October 1, 2018

Aided Language Stimulation Leading to Functional Communication Gains in Children Using Augmentative and Alternative Communication

Introduction / Background

Limited consistent research exists on forms of intervention within the Augmentative and Alternative Communication specialty area of speech-language pathology. Development of the BESt Statement originated from the authors interest in the effectiveness of aided language modeling utilizing AAC devices with children who have limited to no functional communication. The research topic is important in order to provide treatment that is effective and backed by evidence. The topic provides a framework for speech-language pathologists to use in therapy sessions for children using AAC as well as to demonstrate to parents how to stimulate both receptive and expressive language in children. Additionally, Cincinnati Children's Hospital is a research hospital that encourages all disciplines to provide evidence for their treatment models. The current BESt is targeted for a specialized speech-language pathologist who can train parents to implement and use the model of teaching at home. One of the strengths of the treatment technique is the similarity to language modeling used with children working on verbal expression. The model takes into consideration the interests and abilities of the child, while incorporating both a visual and verbal model to demonstrate the communication of messages. Aided language modeling is easier to implement, increases positive parent perception, and increases the overall quality of parent-child interactions compared to traditional models.

***Definitions** for terms marked with * and **Abbreviations** may be found in an Abbreviations and Definitions section below.*

Clinical Question

P	*(Population/Problem)*	Among children and adolescents with limited to no verbal communication
I	*(Intervention)*	does the implementation of an aided language modeling approach*
C	*(Comparison)*	
O	*(Outcome)*	lead to an increase in functional communication skills*?

Target Population for the Recommendation

Inclusion Criteria

- Children (birth to 18 years old)
- Children with limited to no functional communication skills

Exclusion Criteria

- Adults (>18 years)
- Children with functional verbal communication skills
- Children for whom augmentative and alternative communication is a secondary means of expression and communication
- Peer Modeling

Target Users for the Recommendations

Target users include, but are not limited to, speech-language pathologists caring for inpatients/outpatients, school-based speech-language pathologists, teachers and school-based paraprofessionals, and parents of children with severe communication impairments who are using AAC.

EVIDENCE–BASED CARE RECOMMENDATION

It is recommended that aided language stimulation and related aided language modeling strategies be used to support the learning of functional communication skills and use of speech generating device systems with children in the language acquisition stage of development who have limited to no verbal communication (Binger, 2008 [5b]; Chiang, 2009 [4b]; Iacono, 1995, [4b]; Kent-Walsh, 2015 [4b]; Romski, 2011 [4a]; Sennott, 2016 [1b]; Solomon-Rice, 2014 [4b]).

Note 1: The use of aided language modeling supports an increase in functional communication, syntax, morphology, semantics, and pragmatics*. The specifics of the aided language stimulation method include use of a communication system while teaching core vocabulary*, modeling augmentative and alternative communication (AAC)* systems that are used, use of child-directed activities or naturalistic contexts, implementing AAC as early as possible, and the involvement and training of parents/caregivers (Binger, 2008 [5b]; Chiang, 2009 [4b]; Iacono, 1995, [4b]; Kent-Walsh, 2015 [4b]; Romski, 2011 [4a]; Sennott, 2016 [1b]; Solomon-Rice, 2014 [4b]).

Note 2: Aided language modeling and aided language stimulation are used interchangeably throughout the BESt.

Dimensions of Judging the Recommendation Strength for Functional Communication

1. Safety / Harm *(Side Effects and Risks)*	☒ Minimal		☐ Moderate / Neutral		☐ Serious			
2. Health benefit to patient	☐ Significant		☒ Moderate / Neutral		☐ Minimal			
3. Burden on population to adhere to recommendation	☒ Low		☐ Unable to determine		☐ High			
4. Cost-effectiveness to healthcare system	☒ Cost-effective		☐ Inconclusive		☐ Not cost-effective			
5. Directness of the evidence for this target population	☒ Directly relates		☐ Some concern of directness		☐ Indirectly relates			
6. Impact on quality of life, morbidity, or mortality	☒ Positive		☐ Moderate / Neutral		☐ Negative			
7. Grade of the Body of Evidence *(See Evidence Table below; *GNA – Grade Not Assignable)*	☐ High ⊕⊕⊕⊕		☒ Moderate ⊕⊕⊕◯		☐ Low ⊕⊕◯◯		☐ Very Low ⊕◯◯◯	☐ GNA*
Overall Strength of the Recommendation:	**☐ Strong**	**☒ Moderate**	**☐ Weak**	**☐ Consensus Only**				

Given the dimensions above for each recommendation and that more answers to the left of the scales indicate support for a stronger recommendation, the recommendation statements reflect the strength of each recommendation as judged by the development group.
(Note that for negative recommendations, the left/right logic may be reversed for one or more dimensions.)

Discussion/Synthesis of the Evidence and Dimensions for the Recommendation

Aided language stimulation is a 3-stage highlighting technique to assist a communicator in using target (meaningful) vocabulary. The premise of aided language stimulation is that an AAC user would not and could not learn to use their AAC system interactively if not modeled interactively in meaningful contexts (Sennott, 2016 [1b]). The approach begins by the clinician pointing out picture symbols* on the child's communication display in conjunction with all ongoing language stimulation. The type of display format or the selection technique used by the child is irrelevant to the facilitator's use of the technique. Prompting included using a 5-tier prompt hierarchy (Sennott, 2016 [1b]). The aided language modeling approach has evolved to include a combination of features, namely modeling use of the AAC system being targeted, referring to real objects in the environment, and providing verbal language modeling while using the AAC system (Romski, 2011 [4a]; Sennott, 2016 [1b]). The aided language modeling approach is designed to mirror the verbal input used for language acquisition of verbal children by providing augmented models for children who will use augmented communication.

Studies involving aided language stimulation techniques have included a variety of augmentative and alternative communication systems including aided* and non-aided* techniques (i.e. verbal models, signs, and gestures), static boards*, structured use of picture symbols, speech generating devices* (SGD), and voice output devices (VOD) (Iacono, 1995 [4b]; Kent-Walsh, 2015 [4b]; Romski, 2011 [4a]; Sennott, 2016 [1b]; Solomon-Rice, 2014 [4b]).

Increase in Communication

Across the body of evidence, there was increase in overall expressive communication for all participants who were exposed to aided language modeling (Binger, 2008 [5b]; Chiang, 2009 [4b]; Iacono, 1995, [4b]; Kent-Walsh, 2015 [4b]; Romski, 2011 [4a]; Sennott, 2016 [1b]; Solomon-Rice, 2014 [4b]). An increase in expressive spontaneous communication and autonomous word production, as well as, an increase in multi-symbol AAC turns were observed for all participants (Binger, 2008 [5b]; Chiang, 2009 [4b]; Iacono, 1995, [4b]; Kent-Walsh, 2015 [4b]; Romski, 2011 [4a]; Sennott, 2016 [1b]; Solomon-Rice, 2014 [4b]). High tech aided communication* in combination with sign language was found to be more effective than solely signed language in eliciting expressive word productions (Iacono, 1995 [4b]). In addition to high tech aided communication, implementation of aided language stimulation with low tech static boards also demonstrated an increase in receptive and expressive language (Sennott, 2016 [1b]). When aided language stimulation was used in teacher instruction, a positive correlation was seen with the occurrence of functional requesting and overall expressive communication elicited by students (Iacono, 1995 [4b]).

Syntax and Morphology

Positive gains were seen in syntactic and morphological skills when using aided language modeling (Binger, 2008 [5b]; Branson, 2009 [1b]; Chiang, 2009 [4b]; Iacono, 1995 [4b]; Kent-Walsh, 2015 [4b]; Romski, 2011 [4a]; Sennott, 2016 [1b]; Solomon-Rice, 2014 [4b]). Children who use traditional AAC methods are generally taught to use basic requests and functional statements, (e.g. I want + object) and therefore are often at risk of syntactic and morphological deficits in their expressive communication which limits the ability to combine and generate a variety of sentence structure (Sennott, 2016 [1b]). Aided language modeling was shown to decrease the risk of the preceding deficits. Gains in syntactic skills were seen through an increase in specific sentence structure skills, as well as, the ability to combine more than one symbol to create messages (Kent-Walsh, 2015 [4b]; Sennott, 2016 [1b]). With aided language modeling as the primary intervention, syntactic gains were seen in the context of play (Kent-Walsh, 2015 [4b]; Sennott, 2016 [1b]) and shared storybook reading (Sennott, 2016 [1b]). Increases in the mean length of utterance of the child, and an increase in targeted bound morphemes including verb + -ing, possessive's, third person singular -s, regular past tense -ed, and plural -s were reported in a systematic review of the literature (Sennott, 2016 [1b]).

Semantics and Pragmatics

The body of evidence supports positive gains in the language domains of semantics and pragmatics using aided language stimulation (Binger, 2008 [5b]; Chiang, 2009 [4b]; Iacono, 1995, [4b]; Kent-Walsh, 2015 [4b]; Romski, 2011 [4a]; Sennott, 2016 [1b]; Solomon-Rice 2014 [4b]). Children who received aided language modeling demonstrated increases in overall comprehension of whole word meanings, as well as, word parts (i.e. prefixes/suffixes) (Binger, 2008 [5b]; Chiang, 2009 [4b]; Iacono, 1995 [4b]; Kent-Walsh, 2015 [4b]; Romski, 2011 [4a]; Sennott, 2016 [1b]; Solomon-Rice, 2014 [4b]). Increases in semantic knowledge through aided language modeling were also manifested by an improvement and increase in expressive language by AAC users, as evidenced by an increase in trained target word use (Sennott, 2016 [1b]; Solomon-Rice, 2014 [4b]). A variety of modeling techniques were present in the body of evidence, which resulted in an increase in vocabulary labeling via AAC and verbal usage. The modeling techniques included: scripted modeling, non-scripted modeling interventions, and play-based intervention (Sennott, 2016 [1b]; Solomon Rice, 2014 [4b]). Positive pragmatic gains revealed in the body of research included an increased frequency in communication turns while utilizing AAC and aided language modeling, as well as an overall increase in social engagement with peers in a naturalistic context (Romski, 2011 [4a]; Sennott, 2016 [1b]).

Maintenance and Generalization

The maintenance and generalization of functional gains with the use of aided language modeling were inconsistently reported due to various research designs within the body of evidence (Binger, 2008 [5b]; Chiang, 2009 [4b]; Iacono, 1995, [4b]; Kent-Walsh, 2015 [4b]; Romski, 2011 [4a]; Sennott, 2016 [1b]; Solomon-Rice, 2014 [4b]). All studies demonstrated immediate gains in functional communication; however, few study designs examined the maintenance and generalization of those immediate gains (Sennott, 2016 [1b]; Kent-Walsh, 2015 [4b]). Comparatively, a discussion of generalization and maintenance probes of the acquired communication skills varied among articles (Binger, 2008 [5b]; Iacono, 2009 [4b]; Romski, 2011 [4a]; Chiang, 2009 [4b]). The absence of generalization and maintenance data was largely due to the heterogeneous populations selected in the research; which often mirror the clinical realities for speech-language pathologists and the individual communication needs of clients. Although immediate positive gains were shown in all

included populations, which is a strength of the intervention, further research is needed to examine the maintenance and generalization of gained functional communication.

Impact on Caregivers

Evidence also shows an increase in the parents' positive perception of their children's communication success, directly correlating to a positive increase in the child's functional communication (Romski, 2011 [4a]; Sennott, 2016 [1b]). Giving children a modality to communicate other than speech likely reduces the pressure that parents feel in their inability to successfully communicate with their children. Many parents surveyed felt more satisfied with the way their children were communicating post-intervention, that their children had made great strides in expressing themselves, and that their efforts in working on communication with their children had paid off. Additionally, of the surveyed parents, the majority reported feeling more confident in their ability to help their children develop ways of communicating and felt satisfied with the new way of communicating with their children. Lastly, post intervention, parents concluded that helping their children learn to communicate required less work than previously anticipated (Romski, 2011 [4a].

Limitations

The body of evidence for aided language modeling among children and adolescents with little to no functional communication is not without limitations. One of the most significant limitations is regarding the sample size available in the research. Many studies in the body of evidence were not only small (Branson, 2009 [1b]; Iacono, 1995 [4b]; Kent-Walsh, 2015 [4b]), but also heterogeneous (Branson, 2009 [1b]; Iacono, 1995 [4b]; Kent-Walsh, 2015 [4b]; Sennott, 2016 [1b]) leaving little control to evaluate the effects of aided language modeling on a single population. The populations within the body of research narrowly ranged in age in comparison to the inclusion age range established (ages 0-18). The majority of studies included children six-years-old and under, limiting the research to children who are largely within the stage of initial language acquisition and mastery (Iacono, 1995 [4b]; Kent-Walsh, 2015 [4b]; Romski, 2011 [4a]; Sennott, 2016 [1b]; Solomon-Rice, 2014 [4b]). Minimal available research exists for aided language modeling with children over the age of six-years. While generalization and maintenance were reported for select studies (Kent-Walsh, 2015 [4b]; Sennott, 2016 [1b]; Solomon-Rice, 2014 [4b]) within the body of research, further exploration regarding the impact of aided language modeling intervention on functional daily communication skills of an AAC user is needed (Sennott, 2016 [1b]).

Although the heterogeneous population is a limitation within the body of research, it can be considered a strength regarding the clinical application of the treatment technique. The heterogeneous population within the body of research accurately represents the variability within the population that is treated clinically within the field of speech-language pathology. The diverse population demonstrates the efficacy of the use of aided language stimulation, due to the effectiveness of the same treatment principles with a wide range of patients.

DEFINITIONS

Definitions

- **Aided Language Modeling Approach:** language intervention that is embedded into functional and meaningful contexts that promotes transactional communication in a natural environment (ASHA, 2016 [5a]).
- **Aided Symbols**: requires a device or accessory that is external to the body to transmit a message (ASHA, 2016 [5a]).
- **Augmentative & Alternative Communication (AAC):** includes all forms of communication (other than speech) that are used to express thoughts, needs, wants, and ideas. Examples include facial expressions, gestures, use of symbols or pictures, or writing (ASHA, 2016 [5a]).
- **Core Vocabulary**: A small set of words with the highest frequency of use both in conversation and in written text (ASHA, 2016 [5a]).
- **Functional Communication Skills:** the skills required to receive, send, process, and comprehend concepts or verbal, nonverbal and graphic symbol systems (ASHA, 2016 [5a]).
- **High Tech Aided Communication:** An aided electronic augmentative and alternative communication system (ASHA, 2016 [5a]).
- **MLU:** mean length of utterance (ASHA, 2016 [5a]).

- **Picture Exchange Communication System (PECS):** A picture-based communication strategy used to teach communication skills to persons with developmental disabilities (ASHA, 2016 [5a]).
- **Play-Based:** practices designed to improve socio-emotional, physical, language, and cognitive development through guided interactive play (ASHA, 2016 [5a]).
- **Pragmatics:** function of language, the system that combines form and content of language into functional and socially appropriate communication (ASHA, 2016 [5a]).
- **Speech Generation Device/Speech Generating Device:** SGDs produce spoken communication even though the individual is using pictures to create the message. The spoken messages can be readily understood by communication partners (ASHA, 2016 [5a]).
- **Static Board/manual boards:** symbols are arranged on individual pages; the symbols do not change position on the display. In such systems, one page is physically removed and replaced by another to access additional vocabulary (ASHA, 2016 [5a]).
- **Symbol:** something that stands for or represents something else (ASHA, 2016 [5a]).
- **Unaided Symbols**: require only one's body—speaking, gesturing, vocalizing, and singing (ASHA, 2016 [5a]).

IMPLEMENTATION

Applicability & Feasibility Issues

The body of evidence supports the use of aided language modeling to teach children to communicate through AAC in the clinical setting, as well as in the home and community. A potential barrier for the implementation of aided language stimulation could include the cost of a high-tech aided communication system should it be determined that this form of communication support is needed and is not already a part of the patient's plan of care. In addition, the consistency of use across environments: school, home, clinic, and the community could prove difficult for generalization of functional communication gains due to the varied communication partners and their level of training. However, little time would be needed to provide training and support to other members of the child's care team to appropriately implement this treatment approach.

When evaluating and treating children who use augmentative and alternative communication, many concerns often arise. For one, the age to begin implementation of AAC and what prerequisite skills are needed (i.e. device accessibility in relation to cognitive and physical abilities) are at the forefront of the decisions to be made when considering the use of AAC with children. Additionally, target concepts and vocabulary taught will vary from child to child and need to be child specific to ensure they develop the language necessary for functional communication. Finally, determining how communication breakdowns will be handled across communication partners should be considered to maintain consistency for the child as well as to teach the repair of breakdowns.

When determining possible factors that lead to gains in functional communication, various implementation methods of aided language stimulation must be considered. The following were noted in the reviewed studies that warrant further consideration: instruction delivered during play-based* activity (Iacono, 1995 [4b]; Sennott, 2016 [1b]), child-preferred activities used during instruction (Sennott, 2016 [1b]), intervention in a natural setting (Branson, 2009 [1b]; Iacono, 1995 [4b]; Kent-Walsh, 2015 [4b]; Romski, 2011 [4a]; Sennott, 2016 [1b]), referring to objects in the environment (Iacono, 1995 [4b]; Kent-Walsh, 2015 [4b]; Romski, 2011 [4a]; Sennott, 2016 [1b]), modeling the use of the AAC system (Iacono, 1995 [4b]; Kent-Walsh, 2015 [4b]; Sennott, 2016 [1b]), and providing verbal language modeling during interactions (Branson, 2009 [1b]; Iacono, 1995 [4b]; Romski, 2011 [4a]; Kent-Walsh, 2015 [4b]; Sennott, 2016 [1b]).

To implement aided language modeling, steps should be taken to put the intervention into practice. The development of a clinical pathway for AAC intervention and aided language modeling would standardize care for patients who use AAC. A clear set of instructions for implementation of the intervention would give clinicians a hierarchy for therapy structure, delivery, cueing strategies, and stage setting. Educational materials must be created and provided to families to educate them on the process of aided language modeling for AAC intervention. Education materials would feature the different phases of intervention, and how to implement the intervention techniques through play and verbal conversation. Education may also include collaborative reflection while watching video models of the parent-child interaction using aided language modeling. Together with the clinician, the parents would watch the video to discuss the interaction, have the parent discuss what was done well, and allow the clinician to provide feedback. This is an adaption from the Palin

Parent-Child Interaction therapy program for children who stutter (Kellman 2008 [5a]). The collaborative reflection process is meant to increase the comfort and confidence levels of the parent to maximize carryover. Clinicians would benefit from the development of smart phrases for electronic medical records programs, to streamline documentation of intervention techniques and goals.

Relevant CCHMC Tools

- *Growing Through Knowing: We Have Our AAC Device...Now What?* (Cincinnati Children's Hospital Medical Center, 2016)
- *Growing Through Knowing: Normal Language Development: 12-36 Months*, (Cincinnati Children's Hospital Medical Center, 2016)
- *Developmental and Behavioral Pediatrics Augmentative Communication Questionnaire for Private Speech Language Therapy* (Cincinnati Children's Hospital Medical Center, 2016)
- *Developmental and Behavioral Pediatrics Augmentative Communication Parent Questionnaire* (Cincinnati Children's Hospital Medical Center, 2016)
- *Augmentative Communication Evaluation Chart (*Cincinnati Children's Hospital Medical Center, 2016)
- *Alternative Communication Systems for Children with Limited Speech* (Cincinnati Children's Hospital Medical Center, 2015)
- *Growing Through Knowing: What to Expect from an Augmentative Communication Evaluation* (Cincinnati Children's Hospital Medical Center, 2012)

Outcome Measures and Process Measures

Outcomes can be monitored by changes and improvements in an increase in communication turns, increase in vocabulary knowledge, increase in multi-symbol utterances, increased MLU, and knowledge of earlier morphological forms. Clinicians should take data each session to track the progress and language skills of the child. Assessment of the child's progress, maintenance, and generalization should be performed in regular intervals. Such information can be used to analyze how quickly children make progress because of aided language modeling. Patient and patient family satisfaction may be evaluated at regular intervals as well. Including elements of evaluation, intervention, and maintenance/generalization in the implementation plan will assist clinicians in performing well-constructed aided language modeling intervention. To create a guide for implementing aided language modeling, one must first consider the evaluation, intervention, and the maintenance or generalization. Children who may be appropriate for AAC should first be referred for an AAC evaluation. An evaluation for AAC will allow the clinician and the family to investigate which AAC method may be appropriate for trialing with the child. Referrals for AAC evaluations and data on devices obtained may be tracked to measure how many referrals resulted in the child obtaining an AAC device. Aided language modeling is recommended for use throughout the trial and intervention processes. Development in the use of vocabulary, morphemes, and complex syntactical structured could also be tracked from the date of evaluation throughout the course of training and therapy to monitor and measure outcomes.

Inclusion Criteria, Evidence Search Strategy, & Search Results

Criteria for considering studies for this review

Types of Studies	All types of studies were considered.
Types of Participants	Children and Adolescents with limited to no verbal communication
Types of Interventions	Interventions which were considered for inclusion included aided language modeling and aided language stimulation with children or adolescents with limited to no functional communication. There were no comparisons within our review.
Types of Outcomes	Outcomes which were considered for inclusion included gains in functional communication. Specifically, gains in pragmatics, semantics, syntax, and morphology.
Exclusion Criteria, *if any*	Peer modeling studies and studies where the intervention did not involve a licensed speech-language pathologist were excluded.

Search Strategy

Search Methods

To select evidence for critical appraisal by the group for this BESt, the databases below were searched using search terms, limits, filters, and date parameters to generate an unrefined, "combined evidence" database. This search strategy focused on answering the clinical questions addressed in this document and employing a combination of Boolean searching on human-indexed thesaurus terms (e.g., MeSH) as well as "natural language" searching on words in the title, abstract, and indexing terms.

Search Databases	Search Terms	Limits, Filters, & Search Date Parameters	Date of Most Recent Search
☒ MedLine via PubMed or Ovid ☒ CINAHL ☒ Cochrane Database for Systematic Reviews ☒ PsycInfo ☒ Other: ASHA	"aided communication intervention" "aided language stim*" "aided language model*" "augmentative alternative communication" OR "AAC" AND "model*" AND "speech" "aided communication AND model*"	Publication Dates or Search Dates • All dates included • 1989 to present ☒ English Language ☒ Pediatric Evidence Only ☐ Other Limits or Filters	9/9/2016 9/12/2016 9/14/2016

Search Results

The citations were reduced by eliminating duplicates and non-English articles. The resulting abstracts and full text articles were reviewed to eliminate low quality and irrelevant citations or articles. During the BESt development, additional articles were identified from subsequent refining searches for evidence, clinical questions added to the guideline and subjected to the search process, and hand searching of reference lists. The dates of the most recent searches are provided above.

The initial search for evidence identified 895 articles, of which 757 articles were eliminated by review of title and abstract due to not meeting the search criteria.

138 articles met the search criteria, of which 120 articles were discarded due to not meeting the inclusion/exclusion criteria upon further review or they did not follow aided language modeling or stimulation techniques (e.g. there was mention of language modeling, but a traditional or undefined technique was used with no data to support gains or track outcomes across our target population).

Once inclusion and exclusion criteria were applied, 18 articles remained and were read in full. Ten articles were excluded/discarded for the following reasons: All articles were included within a systematic review with level 1a evidence (n=10) that was included in this review.

The remaining 8 articles were critically appraised and used in this recommendation.

TEAM MEMBERS & CONFLICTS OF INTEREST

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Conflicts of Interest were declared for each team member and:

☒ No financial or intellectual conflicts of interest were found.

☐ No external funding was received for development of this recommendation.

Conflict of interest declarations information is maintained in Cincinnati Children's ePAS *(electronic Protocol Administration System)*.

LEGEND Evidence Evaluation System *(Let Evidence Guide Every New Decision)*

Full tables of the LEGEND evidence evaluation system are available in separate documents:

- Table of Evidence Levels of Individual Studies by Domain, Study Design, & Quality *(abbreviated table below)*
- Grading a Body of Evidence to Answer a Clinical Question
- Judging the Strength of a Recommendation

Table of Evidence Levels *(see link above for full table)*:

Quality Level	Definition
1a† or 1b†	Systematic review, meta-analysis, or meta-synthesis of multiple studies
2a or 2b	Best study design for domain
3a or 3b	Fair study design for domain
4a or 4b	Weak study design for domain
5a or 5b	General review, expert opinion, case report, consensus report, or guideline
5	Local Consensus

†a = good quality study; b = lesser quality study

Table of Grade for the Body of Evidence *(see link above for full table)*:

Grade	Definition
High	Good quality, High-level studies with consistent results
Moderate	Good quality, Lower-level OR Lesser quality, Higher-level studies with consistent* results
Low	Good or lesser quality, Lower-level with results that may be inconsistent
Very Low	Few Good or Lesser quality, Low-level studies that may have inconsistent results
Grade Not Assignable	Local Consensus

Table of Language and Definitions for Recommendation Strength *(see link above for full table)*:

Language for Strength	Definition
It is strongly recommended that… It is strongly recommended that… not…	When the dimensions for judging the strength of the evidence are applied, there is high support that benefits clearly outweigh risks and burdens. (or visa-versa for negative recommendations)
It is recommended that… It is recommended that… not…	When the dimensions for judging the strength of the evidence are applied, there is moderate support that benefits are closely balanced with risks and burdens.
It is suggested that… It is suggested that… not…	When the dimensions for judging the strength of the evidence are applied, there is weak support that benefits are closely balanced with risks and burdens.
There is insufficient evidence to make a recommendation…	

Evidence-Based Clinical Care Recommendation Development Process

The process by which these recommendation statements were developed is documented in the BESt Development Process Manual; relevant development materials are kept electronically. The recommendations contained in this BESt were formulated by a multidisciplinary working group, which performed a systematic search and critical appraisal of the literature using LEGEND *(see section above)*. The BESt has been reviewed and approved by clinical experts not involved in the development process.

Recommendations have been formulated by a consensus process directed by best evidence, patient and family preference, and clinical expertise. During formulation of these recommendations, the team members have remained cognizant of controversies and disagreements over the management of these patients. They have tried to resolve controversial issues by consensus where possible and, when not possible, to offer optional approaches to care in the form of information that includes best supporting evidence of efficacy for alternative choices.

Review Process

This Best Evidence Statement has been reviewed against quality criteria by two independent reviewers from the CCHMC Evidence Collaboration.

The guideline was also externally appraised by three independent reviewers using the AGREE instrument *(Appraisal of Guidelines for Research and Evaluation)* and the results by domain are:

- Scope and Purpose 100%
- Stakeholder Involvement 78%
- Rigor of Development 93%
- Clarity and Presentation 94%
- Applicability 100%
- Editorial Independence 100%

Revision Process

The BESt will be removed from the Cincinnati Children's website, if content has not been revised within five years from the most recent publication date. A revision of the BESt may be initiated at any point that evidence indicates a critical change is needed.

Review History

Date	*Event*	*Outcome*
10/1/18	**Original Publication**	New BESt developed and published

Permission to Use the BESt

Copies of this Best Evidence Statement (BESt) and related tools (if applicable, e.g., screening tools, algorithms, etc.) are available online and may be distributed by any organization for the global purpose of improving child health outcomes.

Website address: http://www.cincinnatichildrens.org/service/j/anderson-center/evidence-based-care/bests/

Examples of approved uses of the BESt include the following:

- Copies may be provided to anyone involved in the organization's process for developing and implementing evidence-based care;
- Hyperlinks to the CCHMC website may be placed on the organization's website;
- The BESt may be adopted or adapted for use within the organization, provided that CCHMC receives appropriate attribution on all written or electronic documents; and
- Copies may be provided to patients and the clinicians who manage their care.

Notification of CCHMC at **EBDMinfo@cchmc.org** for any BESt adopted, adapted, implemented, or hyperlinked by the organization is appreciated.

Please cite as:

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About Cincinnati Children's Best Evidence Statements and the development process, contact the Cincinnati Children's Evidence Collaboration at EBDMinfo@cchmc.org.

Note / Disclaimer

This Best Evidence Statement addresses only key points of care for the target population; it is not intended to be a comprehensive practice guideline. These recommendations result from review of literature and practices current at the time of their formulation. This Best Evidence Statement does not preclude using care modalities proven efficacious in studies published subsequent to the current revision of this document. This document is not intended to impose standards of care preventing selective variances from the recommendations to meet the specific and unique requirements of individual patients. Adherence to this Statement is voluntary. The clinician in light of the individual circumstances presented by the patient must make the ultimate judgment regarding any specific care recommendation.

Evidence Table for Included Articles *(i.e., articles meeting inclusion criteria; Dimension 1 for each outcome)*

Citation & Funding *(Author, Date, etc. & Funding Source)*	**Population Research Design**	**Intervention**	**Outcomes**	**Significant Results** *(e.g., p-value, confidence interval, NNT, odds ratio, likelihood ratio, etc.)*	**Limitations Gaps**	**Applicability**	**Evidence Level**
Binger, 2008 Funded by: information not provided.	All Latino children. The children in the studies had disabilities such as apraxia, CP, sub palatal cleft accompanied by profound velo-laryngeal incompetence, and suspected velo-cardial-facial syndrome. Expert Opinion - A review of two studies. Both studies were single subject, multiple baselines across participant research designs.	N/AMPERKS	N/A	See Figure 1 and 2. Children in both studies made significant gains in their use of aided AAC symbols. Using aided AAC also may result in some children using fewer gestures that do little to build expressive language skills, instead, children begin to use their energies to access their AAC devices, which can provide them with the means to vastly expand their level of linguistic competence.	The parents and educational assistants were trained on aided AAC.	Applicable	5b
Branson, 2009 Funded by: Information not provided	12 studies were included. Studies were between 1982-2007; participants were birth-3 years old and adult communication partners, and studies reported data on unaided or aided AAC use. 190 total participants ages 8-36 months. 99 participants had developmental delays, 26 had autism, and 5 had cerebral palsy. Systematic Review of research 12 studies regarding AAC use in toddlers with disabilities were reviewed and analyzed.	Unaided AAC methods, aided AAC methods Various treatment procedures involving teaching children to use language skills through AAC. 2 studies trained communication partners, 1 study investigated a preschool program for children with autism, and 7 studied teaching children to use language skills through AAC. 5 of the 12 studies were found to be inconclusive due to uncertainty of results. 7 of the 12 studies were found to be conclusive with certainty of results.	Participant's communication using unaided and aided AAC, including: Requesting, intentional communication acts, intervals of sign language, frequency of sign language, number of words produced, number of spontaneous words produced, communicative functions, and commenting. Various outcome measures were used throughout the 12 studies.	10 out of 12 interventions used in the studies were determined to be highly or fairly effective. 97% of participants demonstrated increased communication skills, however, studies with conclusive evidence made up only 71% of the total. Communication partners were able to be trained to provide more positive and responsive communication environment for children using AAC. Children ages 36 months and younger with disabilities were able to learn how to use many different types of AAC.	Only 7 out of 12 studies were found to have conclusive evidence. Studies only included children ages 36 months and younger. There were various interventions and outcomes measures used throughout the studies.	Applicable	1b

Chiang, 2009 Funded by: No funding information provided.	17 Australian and 15 Taiwanese children with autism who were mute or had limited spoken language Cross-Section	Independent Variable: Teacher's instruction/prompts used to elicit expressive communication Intervention: Naturalistic observations/data on elicited expressive communication occasioned by teacher instructions in school settings. Instrument Validity: N/A	Spontaneous communication, play behaviors, social interaction, and teachers' responses to communicative behaviors. N/A N/A	Almost all teachers successfully elicited their students' expressive communication. A combination of verbal prompt and modeling was positively associated with the occurrence of requesting function and aided AAC communication form. Physical prompt is not a useful instruction in the natural environment to facilitate the occurrence of expressive communication of children with autism who have limited spoken language.	Limitations: Observations of teacher instructions in relation to the least-to-most prompting strategy and the time delay procedure are beyond the scope of current research. Also, the teacher instructions reported were limited to those that had successfully elicited students' expressive communication.	Applicable	4b
Iacono, 1995 Funded by: Research was funded by grants awarded by the Australian Research Council and the Depart-ment of Education, Employment and Training, Australian Second Language Learning Program.	Case study of a 2 year 8-month-old girl with Down Syndrome Alternating treatments Longitudinal Study Comparing the use of sign vs sign + augmented input to facilitate vocabulary and expression	Use of sign alone or sign plus electronic communication device.	Expressive productions	Sign plus electronic communication device was found to be more effective than sign alone in eliciting expressive word productions (1,2, or 3 words.)	Case study (limited sample size) Alternating treatments may affect the results	Applicable	4b
Kent-Walsh, 2015 Funded by: No information provided.	Sample Size: 3 participants Inclusion criteria: (a) were between 4 and 6 years of age; (b) presented with severe, congenital motor speech impairments, (c) had hearing, vision, and fine motor skills within or corrected to be within functional limits; (d) had prior experience with AAC iPad application use; (e) had an expressive vocabulary of at least 50 words per	Aided Modeling of AAC use	Dependent Variable 1: Subject + Aux V (is) + Main Ving Dependent Variable 2: Aux V (is) + Subject + Main Ving Generalization Variables 1,2,3: Subject + Copula (is) + Complement Copula (is) + Subject + Complement	The instructional program yielded positive results for all participants. Each child progressed from producing none of the targets before entering intervention phase to producing both of the main dependent variable sentences with high levels of accuracy over an extended period of time. In addition, all participants evidenced high levels of generalization to a sentence target of similar	Limited sample size Further examination of groups of children with primary diagnoses of motor speech disorders, such as CAS and dysarthria accompanied by age appropriate receptive language skills	Applicable	4b

	parent report; (f) communicated using grammatically incomplete/incorrect messages per parent report. In addition, participants demonstrated adequate receptive syntax skills for targeted goals as demonstrated through (a) score of 6 or greater on the Elaborated Sentences and Phrases subtest of the Test of Auditory Comprehension of Language-Third Edition (TACL) and (b) at least 80% accuracy on 10 probes designed to assess comprehension of two and three word instructions with toys as subjects. Longitudinal		Subject + Aux V (is) + Reversible V + Object	length and structure. Findings indicate that the participants learned to produce rule-governed sentences using aided AAC.	Future efforts should examine potential acquisition of more specifically defined linguistic goals will be important next steps in the line of research		
Romski, 2011 Funded by: National Institutes of Health Grant DC-03799	53 parents and their children Children with a mean age of 30 months 1) At a significant risk for speech and language impairment: not having begun to talk, as indicated by a vocabulary of fewer than 10 intelligible spoken words 2) at least primitive intentional communication abilities; 3) upper extremity gross motor skills that permitted them to touch the symbols on an SGD; and 4) primary disability other than delayed speech and language impairment, deafness/hearing impairment, or autism Mixed Methods Study	Independent variable: specific mode of delivery Intervention: Parents and children were randomly assigned to one of three intervention groups: Focus on AC input, focus on AC output, or spoken communication vocab set individually chosen for each child by parent in collaboration with SLP 24, 30-minute sessions in length, with 18 sessions in the laboratory setting and last 6 in child's home	Dependent variables: (1) Parents' perceptions of their child's communication success and difficulty. (2) Children's communication through expressive vocabulary use. Primary Outcome Measures: (1) Parent Perception of Language Development survey (2) The number of spontaneous expressive vocabulary use instances by children using AAC and/or speech.	(1) Parents' perceptions regarding their child's communication success: Positive increase in parent's perception of their child's communication success across all 3 groups, however the increase was not statistically significant. Parent's perceptions regarding their child's communication difficulties: Decreased parents' perceptions of their child's communication difficulty in both AAC intervention groups, but not the spoken language group (where parents perceived their child's difficulties as increased after the study). (2) All participants in the AAC groups (except 1 participant in the AC-I group) used at	Study only included children ages 20-40 months of age. Small sample size (53). Parent Perception of Language Development survey was newly created by the authors and has not been widely used/tested.	Applicable	4a

				least 1 spontaneous word by using AAC. 5 from AC-I, 9 from AC-O, and 7 from spoken communication groups spoke at least 1 word. A positive correlation was found between child communication increases and parent perception of communication success. A negative correlation was found between child communication increases and parent perception of communication difficulties. Correlations were weak to moderate due to small sample size.			
Sennott, 2016 Funded by: The Office of Special Education Programs, Office of Special Education and Rehabilitative Services	10 studies were included in the best-evidence analysis, nine single-case design studies (31 participants ages 2:11-12:0) and one group design study. n=21 younger than 6:0 n=10 older than 6:0 Inclusion criteria for articles: Included articles were published in an English language peer reviewed journal from 1989 to 2013. Articles reported a primary intervention variable that included modeling of aided AAC in the context of a naturalistic communication interaction. Systematic review of the research	Independent variable: AAC-modeling based intervention packages (including AAC modeling, question asking, time delay, and responding to child communication attempts). Intervention: The nature of the interventions were interactive communication experiences	Dependent Variables: Pragmatic Skills Semantic SKills Syntax Skills Morphology Skills	No statistical significance reported, however, clinical significance reported, see table 2. Overview of data provided below: *Results reported in Mean Difference (SD)* Pragmatic Skills: Results indicated a meaningful difference Kent-Walsh, Binger, and Hasham, 2010 Rosa-Lugo & Kent-Walsh (2008) Semantic Skills: reported gradual increases in vocabulary knowledge in response to AAC modeling Dada & Alant, 2009 Drager et al., 2006 Harris & Reichle, 2004 Syntax Skills: demonstrated gains in syntax in the form of increasing multi-symbol utterances Binger & Light, 2007	Data set represented a restricted population. Limited range of age [only pediatric], participants had a range of complex communication needs, non-responders were less represented. Additionally, each of the interventions was considered a "packaged intervention" where AAC modeling was the primary component but there were also other portions of the interventions that could have made an impact on the results.	Applicable	1b

				Binger, Kent-Walsh, Berens, Del Campo, and Rivera, 2009 Morphology skills: Provided evidence of gains in morphology development in the context of book reading Binger, Maguire-Marshall, and Kent-Walsh, 2011			
Solomon-Rice, 2014 Funding: No information provided.	3 children with complex communication needs. Longitudinal study Compared vocabulary growth with focused stimulation vs. augmented input.	Independent variable: AAC intervention technique (either focused stimulation or augmented input). Intervention: Focused stimulation-adult verbalized each target vocabulary word 10 times. Augmented input- adult verbalized and used AAC to model each target vocabulary word 10 times.	Dependent Variable: Increase use of expressive vocabulary The outcome measure was the percent of target vocabulary autonomously produced by the child during each 20-min play session.	Both treatments resulted in rapid vocabulary production for ⅔ of the participants.	Did not conduct a component analysis to determine if augmented input/focused stimulation facilitated the change, or the intensity. All children received both types of treatment. No SGDs	Applicable	4b

REFERENCES

(Evidence Level in [ ]; See Table of Evidence Levels)

American Speech Language Hearing Association (n.d.). Retrieved October 10, 2016, from http://www.asha.org/. [5a]

Binger, C., & Light, J. (2007). The effect of aided AAC modeling on the expression of multi-symbol messages by preschoolers who use AAC. *Augmentative and Alternative Communication, 23*(1), 30-43. [5b]

Branson, D., Demchak, M. (2009). The use of augmentative and alternative communication methods with infants and toddlers with disabilities: A research review. *Augmentative and Alternative Communication, 25*(4), 274-286. [1b]

Chaing, H-M. (2009). Naturalistic observations of elicited expressive communication of children with autism. *Autism, 13*(2), 165-178. [4b]

Iacono, T.A., Duncum, J. E. (1995). Comparison of sign alone and in combination with an electronic communication device in early language intervention: Case study. *Augmentative and Alternative Communication, 11*(4), 249-259. [4b]

Kellman, E. & Nicholas, A. (2008). Practical Intervention for Early Childhood Stammering. Milton Keynes, UK: Speechmark. [5a]

Kent-Walsh, J., Binger, C., & Buchanan, C. (2015). Teaching children who use augmentative and alternative communication to ask inverted yes/no questions using aided modeling. *American Journal of Speech-Language Pathology, 24*(2), 222-236. [4b]

Romski, M., Sevcik, R. A., Adamson, L. B., Cheslock, M., Smith, A., Barker, R. M., & Bakeman, R. (2010). Randomized comparison of augmented and nonaugmented language interventions for toddlers with developmental delays and their parents. *Journal of Speech Language and Hearing Research, 53*(2), 350-364. [4a]

Sennott, S. C., Light, J. C., & McNaughton, D. (2016). AAC modeling intervention research review. *Research and Practice for Persons with Severe Disabilities, 41*(2), 101-115. [1b]

Solomon-Rice, P. L., & Soto, G. (2014). Facilitating vocabulary in toddlers using AAC: A preliminary study comparing focused stimulation and augmented input. *Communication Disorders Quarterly, 35*(4), 204-215. [4b]