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# Does Increasing Speech Production and Language Acquisition Through Therapies Aimed At Emphasizing Speech Therapy Improve the Verbal Communication Capabilities in Autistic Children?

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**Does increasing speech production and language acquisition through therapies aimed at emphasizing speech therapy improve the verbal communication capabilities in autistic children?**

Jessica Olejnik, PA-S

A SELECTIVE EVIDENCE BASED MEDICINE REVIEW

In Partial Fulfillment of the Requirements For

The Degree of Master of Science

In

Health Sciences- Physician Assistant

Department of Physician Assistant Studies

Philadelphia College of Osteopathic Medicine

Philadelphia, Pennsylvania

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## Abstract

**Objective:** The objective of this EBM review was to determine if increasing speech production & language acquisition through therapies which emphasized speech therapy, would improve verbal communication skills in autistic individuals.

**Study Design:** Three RCTs selected due to relevance to the proposed question and fulfillment of the requirement of measuring POEMs.

**Data Sources:** All articles were published in peer-reviewed journals via PubMed.

**Outcome Measures:** The Preschool Language Scale 4 and Comprehensive Assessment of Spoken Language was measured pre-intervention and 12 months later.<sup>1</sup> The verbal production evaluation scale which measured phonology, pragmatics, prosody, and semantic features.<sup>2</sup> The number of verbal attempts, correct words used (list of target words assessed at baseline and beginning of each treatment week for reassessment).<sup>3</sup>

**Results:** The results from Casenhiser et al. demonstrated that language development improved with the intervention group (MEHRIT therapy).<sup>1</sup> The mean changes from pretest was 0.61 w/SD of 0.32.<sup>1</sup> Post treatment was a mean of 0.72 w/SD of 0.39.<sup>1</sup> The MEHRIT group had  $p=0.038$ .<sup>1</sup> Lim et al. examined the speech therapy group to a music therapy group and control.<sup>2</sup> The change in score of speech production pre-post test was a mean of +65.33, SD 56.89.<sup>2</sup> Comparing speech vs control had a mean difference of 64.405, SD 12.973.<sup>2</sup> When comparing speech to no treatment the p value was  $<0.001$  indicating large effect of speech treatment.<sup>2</sup> When comparing speech pre-test and post-test the p value was  $<0.001$ .<sup>2</sup> Sandiford et al. evaluated melodic based communication/speech therapy vs. traditional speech therapy.<sup>3</sup> It was determined that both improved their social skills through F score.<sup>3</sup> Number of verbal attempts for both groups had  $F=6.9$  and  $F=4.1$  for number of correct words.<sup>3</sup> The p value for number of verbal attempts was  $p<0.001$  and  $p<0.04$  for number of correct words.<sup>3</sup>

**Conclusions:** Although inconclusive, there was improvement in communication skills gained through the 3 RCTs above suggesting that early intervention and speech therapy is critical to development.

**Keywords:** autism, speech therapy.

## **Introduction**

Autism has increased 10-fold in the past few decades and 1 in 68 Americans is diagnosed as having an autism spectrum disorder.<sup>4</sup> Autism is defined as a neurological condition that impairs social communication, language acquisition, and intellectual capability.<sup>4</sup> Autism is better described by a spectrum of disorders since no two individuals are alike and some may be higher or lower functioning in different developmental areas. The disorder is characterized by impairments in early brain development and it is typically diagnosed in the first 3 years of life.<sup>5</sup> The condition affects all races, SES standings, cultures and it is likely that whether in the social setting or in the workplace that one will encounter an individual who suffers from this condition.

With over 3 million people diagnosed with autism in the USA alone, it is estimated that supporting these individuals costs our nation at least \$61 billion per year.<sup>6</sup> The lifetime cost ranges from \$1.4-2.4 million depending on the severity of disability.<sup>6</sup> Early intervention is believed to be linked to improvements in all social domains and thus the amount of healthcare spending can be reduced if issues are addressed earlier.<sup>6</sup> The amount of healthcare visits varies based on the individual's needs and intellectual impairment status. Often times an individual will need to see a psychiatrist, neurologist, family physician/pediatrician, speech therapist, PT, OT, and more.<sup>7</sup> Autistic children are more likely to utilize psychiatric visits, pediatrician visits, and be hospitalized than their peers.<sup>7</sup> They are 9 times more likely to be placed onto psychiatric medication and twice as likely to use GI medication.<sup>7</sup> Clearly it is crucial that healthcare staff work together to help meet the needs of autistic individuals and funding is allocated properly.

Although the cause is unknown, research is focusing on a combination of environmental factors and genetics. There is unfortunately no cure. However, it is known that early intervention is linked to better success and screening typically occurs at pediatrician offices between 18-24

months which is a crucial developmental time frame.<sup>5</sup> Treatments include educational and behavioral interventions, speech therapy, music therapy, play therapy, OT, PT, diets, psychiatric medications, and anti-convulsants for related seizure control.<sup>4</sup> When speech therapy is incorporated at an early age it is likely to help improve communication skills by engaging the individual in more conversations, interactions, and use of verbal communication skills.

### **Objective**

The objective of this systemic review is to determine whether or not increasing speech production and language acquisition through therapies aimed at emphasizing speech therapy will improve verbal communication skills in those with autism.

### **Methods**

The studies included were 3 RCTs. The populations studied included children ages 2-7 years old diagnosed with an autism spectrum disorder.<sup>1,2,3</sup> There were three interventions investigated versus comparison groups. Casenhiser et al, study included the MEHRIT therapy group which emphasized social interaction/communication versus a community treatment group.<sup>1</sup> Outcomes included improvement in acquisition of language at age appropriate level.<sup>1</sup> Lim et al, studied speech training (video with 6 songs/pictures) versus the comparison groups of control/no treatment group and music training group<sup>2</sup>. The outcomes were increase in speech production/language acquisition.<sup>2</sup> The Saniford et al. study included 5 weeks of melodic based communication/speech therapy as the intervention group versus traditional speech therapy.<sup>3</sup> The outcomes included verbal attempts and correct words used.<sup>3</sup>

The key words used in the searches included “autism” and “speech therapy”. All articles were in English and published in peer-reviewed journals. Lim was published in 2010 and Casenhiser and Sandiford in 2013.<sup>1,2,3</sup> The articles were searched in January of 2016 from

PubMed. I did the research myself and selected the studies based off of similar goals of therapy and relevance to the proposed objective. The inclusion criteria consisted of children ages 2-7 diagnosed with an autism spectrum disorder, studies conducted in the last 15 years, and willing to undergo speech therapy.<sup>1,2,3</sup> The exclusion criteria were those who failed to follow up, had comorbidities, and those studies completed in a time frame greater than 15 years.<sup>1,2,3</sup> All of the studies utilized dealt with POEMS. The analysis used was mean changes from pre-test to post-test and SD, p values, and F score.

**Table 1: Demographics and characteristics of included studies:**

Study	Type	# Pts	Age (yrs)	Inclusion criteria	Exclusion criteria	w/d	Interventions
Casenhiser <sup>1</sup> (2013)	RCT	51	2 y/o-4 years 11 months old	Diagnosis of ASD confirmed by ADOS and Autism Diagnostic interview	Neurological disorders other than ASD; those who could not meet time requirements	22	Target treatment group (MEHRIT) utilizing 2 hours of therapy each week emphasizing social communication compared to a community treatment group
Lim <sup>2</sup> (2010)	RCT	50	Ages 3-5	Those who met diagnostic criteria by PCP, level of functioning via scores on CARS or ADI-R. Test score of language according to the preschool language scale, Peabody picture vocab test, and expressive/receptive one word picture vocab test	Those with multiple other diagnoses such as Down syndrome	0	Speech training (video with 6 songs/pictures) compared to a control group with no treatment and a music training group

Sandiford <sup>3</sup> (2013)	RCT	12	Ages 5-7	Children with diagnosis of autism as per ADOS. Nonverbal participants defined as having expressive vocab of 10 words or less and no functional speech.	Other therapy, unable to attend, hearing impairment, blind, damaged laryngeal structures, seizures, cerebral palsy, and paraplegia.	2	5 weeks of MBCT w/four 45 min sessions weekly (melodic based communication/speech therapy) compared to traditional speech therapy
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**Outcomes Measured**

Casenhiser et al, outcomes were measured based on the Preschool Language Scale 4 (PLS-4) measuring receptive and expressive language skills up to age 6 and the Comprehensive Assessment of Spoken Language (CASL) for children older than 6 years assessed pre-intervention and again 12 months later.<sup>1</sup> Lim et al. measured the outcomes in regards to production of a list of “target words” based off of 4 components: phonology, pragmatics, prosody, semantics (verbal production evaluation scale).<sup>2</sup> Sandiford et al. outcomes were measured based on the number of verbal attempts, number of correct words, and number of words reported by parents.<sup>3</sup> To detect the number of verbal attempts and correct words a vocabulary test was developed and given at baseline, throughout treatment, and at completion<sup>3</sup> There were 25 target words that were used.<sup>3</sup>

**Results**

The results of the 3 studies were all presented as continuous data, which could not be converted to dichotomous data. Relative risk reduction, absolute risk reduction, and numbers needed to treat and harm were not completed for this review and there was no indication of the therapies used causing harm to the participants. The clinicians were well-trained speech

pathologists and healthcare personal who conducted the studies in addition to parental support. They were all well trained in their duty and the child's overall safety was not addressed.<sup>1,2,3</sup>

Casenhiser evaluated children recruited from PCPs, public schools, and newspapers in the Greater Toronto Area.<sup>1</sup> The diagnosis was confirmed by ADOS and Autism diagnostic interview.<sup>1</sup> 51 children participated and were 2-5 years old at the start of the study.<sup>1</sup> Those who had other neurological or developmental disorders were not included or who could not meet the time requirements.<sup>1</sup> This was because other neurological disorders could impact brain functioning and thus language development making the results indeterminate if related to autism or other dual diagnoses.<sup>1</sup> The intervention addressed was a target treatment group receiving MEHRIT (2 hours of therapy/coaching each week emphasizing social interaction and communication) versus a community treatment group.<sup>1</sup> The PLS-4 was used to measure receptive and expressive language skills for those up to age 6 and those older than 6 were evaluated on the CASL.<sup>1</sup> They were assessed pre-intervention and 1 year later.<sup>1</sup> Those who withdrew (9 from MEHRIT and 13 from CT) stated that government funding which became available gave their child other options they wished to explore.<sup>1</sup> The community treatment group (n=26) encouraged families to seek treatment on an average of 3.9 h per week using traditional speech therapy, ABA, and early intensive behavioral intervention.<sup>1</sup> The participants were videotaped prior to treatment with their parents in the home setting where communication acts were coded.<sup>1</sup> The analysis of efficacy was done to evaluate developmental quotients in children in both MEHRIT and CT groups.<sup>1</sup> Pre-test mean for the MEHRIT group was 0.64 with a SD of 0.32 and post test was 0.72 with a SD of 0.39 and the CT group was a pre-test mean of 0.54 with a SD of 0.26 and a post test mean of 0.64 with a SD of 0.32.<sup>1</sup> The p value for the MEHRIT group was 0.038 and CT group was <0.001.<sup>6</sup> P<0.05 was significant.<sup>1</sup> There was bias in regard to

parent's interaction with the children (some offered more hours/engaged more than others) and being aware of the treatment their child received.<sup>1</sup> Even though some children were lower functioning and may not have understood the difference in treatment groups parents would be aware because they activated the therapy. The children were kept safe and no harm was done, although there was the limitation in regards to some children receiving more hours of therapy than others thus making equality to treatment an issue and limited consistency<sup>1</sup>

Lim's study evaluated a total of 51 children who were diagnosed with an ASD.<sup>2</sup> One child was not included secondary to having a diagnosis of Down Syndrome in addition to ASD.<sup>2</sup> This was because the study wanted to solely focus on those with ASD alone.<sup>2</sup> Therefore, the total participants included was 50 children ages 3-5.<sup>2</sup> The level of functioning was determined based on the childhood autism rating scale (CARS) or the autism diagnostic interview revised (ADI-R).<sup>2</sup> Age appropriate and mildly impaired children via the CARS criteria were considered high functioning.<sup>2</sup> Moderately impaired and severely impaired on the CARS were labeled as low functioning.<sup>2</sup> ADI-R was measured based on poor behavior with 0=behavior abnormal in areas not coded; 1= abnormal behavior but not severe to meet criteria; 2= definitive abnormal behavior; 3=extreme severity.<sup>2</sup> ADI-R scores 0 and 1 were labeled high functioning children and 2 or 3 were low functioning.<sup>2</sup> Overall 25 children were categorized as low functioning and 25 high functioning.<sup>2</sup> The participant's language age and echolalia status were determined.<sup>2</sup> There was a total of 36 target words deemed age appropriate utilized in this study.<sup>2</sup> The children were tested via fill in the blank and verbal communication.<sup>2</sup> There were 6 songs used to include the 36 target words for the music comparison group.<sup>2</sup> The speech stimuli group used stories composed of the target words and recorded on a videotape to be presented via a monitor to the children.<sup>2</sup> The children were randomly assigned to music, speech, or no training.<sup>2</sup> Music group was 9

minutes in duration, speech 5 minutes and 40 seconds.<sup>2</sup> There were 18 participants in the speech and 18 in the music group, the rest in no training.<sup>2</sup> Each child watched the corresponding video (music or speech or nothing) twice a day for 3 days in a clinical office setting.<sup>2</sup> A correct verbal production was based on semantics, phonology, pragmatics, and prosody via the verbal production evaluation scale (VPES).<sup>2</sup> The data collection was done by speech pathologists who were blinded to the coding.<sup>2</sup> The ANCOVA was used to evaluate the efficacy on the posttest results of VPES.<sup>2</sup> Both music training and speech had a large effect on speech production compared to the control that received no treatment.<sup>2</sup> Due to a large effect size (partial  $\eta^2$  of 0.54) and significant  $p$  ( $p < 0.05$ ) the analysis of training on changes in scores was conducted for music vs. no training and speech vs. no training.<sup>2</sup> For the speech vs. no training the mean difference was 64.405 with a SD of 12.973 and  $p$  value of 0.00.<sup>2</sup> The pre test score for the speech therapy group was 60.50 with a SD of 67.53 and posttest score of 125.83 with a SD 81.03 ( $p < 0.001$ ).<sup>2</sup> The overall change in score was a mean of 65.33 with a SD of 56.89.<sup>2</sup> The comparison music group had a change in score of 77.47 SD of 43.09 and no training group had change score of 0.93 with a SD of 9.84 demonstrating significant improvement with the music and speech group.<sup>2</sup> The results were limited in the sense that those individuals that scored higher on the pre test (higher functioning level) had more success than the lower functioning children.<sup>2</sup> Compliance was good because the study itself was only three days, but long-term follow up was not completed.<sup>2</sup> There was no harm done during this study and the individuals were safe. See table 2 for further information.

The participants in the Sandiford study were selected using local media, letters to professionals, contacting support groups, and word of mouth.<sup>3</sup> The individuals included had a diagnosis of autism based on the Autism Diagnostic Observational Scale (ADOS).<sup>3</sup> These

children needed to be nonverbal as opposed to the other studies. Nonverbal was described by having a vocabulary of 10 or fewer words, no functional speech, and lack of speaking on a daily basis.<sup>3</sup> The subjects were 5-7 year old's studied in their home and clinical environment.<sup>3</sup> If other language treatments or therapies were being used during this study, the children were not able to attend the four 45-minute sessions, or dual diagnoses they were excluded.<sup>3</sup> Also if they had a history of hearing impairments or blindness, or medical condition preventing them from going to therapy the individual was excluded.<sup>3</sup> This was to focus on the verbal component of the individual solely without having any confounders.<sup>3</sup> There were 12 participants: 6 randomly allocated to the traditional group and 6 randomly to the MBCT group.<sup>3</sup> 2 individuals did not follow up due to compliance and time management issues.<sup>3</sup> The intervention assessed in this study was 5 weeks of MBCT with four 45-minute sessions weekly (melodic based communication/speech therapy).<sup>3</sup> MBCT uses musical prompts in order to increase verbal output using a unique melody for each of the target words selected for this study.<sup>3</sup> The comparison group received traditional speech therapy.<sup>3</sup> The clinicians that worked with the children were not blinded to the treatment each child was receiving but were blinded to how the scoring system itself worked.<sup>3</sup> Parents were also advised to inform the clinicians if their child used any of the target words in the home setting. The goal of both groups was to be able to teach the individuals speech production of the 25-target words.<sup>3</sup> Both groups made significant progress (F value= 6.9,  $p < 0.001$ ) for the amount of verbal attempts.<sup>3</sup> P value was significant if  $< 0.05$  like the other two studies.<sup>3</sup> The number of correct words utilized was also significant (F=4.1,  $p=0.04$ ).<sup>3</sup> Efficacy for this study was determined by number of verbal attempts and number of correct words.<sup>3</sup> Both groups were found to be effective, MBCT had possible faster rates of improvement and overall success based off of parent feedback on their child's usage of the target words in the home

setting.<sup>3</sup> The median (min, max) differences (difference post-pre) between the 2 groups was: verbal attempts for the traditional group: mean of 2 (-1,16) and MBCT group: mean of 12 (7,22) with a p value of 0.08.<sup>3</sup> In regards to correct words the traditional group's mean was mean of 5 (1,6) and MBCT mean of 5 (-1,22) with a p value of 0.4.<sup>3</sup> Words reported by the parents for the traditional group had a mean of 6 (2,23) and MBCT mean of 13 (5, 51) with a p value of 0.45.<sup>3</sup> Compliance was an issue for this study, because when attempts were made months after the study to re-assess progress post-treatment there was little response from both groups.<sup>3</sup> This was limited because it relies a lot on the parents as well and their contribution. Some parents were more involved than others, which skewed results. Children were safe without harm mentioned. See table 2 for summary of results.

**Table 2: Comparison of studies and key outcome assessments**

Study	How efficacy was measured	Scoring System	Statistic Measured	P-value	Statistically significant?	Safety?
Casenhiser <sup>1</sup> (2013)	Improvement in language at age appropriate level	PSL-4; CASL	Pre-test mean 0.61+SD of 0.32; Post test treatment mean of 0.72 w/SD of 0.9	P=0.038 (MEHRIT), CT= 0.001	Yes	No adverse outcomes noted
Lim <sup>2</sup> (2010)	Target words produced	VPES scale examining 4 components of language including pragmatics, phonology, semantics, prosody	Mean of 65.33 SD 56.89; speech versus no training= mean difference of 64.405 SD 12.973	P= 0.001 for pre to post test speech treatment; p <0.000 for speech versus no training	Yes	No adverse outcomes noted
Sandiford <sup>3</sup> (2013)	Number of verbal attempts for both treatment groups	25 target words	F= 6.9 for verbal attempts and 4.1 for number of correct	P <0.001 for verbal attempts; P<0.04 for correct words.	Yes	No adverse affects noted

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## Discussion

This systematic review was intended to analyze the results of 3 RCTs to indicate if speech therapy techniques would improve verbal communicational skills and language acquisition in autistic children. A particular emphasis was placed on speech therapy. There were many limitations to the studies. The sample size was small in all 3 studies which was secondary to the population being difficult to work with at times and this may have affected the validity.<sup>1,2,3</sup> In addition, government funding and time requirements became key reasons for withdrawing from the studies.<sup>1,2,3</sup> Also, no two autistic individuals are alike and some are higher functioning than others thus using the same list of target words for those who are low functioning versus high functioning may have limitations in its own.<sup>1,2,3</sup> While the proposed question researches autistic children in general, it is important to differentiate between the high and low functioning to know their capabilities and what is considered a significant change in one may not be for the other. Lim's study proposed that those who displayed profound echolalia may have skewed the results.<sup>2</sup>

There were also some limitations in regards to complete blinding. Parents had to actively engage with their children for the studies and were aware of the therapy their child received.<sup>1,2,3</sup> When relying on parent feedback their input or bias had the potential to skew results.

The Individuals With Disability Act was first developed in 1975, which protects the educational rights of those with disabilities including autistic individuals.<sup>8</sup> The law requires that the individual be eligible to receive free education and emphasizes that there are additional services that the individual needs which should be accounted for such as early intervention.<sup>8</sup> If the parent desires a specialized therapy there is a chance it is not covered by government funding.<sup>8</sup> There is a certain amount allocated for each individual and to cover the necessities first

and then secondary resources afterward. Luckily, there are grants, state aid, and support groups aimed at providing autistic individuals the extra funds they need to attempt to cover out of pocket expenses family would pay.<sup>9</sup> Speech therapy most likely would be covered but specialized forms of it may not be in some states and thus require the additional grants, and funding.<sup>9</sup>

American Speech Language Hearing Association (ASHA) developed a list of therapies they provide to help reach the individualized goals of autistic children working on speech production.<sup>10</sup> By using a combination process including family involvement, picture exchange communication systems, activity schedules, computer or video assisted technology, ABA, functional communication training, along with others it is highly suggested that the early intervention is crucial.<sup>10</sup> The APA believes that treatment within the first 6 years is most beneficial and can reverse or lower the severity of autistic symptoms.<sup>5</sup>

## **Conclusions**

This systemic review is inconclusive on whether or not speech therapy on its own impacts the language acquisition and speech production in autistic individuals.<sup>1,2,3</sup> Flaws that can be turned into future research include longer duration of the studies and follow up. It would also be beneficial to assess the individuals as they mature into teenagers. Another suggestion is to divide the individuals based on functioning level and adjust the target words accordingly. Some target words may have been too simple for those higher functioning or too hard for lower functioning. Limitations include lack of funding and lack of knowledge of available services. Certain geographical areas are more advanced in regards to research and services. What may be available in one area of the country may not be in another. Overall, by utilizing early intervention techniques and focusing on strategies to improve speech production autistic individuals are likely to improve their ability to communicate.

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