary items used within vocabularies and also in terms of vocabulary organization.

The choice, or use, of a core and fringe-based vocabulary was described as explicitly considered in many discussions and was often presented as a prominent consideration. Rationales for choice or use of core vocabulary were not well represented in the data with only two examples of where a rationale for use was discussed with one citing 'new research' and the other 'memory loading'.

> And as a school around this time, we were very much moving towards a core vocabulary approach because of all the new research that had come out. LSLT01003 (SLT)

The organization of vocabulary into categories considered as core and fringe were referred to in terms of being linked to specific vocabulary packages.

> I think [package], you had core vocabulary down the left hand side and your working vocabulary or whatever related bits and pieces on the kind of right hand side. You could click through different layers and different pages of colours or food or feelings or whatever and you could adapt that to look how you wanted, but you always had that core kind of vocab. This very much reflected the communication book approach that we'd done up until this point and the transition was actually very smooth. Tea03503 (teacher)

No specific descriptions or definitions of core or fringe were provided in discussions. In some discussions core and fringe vocabulary was described in some ways as a flexible or a gradated concept in terms such as 'more flexible core words', 'advanced/basic core', 'clearer core' and 'nicer core'. One participant discussed the concept of core vocabulary not being a universal concept and something that might vary per person.

'Fringe' vocabulary was described without reference to core on one occasion. In one case core vocabulary was described as less relevant as the child achieved this communication using other methods.

Personalized vocabulary

The term personalize(d) was used many times by participants to refer to the process of changing pre-existing vocabulary packages for a specific individual. Many terms were used such as 'editing', 'program', 'customise', 'amending', 'changing' and 'making relevant'.

Examples of personalization included adding vocabulary specific to the individual (e.g., their name), preferences and likes (e.g., names of family, friends etc., favourite TV characters), language and culture (e.g., 'anglicizing') and pronunciations, reasons for communication (e.g., storytelling, news), opportunities for communication (e.g., playing games), motivations for communication (e.g., rude or funny words or fun topics or jokes), specific settings (e.g., school/classroom), situations or activities (e.g., holiday) and topics (e.g., school topics, phonics for literacy learning or TV shows).

Personalization of vocabulary was commonly referred to in terms of adding topics, that is, sets of grouped words on a page. Adding personalized topical vocabulary was referred to in terms of curriculum topics, specific situations and communication opportunities (e.g., shopping), conversational topics (e.g., TV, songs), or the person's current or anticipated context and conversational opportunities that might be offered. Participants also discussed adding phrases or pre-prepared personalized content to prepare for specific situations, these included jokes, telling stories, passing on news, commenting or joining in with activities or for accessing books.

Personalization did not seem to impact upon or drive decisions and actually appeared to be an assumed modification to any system amongst participants rather than something to be factored into decision-making. The only process for personalizing vocabulary described in detail was that of informal collaboration between family and others in adding vocabulary items to systems.

Personalization was described as driving the use of, understanding of, and motivation to use the communication aid by the children and young people and as a way of engaging parents and others around the child in using and supporting the use of the system. The need for training parents and others to learn how to personalize the vocabulary was noted by participants. Discussion of personalization was strongly related to ease of editing.

A spectrum of personalization was described, from 'tweaking' to making changes such that it was difficult to identify as the original package. Participants expressed a range of views about the need for different levels of personalization, with some stating that children will find creative ways to use words to get a point across, with others suggesting the system as needed to be 'totally personalized'.

> He's using [Staged Package] but that has been massively personalised and changed and added to, so it doesn't in some ways look like [Staged Package]. SSLT00303 (specialist SLT)

Some participants described current or prior communication aids which had not been based on pre-prepared vocabulary packages and had thus been entirely personalized. In a number of cases, these vocabularies had evolved from a paper-based system and/or transitioned into a pre-prepared vocabulary package. A small number of participants described being conscious of the need to maintain the underlying structure or organization method of a package and described that managing the available vocabulary could be challenging.

> It's not just dumping a load of words in a folder. You got to think about how does he get to it, does that make sense, he shouldn't have to go through food to get to the book that he wants to read and stuff like that. So you do have to always constantly sort of every few weeks, take stock, look at what you've loaded on there and think, Is this just getting really bloated or does it make sense. TA01603 (teaching assistant)

The challenge of maintaining the right amount and type of vocabulary, whilst ensuring it was personalized and relevant was discussed, as was the challenge of being able to predict or note what specific vocabulary an individual might want in their communication aid.

Amount of vocabulary

The amount of vocabulary included within an AAC vocabulary was considered in terms such as 'number of symbols', having 'more/lots on it', 'full'/'large'/'vast'/'huge' and conversely 'small'/'simple'/'basic'/'paired down'.

Vocabulary quantity was often referred to synonymously with the page size of the vocabulary package. Participants frequently described vocabulary packages according to the number of vocabulary items per page and this was often summarized into a single number or set of dimensions.

The amount of vocabulary was frequently described as being directly linked to the choice of specific vocabulary packages. In some discussions, the amount of vocabulary within a package was considered in terms of the appropriateness of the vocabulary items within the communication aid (e.g., the appropriateness of vocabulary items for children versus adults). In some discussions, the amount of vocabulary was linked to the consideration of staged vocabularies.

> He's recently moved on from a [Package] 36 to [Package] 70 because he quite quickly ran out of vocabulary. LSLT00403 (local SLT)

When discussions centred on there being too little vocabulary this was described in terms of being 'limiting' or 'not enough', large vocabularies were described as allowing and 'opening' opportunities for independent expression and learning of language.

The impact of managing the amount of vocabulary on a communication aid was linked to the concept of personalizing vocabularies and in some cases, large vocabularies were described as being 'unmanageable'. When describing paper-based communication aids the amount of, and management of, vocabulary was also discussed as a specific challenge in terms of keeping them up to date with the child or young person's need and organizing them. The amount of vocabulary on paper-based aids was also linked to considering powered communication aids as a workable alternative.

> And those boards just grew arms and legs, there was more and more and more of them. LSLT00403 (local SLT)

Learning and navigational demands of using the system in finding vocabulary (rather than learning the vocabulary items) were described as impacting on choices of the amount of vocabulary. Participants also described considering size of vocabulary operationally in terms of the impact of being able to model and teach how to use the communication aid (rather than understanding and using the vocabulary representations to support effective communication).

Software graphic representation

Graphic representations were discussed using words such as 'symbol sets' and 'symbols' and 'visuals/visual representation' or vocabulary being 'symbolized' as well as using the brand name of a symbol set. Symbols were described as 'clear', 'visual', 'nice', 'complex', 'simple', 'concrete', 'iconic', 'pictographic' and 'representing' and as being 'understood', 'recognized', 'picked up' and 'learnt' by children.

In many discussions the decision to choose particular graphic representations was made without explicit discussion of the type of symbol, and discussions debating and comparing different types of symbol were largely absent. In the instances where the type of symbol was explicitly considered these debates clustered around symbols representing multiple meanings (iconic/concept-driven) or symbols perceived as 'concrete' (transparent).

Some children and young people were described as using two or more communication aids contemporaneously with different symbol sets on each communication aid. Situations were also described where symbols from

different sets were used in different environments or situations, such as home and school. In one case this was described as one set of symbols for reading and one for speaking via the communication aid. The use of symbols was described by some as being 'transferred' and symbols being 'similar' with the perceived impact of changing symbol on the child or young person as being 'low'. In some instances, a child was described as having used a range of symbol sets over their lifetime. Mixing graphic symbols from different symbol sets within a communication aid was described a number of times within the data.

A small number of discussions described decisions to maintain a specific graphic symbol set between communication aids or settings.

> I think that probably wasn't our primary worry because when we tried the devices he picked up the symbols so quickly. I think some children it's really important that their symbol sets stay the same, but other children actually can be a bit more flexible with it. Sometimes us adults find it harder to be flexible with the symbols than the children do, so I think on assessment [child] picked up the symbol set pretty quickly. SSLT02203 (specialist SLT)

The symbol set was described on some occasions as a choice related solely to the environment.

> I think probably [School] have moved more towards [Symbol Set] now, and then this school is definitely a [Symbol Set] school. LSLT03703 (local SLT)

Graphic symbol choice was on some occasions described as a bi-product of the AAC software platform being used on the communication aid or to produce the paper-based communication aid content. Often graphic symbol sets were discussed as an adjunct to the vocabulary package, software or device, that is, whatever symbol set that was present was used.

> Yeah, that was more that because it's [AAC Software], we used [AAC Software] all around the school already, so it was kind of decided that [AAC Software] symbols. SLTA04503 (SLT assistant)

Text

The use of written words within the graphic representation system was described in terms of 'text', 'text pages', 'typing', using the 'alphabet' and 'keyboards'. Text gloss associated with symbols was described as 'symbol and text' or 'symbols with words underneath/above'. Vocabulary packages were described that used a mix of written and symbolized words; 'symbol vocabularies with keyboards'; and 'keyboards with symbol support'. Systems using only text were described as text, spelling or keyboard based.

The use of written words was described in the context of the impact on language learning. Packages were described as 'literacy based' and described in terms of being 'linguistic' enabling 'sentence building' or 'forming longer sentences'.

> Yeah, so originally we chose [Package] because it is really well-researched, well evidence-based, it's nice and dynamic and it really helps the sentence building. SSLT02203 (specialist SLT)

The predicted future literacy of a child was described as impacting on 'package' choices and a 'literacy based' package versus other options was frequently described as a critical choice. Choices were often described in terms of 'transition' or 'bridging' to literacy, 'literacy alongside communication' or 'being ready' for a solely text-based system. One participant also described the link between the use of text for communication and access to a phonics curriculum via a phonic keyboard on the communication aid.

The change of representation systems from graphic symbols to text over time was discussed by a number of participants with some vocabulary packages considered to better support this than others. The inclusion of text as a representation medium was also described as a consideration in the use of staged vocabularies, moves between stages, and 'bridging' to entirely literacy-based systems.

Being able to self-generate (novel) utterances more freely, to add new vocabulary independently, and to communicate more quickly were discussed as reasons for using or aiming for text-based systems.

> I think because he's got such high-level communication skills, we couldn't possibly predict everything that he might want to say, so I think he found it easiest just to type out. LSLT04403 (local SLT)

Photos

Photos were described as used in some communication aids alongside graphic symbols. Photos were described as being considered for representation of individuals (e.g., family members, teachers), specific concepts (e.g., TV

programmes), or when a symbol was not considered to represent a concept effectively. Photos were also described as considered for storytelling and narratives using a photo or video of an event that the child or young person was involved with and using this to tell a story or promote a conversation.

Photos were described in one case as 'easier' and in other cases as being 'more motivating' for both the child or young person and their peers. One participant described that :

(Photos provide a) joint focus of attention, to co-construct meaning with people and also to experience successful communication. 0602SLT (SLT)

Software consistency and intuitiveness of design

Two sub-themes emerged when considering the attributes participants described related to the consistency and intuitiveness of software. Both sub-themes notably resonate with other attributes described in this analysis but were discussed as, and thus coded as, sub-themes in their own right.

Consistency between communication aids

Moving between systems was described in terms of progression over time (old to a new communication aid) and also as using multiple communication aids contemporaneously. Consistency between communication aids was described using words such as 'continuity', 'duplication', 'similar', 'based on', 'same', 'mimic' and 'transferring'. Consistency was described in using and moving between paper and powered communication aids, in different environments, or with different people.

> We now have a [Communication Aid] from [AAC company] with [AAC Software] on it, and my wife spent quite a lot time sorting out the grids so it reflects her communication system book. Par06203 (parent)

Promoting consistency in moving between systems was linked in some discussions to the use of staged vocabularies. Consistency in the use of graphic symbols in moving between systems was considered important in some discussions but considered not important in others.

Maintaining consistency between communication aids appeared to be a key factor that drove a number of decisions discussed within these data. The impact of consistency between systems was described in a number of ways: the learning demands of moving between consistent systems; the effort and time required to ensure consistency between systems; and the future impact of consistency between systems on a child's progression, development and longer term needs. A specific example of maintaining consistency in communication aids can be seen in one participants' consideration of the commercial sustainability of a system developer.

> The language organization, you've got to stick to [AAC company] stuff. And if [AAC company] go out the window, we're stuffed. PAR04803 (parent)

Consistency of vocabulary item location

Consistency was also used to describe the location of vocabulary items. Participants used words such as 'being in the same place', 'fixed' and 'same' and consistency was described in relation to the layout and navigation through the system using terms such as 'same kind of drill down structure', 'language organization', 'same pathways', 'core/fringe', 'laid out similarly' and 'symbols/letters being in the same or similar locations'. Consistency of 'function buttons' such as back/home, etc. was also described.

Participants described valuing consistency in vocabulary location as they perceived this consistency as something that promoted learning. Participants also described considering the effort required by those around the individual to personalize and/or make a package consistent when adding new vocabulary items.

> Periodically, we would sit and go through the organization of it and put things in some semblance of logical order. Because there's pages within pages and submenus and what have you, it had to be quite intuitive for both [Child] to figure it out and learn it, but also have a very good sense of common sense relating to it, to enable me and my staff to help him navigate through. Tea03503 (teacher)

Software ease of editing

Ease of editing using the AAC software platform was described in terms of how easy it was to edit a range of aspects of the vocabulary within the communication aid and the training required for an individual or team to be able to do this. Ease of editing vocabulary was described using words such as 'programming', 'editing', 'loading things on', 'flexibility' and 'user friendliness'.

Some participants described no longer needing to consider how easy a software platform was to use because of improvements to AAC software editing including the ability to carry out 'direct editing'—that is, to change vocabulary easily on the device itself. Ease of editing was in some cases compared between powered and paper-based devices.

> So sometimes, like there's quite a few things wrong in his [Paper Based AAC] book and I've still not got around to saying, oh could we get this changed or that changed. Whereas the good thing about the [Powered Communication Aid] is you can go in yourself and just click, click, click and add …. Par00203 (parent)

Conversely, aspects of ease of editing were also described in negative terms, this included lack of ease of editing related to software menus and tools, backing up vocabularies, transferring vocabularies between different devices, and finding words within a vocabulary.

Ease of editing was considered explicitly and sometimes identified as being a key driver in decisions. Ease of editing was described as impacting on family involvement in the personalization of vocabulary leading to an increased feeling of ownership by the family and increased support of and use of the communication aid. Ease of editing was also described as supporting others around the child or young person, such as teachers, to be able to edit the system, and in reducing the need to train those around the child or young person which was viewed as increasing the amount of system personalization. Facilitating an individual to be able to edit a vocabulary themselves was also described a small number of times.

> The point is making it easy enough to edit and teach parents how to edit. The ideal scenario is that families take ownership. Because we dip in and they're going to be there. So really from the beginning, we like families to be on board with us. AACOFF03803 (AAC officer)

Preference for specific AAC software platform or operating system

Preference for and use of a specific AAC software platform or operating system was described by participants and coded as an aspect of the ease of editing of communication aids. This preference was described in terms of specific brands of devices, software, vocabulary or representation system and these terms were often used interchangeably. Comfort with software was described using terms such as 'knowing', 'experience of' and 'familiarity'.

On some occasions, AAC software platforms were described as being 'similar' and therefore the decision around the actual software as not being perceived as significant. More often a preference for a specific AAC software platform was discussed as driving some decisions.

> And we took along obviously the [AAC Software] because that's what the local SaLT had experienced. SSLT03103 (specialist SLT)

The support received from AAC companies and being able to access the software to trial or download onto a device were given as reasons for driving choices of specific AAC software. AAC software choice was also described as being considered explicitly per environment when those in an environment were better able to support this software, for example, when staff had already been trained in the software and when peers in the environment had prior 'success' with that software platform.

> Well that's quite an interesting question because we are a [AAC Software] school, we wanted to look at [AAC Software] anyway, so we'd have probably looked at the [AAC package available on AAC Software]. LSLT03703 (local SLT)

The operating system of a communication aid (e.g., Windows, MacOS, etc.) was discussed as being considered in its own right and driving decisions in some cases, and as an aspect of ease of use in others. Operating system choice was described as considered in some cases because it was seen as an enabler in increasing the support for communication aid use and adoption by families and those around the child or young person.

DISCUSSION

This study provides an insight into how software attributes of communication aids are described by those involved in their recommendation, provision and implementation, and the impact these individuals ascribe to these attributes.

Communication aid attribute descriptions

Vocabulary packages appear to be the predominant paradigm in which participants in these data, those around the child or young person using AAC, described graphic symbol communication aids. Vocabulary packages

appeared to be used as a proxy for a range of other potential attributes and other attributes were discussed descriptively rather than as driving decisions—for example, participants are choosing package A (i.e., organized pragmatically) rather than choosing a pragmatically organized vocabulary (such as package A). This finding aligns with the finding from the stated preference experiment of Webb et al. (2019b) where vocabulary/language package(s) emerged as the most highly ranked attribute in terms of importance to practitioners. It is not clear from these findings how this vocabulary package rationale in decision-making impacts on the quality or outcomes of decisions.

A vocabulary package rationale of decision-making does not seem well investigated in the research literature, investigations or evaluations of the vocabulary packages discussed in these data are absent from the empirical research literature (Judge et al., 2019). The organizational terminology described in the empirical literature of static versus dynamic organizational schemas (Hochstein et al., 2003) were absent in these data. Attribute terms such as visual scene, taxonomic and semantic–syntactic vocabulary organizations, and pictographic or ideographic symbols which are also used in research literature (e.g., Light & Drager, 2007; Webb et al., 2019a) also did not seem to be used or considered by participants. These findings may reflect a bias towards discussions of powered communication aids in these data, that participants may use these terms internally, or that other terms may be used and intended as direct synonyms. These findings may also suggest, however, that there is not a strong conceptualization of vocabulary packages as having such descriptive attributes.

The use of the terms core and fringe vocabulary recurred in these data. One recent study by Laubscher and Light (2020) provided a helpful critique of core vocabulary lists used in AAC for early symbolic communicators, providing insights for the reconceptualization of core words. Thistle and Wilkinson meanwhile concluded there was a need for further research into the effect of the use of core vocabulary on language and communication development (Thistle & Wilkinson, 2015). Given the use of these terms and systems in practice these data further highlight the need for research into this approach. In addition, these findings demonstrate the challenges with the use of terms within the practice. Where consistent terms appeared to be used, such as core and fringe vocabulary, these seemed to be conceptualized in different ways by different participants. The descriptions of core and fringe vocabulary convey a lack of understanding of, or an agreed purpose for, the classification into core or fringe categories. Selection of vocabulary items for either category needs to be separated in clinical and theoretical debates from how the vocabulary items are organized and accessed on an AAC system. These data suggest the need to revisit how the terms are interpreted and applied in practice.

Staging of vocabularies resonated with participants' clinical practice and decision-making. Smith provided a review of the evidence and the many ways in which one could approach vocabulary introduction with children and young people who use AAC and suggested that:

> Close monitoring of children's comprehension of sequences of symbol may provide important insights into the nature and stage of development of the system being constructed and its synergy and compatibility with their spoken language system. (Smith, 2015: 37)

However, although staging of vocabularies may have an intuitive and theoretical basis there appears to be a limited empirical work looking at this as an explicit approach to AAC intervention. In highlighting a disconnect between the empirical research data and AAC practice in the UK these findings also suggest the need as identified by others (Matthews, 2001; Wallis et al., 2017) to explore the content of existing training and educational practices. This is notable, given that as Murray et al. (2019) found it is not clear that decisions about symbol communication aids are being made with a clear understanding of the child or young person's language comprehension levels.

Discussion of branded vocabulary packages, as well as branded AAC software and operating systems, was seen throughout these data and branding appeared to be used as a proxy for perceived attributes. In some cases, the brand name was used as the predominate way of describing the symbol communication aid. As with other markets and areas of healthcare choice making, brands are used as a shorthand by consumers to embody a range of attributes and values that may or may not be present in the actual artefact. The link between the use of these brands and their perceived attributes in AAC choices also warrants further investigation.

The impact of attributes

The physical and/or social environment (milieu) were prominent in these data. A number of communication aid attributes within this study were considered because of the impact that they were perceived as having on the adoption of the AAC system within a specific environment or milieu, that is, a communication aid attribute was chosen because the people around the individual would be better able to support use of aid with that attribute. In some cases, attributes were discussed as effectively being a by-product of a physical or social environment, as

example schools were variously described in these data as particular Symbol Set schools, AAC Software schools, Vocabulary Package schools or Core Vocabulary schools. Consideration of communication opportunities and environments are present in several AAC practice models such as in the Participation Model presented by Beukelman and Light (2020). These data suggest that these opportunity and environmental factors may drive decisions about choice of attributes of communication aids rather than driving other interventions that may be targeted at creating supportive communication environments.

Ease of editing is arguably an attribute that relates solely to the milieu. It is an attribute whose primary impact is on the individuals supporting the child or young person using the communication aid, with a secondary impact on the child or young person using the aid. Specific aspects of ease of use were suggested as driving some decisions and this suggests some choices are being made because the software or operating system is best supported by those around the child or young person, rather than being responsive to the child or young person's specific characteristics and their match to attributes across the range of available AAC systems. This may place considerable constraints on choices and decision options, for example in some cases choosing vocabularies available on only one software platform were constraints considered acceptable in order to reap the benefits of better support and increased family engagement. Caron et al. (2016) similarly concluded, from the within subject's crossover design experiment they carried out, that AAC software requiring less steps to edit vocabulary supported professionals to increase the amount of vocabulary personalization and thus may support the effectiveness of use of the communication aid.

The importance of family involvement in AAC implementation and provision is well discussed in the literature but recognized also as challenging to put into practice (Mandak et al., 2017). As well as the perceived impact of ease of editing on increased family involvement, personalization of the AAC system was also highly valued by participants and strongly linked to increasing the involvement of family and others around the child or young person. Personalization of vocabulary was discussed extensively, mirrored by the desire to have software options to support the process. Personalization presents a potential design challenge in communication aid software particularly when considering the competing considerations of maintaining consistency in and between communication aids, as well as maintaining effective organizational structures.

The emphasis on personalization highlights a tension across approaches to AAC organizational taxonomies. For example, a system organized to support communicative motivation may adopt a pragmatic structure, whereas another system may focus on the language learning components of grammar and semantics by organizing the graphic representation system to facilitate grammatically accurate utterances. Within these data there appeared to be geographical and setting biases for the adoption of pragmatic versus language learning organizational packages, suggesting that decisions were more greatly influenced by preferred ways of working rather than child characteristics (Lynch et al., 2019).

The influence of ways of working, environmental and adoption considerations highlight further reasons why AAC practice should be seen as a complex intervention (Zinkevich et al., 2019). These influences also suggest a further role for implementation science (Kent-Walsh & Binger, 2018) and behavioural science in the study of AAC practice.

The choice of graphic symbols did not emerge as a specific attribute consideration in these data, in some cases this was explicitly stated as unimportant both within the communication system and in transitioning between systems. This finding tallies with the quantitative study by Webb et al. (2019b) where graphic representation was given a low relative importance score, and Pampoulou (2017) who found that some practitioners-based symbol decisions on familiarity with particular graphic representation systems. The influence of the graphic representation knowledge of decision-makers suggests the need to further investigate the role of graphic representation within AAC systems.

Some graphic representation systems and associated vocabulary packages were perceived by participants as better supporting literacy development. Participants described considering the future literacy of the child or young person when choosing between packages, resonating with the findings of Webb et al. (2019b) where 'future skills and abilities' had the highest relative importance score. There is a clear impetus to support the learning of literacy for children who use AAC (Erickson & Koppenhaver, 2020) and while the incorporation of text within graphic symbol-based representation systems was an attribute which some participants described as being 'evidence based', we could find few empirical studies that appraise the transition between a graphic symbol system to a fully literacy based AAC system.

Limitations

This paper provides a UK-specific picture and it is likely these data may reflect specific contextual and cultural practices within the UK that may not transfer to other countries or cultures. Efforts were made to ensure sampling of participants across diagnosis, age and geography;

however, it is still likely that this cohort is biased towards those more likely to engage with AAC and use powered communication aids. These data were collected from semi structured interviews and focus groups with participants where AAC recommendations and ongoing support were discussed, thus these data represent stated views, rather than direct observations of practice, and as such may not represent how those involved in these decisions behave in practice. The format of data collection may not have allowed for or encouraged in-depth rationalizing about specific attributes, and thus the absence of discussion about an attribute cannot be assumed to mean that there is no consideration of this attribute in practice.

CONCLUSIONS

This paper presents a qualitative analysis of focus group and interview data from 91 practitioner and family member participants discussing AAC recommendations and ongoing support related to 22 children and young people. Analysis of these data looked at how participants described attributes of communication aids and the way in which these attributes were described as impacting upon system choice during a decision-making process.

Software communication aid attributes identified from this secondary qualitative analysis of these data are presented. Vocabulary package choice appeared to be the primary means of defining particular communication aids across these data but the vocabulary packages discussed in practice do not appear to be included in published research studies. Some vocabulary packages were perceived to be linked to positive outcomes, such as literacy development, and whilst this may have a strong intuitive and theoretical underpinning this highlights a need for future empirical research. Specific attributes such as core and fringe vocabulary and staged vocabularies appear to be established in decision-making but also have a limited empirical research literature. Terms used in the literature to describe vocabulary organization methods were not observed in these data. These findings suggest that practice-based evidence is not supported from the available research literature and this leaves a number of areas where empirical research is needed in order to provide a robust basis for practice.

A number of attributes reflected the acceptability and uptake of the communication aid in a physical or social environment, for example, ease of use of software was a key consideration in some cases due to the impact on family adoption, and extensive personalization of vocabularies was described by participants and linked to improving adoption. The choice of graphic representation was also described as being determined by the environment and participants in many cases did not consider there to be an impact of the use of different graphic symbols on the progress of the child or young person's language and communication development.

This paper provides a picture of how participants conceptualized the software attributes of communication aids. It is important that we understand how decisions are described and valued in practice so that research, communication aid development and practice recommendations can be ecologically valid. The empirical evidence bases to support many of these practice-based reasons for a decision remains limited and these findings provide a basis from which practitioners can review and reflect on their own practice. Many of the trade-offs discussed in these data also suggest a rich design vein that can be exploited by communication aid designers.

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CONFLICT OF INTEREST

The authors report no conflict of interest.

DATA AVAILABILITY STATEMENT

The participants of this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research supporting data is not available.

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