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Auditory Integration Interventions for Children with Autism and Developmental Disabilities: An Evidence-Based Practice Project

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Auditory Integration Interventions
for Children with Autism and Developmental Disabilities:
An Evidence-Based Practice Project

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Keywords: autism spectrum disorder, developmental disabilities, disabled children, therapeutics, therapy, rehabilitation, occupational therapy

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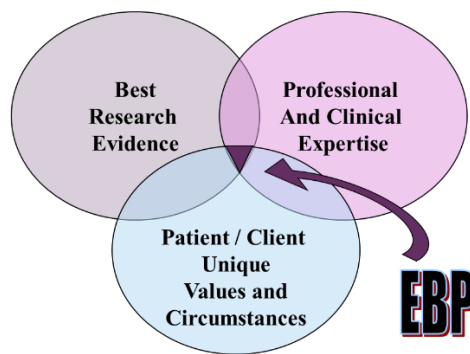
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Introduction

Evidence Based Practice

Evidence based practice is defined as the integration of knowledge from professional and clinical expertise, patient/client unique values and circumstances, and best research evidence (Straus, Richardson, Glasziou, & Haynes, 2005). The EBP courses in the St. Catherine University occupational therapy programs emphasizes skill building in finding, analyzing, and synthesizing research.

A definition of Evidence-Based Practice (EBP)



(Straus, Richardson, Glasziou & Haynes, 2005)



The EBP Project

Occupational therapy graduate students at St. Catherine University complete an EBP project in partial fulfillment of the requirements for a course on Evidence-Based Practice.

The EBP Process

- Begins with a practice dilemma
- Dilemma is framed as an EBP question and PICO
P (population/problem) I (intervention) C (comparison group) O (outcome(s) of interest)
- Background learning
- Search for the best evidence
- Initial appraisal and critical appraisal of the evidence
- Summary of themes from the evidence
- Recommendations for practice
- Next steps – implementation in practice

Practice Dilemma

The practice dilemma for these projects centered on children with developmental disabilities, particularly those with autism spectrum disorder.

In the past couple of decades we have seen the enormous growth in the number of individuals with ASD and the types and costs of services provided to them and their families (Centers for Disease Control and Prevention, 2016):

- Autism spectrum disorder: 1 in 68 children
- U.S. annual costs for children with ASD in 2011
 - \$11-60 billion
- Cost of autism medical care and therapies per year
 - Medical care for children with ASD on Medicare: \$10,000
 - Intensive behavioral interventions: \$40,000-60,000

Occupational therapy is a primary provider for children with autism spectrum disorder and their families. There are expectations that the interventions occupational therapy uses are evidence-based. There are growing questions about Comprehensive Treatment Models that are being used with children with ASD.

Comprehensive Treatment Models for ASD and Developmental Disabilities

A number of governmental agencies and expert review groups have begun to examine those interventions that are most costly and time intensive. These have been described as comprehensive treatment models (rather than focused interventions) because of the unique characteristics related to some of these features (Wong et al., 2013). AOTA, the Department of Human Services, and others receive a lot of questions from practitioners and families about some of these interventions that have been used in practice and thus, it seemed appropriate to conduct a review of the research evidence.

- Comprehensive Treatment Models “consist of a set of practices designed to achieve a broad learning or developmental impact on the core deficits of ASD” and “are characterized by
 - organization (i.e., around a conceptual framework),
 - operationalization (i.e., procedures manualized),
 - intensity (i.e., substantial number of hours per week),
 - longevity (i.e., occur across one or more years), and
 - breadth of outcome focus (i.e., multiple outcomes such as communication, behavior, social competence targeted)” (p. 3)
- Focused Intervention Practice: “address a single goal or skill” (p. 3)

Table 1.

Interventions Reviewed in the Evidence Based Practice Projects

| General Category | Specific Interventions |
|--------------------------------|--|
| Listening Therapies | Auditory Integration Therapy The Listening Program Therapeutic Listening |
| Movement Therapies | Brain Gym Interactive Metronome Makoto Therapy |
| Reflex Integration Therapies | Masgutova Method (MNRI) Reflex Integration Rhythmic Movement Training |
| Sensory/Manipulative Therapies | Wilbarger Therasuit Craniosacral therapy |

Appraisal of Best Research

After searching and finding evidence available from library databases and alternative sources, students conducted an initial appraisal to evaluate the quality and relevance of the evidence and select the best research for further review. Then they conducted critical appraisals of the best formal reviews of primary research (e.g., systematic reviews, meta-analyses) and/or primary/original research studies using the AOTA CAP form (American Occupational Therapy Association, 2016). One of the steps in the CAP process is to evaluate the strength or level of the research design and the types of conclusions that are possible from each design.

Initial Appraisal

- Quality of the evidence
 - type of evidence
 - research design
 - investigator qualifications
 - journal/publication/website
- Relevance of the evidence
 - PICO

Critical Appraisal

- Reviews of primary research
 - systematic reviews, meta-analysis
 - review process and approach
 - consistent and inconsistent findings
- Primary research studies AOTA CAP
 - Level 1: randomized controlled trials
 - Level 2: two groups, nonrandomized/cohort and case control
 - Level 3: nonrandomized, pretest/posttest and cross-sectional
 - Level 4: single subject
 - Level 5: case report

Expert Review Groups

Students also explored the conclusions and recommendations of expert review groups when available (see Tables 1-4). The Wisconsin Treatment Intervention Advisory Committee in particular has made determinations on a number of the interventions that students reviewed.

- Wisconsin Treatment Intervention Advisory Committee
- Evidence-Based Practices for Children, Youth, and Young Adults with Autism Spectrum (UNC)
- Association for Science in Autism Treatment (ASAT) Disorder
- Cochrane Collaboration
- U.S. Department of Health and Human Services, Centers for Medicare & Medicaid Services
- National Autism Center
- American Academy of Pediatrics
- Others

Wisconsin Determination Levels (Wisconsin Department of Health Services, 2016).

After reviewing all of the evidence, students made their own recommendations using the Wisconsin determination levels.

- Level 1- Well Established or Strong Evidence
(DHS 107 - Proven & Effective Treatment)
- Level 2 – Established or Moderate Evidence
(DHS 107 - Proven & Effective Treatment)
- Level 3 – Emerging Evidence
(DHS 107 – Promising as a Proven & Effective Treatment)
- Level 4 – Insufficient Evidence (Experimental Treatment)
- Level 5 – Untested (Experimental Treatment) and/or Potentially Harmful.

References

- American Occupational Therapy Association. (2016). AOTA'S evidence exchange: Guidelines to critically appraised paper (CAP) worksheet. Retrieved from <https://www.aota.org/~media/Corporate/Files/Practice/EvidenceExchange/CAP%20Guidelines%20for%20Evidence%20Exchange.pdf>
- Centers for Disease Control and Prevention. (2016). Autism spectrum disorder. Retrieved from <http://www.cdc.gov/ncbddd/autism/data.html#references>
- Straus, S. E., Richardson, W. S., Glasziou, P., & Haynes, R. B. (2005). How to practice and teach EBM. *Evidence-Based Medicine. Third edition. Elsevier*, 13-29.
- Wisconsin Department of Health Services. (2016). Treatment intervention advisory committee. Retrieved from <https://tiac.wisconsin.gov/summary-determinations-regarding-level-evidence.htm>
- Wong, C., Odom, S. L., Hume, K. Cox, A. W., Fettig, A., Kucharczyk, S., ... Schultz, T. R. (2013). Evidence-based practices for children, youth, and young adults with Autism Spectrum Disorder. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, Autism Evidence-Based Practice Review Group. This report is available online at <http://autismpdc.fpg.unc.edu/sites/autismpdc.fpg.unc.edu/files/2014-EBP-Report.pdf>

All EBP Projects are available at <http://sophia.stkate.edu/>.

Final EBP Question and PICO

Are selected auditory integration interventions (Auditory Integration Therapy/Techniques/ Training, The Listening Program and Therapeutic Listening,) used in occupational therapy for individuals with autism spectrum disorder (ASD) effective in improving social participation, school performance, and communication?

| | Keywords (Our Subgroups) | More Broad and Narrow Keywords (General - Total Group) | Keyword synonyms, abbreviations, and spelling variants |
|---|---|--|--|
| P – Patient / Population Problem | Children, school, clinic, | Vulnerable children, children with ASD, children with disabilities, adults with disabilities | Kids, pediatrics, juvenile, adolescent, youth, teenager, teen, teacher, learning deficits |
| I - Intervention | Therapeutic Listening, The Listening Program, Advanced Brain Technologies, Auditory Integration Therapy | Audiology, therapy, music therapy, adaptation, sensory integration, auditory integration, listening therapy | Auditory Integration Therapy/Technique/Training (AIT), OT, TLP, |
| C - Comparison | | | |
| O - Outcome | Quality of life, school performance, communication, social participation, executive functioning, sleep, brain functionality | Cost of therapies, cost of equipment, degree of training, level of participation, level of independence | ADL, IADL, quality of life, improved auditory/ sensory processing |

Auditory Integration Therapy/Techniques/Training

Reviewed by: Jen Garnness, Erika Janorschke, & Becca Humbert

Executive Summary

Final EBP question and PICO.

When used in occupational therapy, is Auditory Integration Therapy/Technique/Training effective in improving social participation, school performance, and communication in individuals with autism spectrum disorder (ASD)?

| | Keywords (Our Subgroups) | More Broad and Narrow Keywords (General - Total Group) | Keyword synonyms, abbreviations, and spelling variants |
|--|---|--|--|
| P - Patient/ Population Problem | Children, School, Clinic, Adults | Vulnerable children, Children with ASD, Children with disabilities, Adults with disabilities | Kids, pediatrics, juvenile, adolescent, youth, teenager, teen, teacher, learning deficits |
| I - Intervention | Alfred Tomatis Therapeutic Listening- Sheila Frick; The Listening Program (TLP)- Advanced Brain Technologies; Auditory Integration Therapy (AIT)-Guy Berard | Audiology, Music Therapy, Therapy, Adaptation, Sensory Integration; Auditory Integration, listening therapy, Alfred Tomatis Therapeutic Listening- Sheila Frick; The Listening Program (TLP)- Advanced Brain Technologies; | AIT- Auditory Integration Therapy/Technique/Trainin g, OT, |
| C - Comparison | No other comparison therapies found | Persons with hypersensitive hearing Persons without hypersensitive hearing Persons with other sensory deficits | |

| | Keywords (Our Subgroups) | More Broad and Narrow Keywords (General - Total Group) | Keyword synonyms, abbreviations, and spelling variants |
|--------------------|--|---|--|
| O - Outcome | Quality of Life School Performance Communication Social Participation Executive Functioning Sleep | Cost of Therapies Cost of equipment Degree of training Level of Participation Level of independence | ADL IADL Quality of life Accurate auditory/ sensory processing |

Themes.***Description of intervention.***

Auditory Integration Therapy/Technique/Training (AIT) is described as an educational music program for adults and children with difficulties processing auditory input (Patino, 2014; Sensory Clinic, 2016). AIT is a ten-day program that requires the client to listen to two half-hour sessions of specifically selected music a day (Brockett, 2006). If additional AIT is necessary after the first ten-day cycle, clients are instructed to complete another ten-day cycle (Brockett, 2006). AIT must be administered through special hearing devices such as the *Audiokinetron* and *Earducator*™ by a certified Professional AIT Practitioner (Brockett, 2006; Pinnacle Medical Services, 2014; Sensory Clinic, 2016; The Official Berard AIT Website, 2015). The frequency and volume of the music are said to be randomly modulated and filtered to stimulate the auditory and vestibular systems (Pinnacle Medical Services, 2014; Sensory Clinic, 2016; The Official Berard AIT Website, 2015).

Currently, AIT is most widely used for individuals with autism spectrum disorder, but has also been used to treat problems such as ADD, ADHD, depression, dyslexia, sensory issues, and tinnitus. (AIT Institute, 2016; Patino, 2014). AIT is reportedly appropriate for individuals over the age of three as long as they can keep a pair of headphones on for thirty consecutive minutes (The Official Berard AIT Website, 2015). AIT makes a wide variety of claims on its effectiveness, including improved language development, sensory stimulation, concentration, social relationships, athletic abilities, and eye contact. (The Official Berard AIT Website, 2015). The cost of completing AIT in a clinical setting is between \$1,200 and \$2,000 (AIT Institute, 2016). The cost to become a certified AIT Professional Practitioner is \$2,400 (AIT Institute,

2016). To purchase an approved AIT device, it is between \$800 and \$1,800 (AIT Institute, 2016).

Developers/proponents, researchers, and organization/company.

After struggling with tinnitus, a French ear, nose, and throat (ENT) physician, Dr. Guy Berard, developed AIT in the 1950's (The Official Berard AIT Website, 2015). Berard reported personal success from using AIT and began using his method on children with learning disabilities and ASD (Pinnacle Medical Services, 2014). Berard believed differences in the ways individuals perceived auditory frequencies could lead to sound distortion, which could lead to comprehension and behavioral issues (Sensory Clinic, 2016). The Berard AIT technique has been used in the United States since the 1990's and is typically provided by teachers, audiologists, or occupational therapists trained in AIT (Patino, 2014). Currently, the most comprehensive website for AIT methodology, equipment, training, etc. is The Official Berard AIT Website (2015).

Dr. Rimland, former director of Autism Research Institute and his assistant, Dr. Edelson, became interested in possible effects of AIT as an intervention for ASD (The Official Berard AIT Website, 2015). They initiated the widespread interest in AIT throughout the world by promoting clients to share their personal experiences with AIT (The Official Berard AIT Website, 2015). They also conducted the first studies on AIT, claiming it to be an effective treatment for ASD (The Official Berard AIT Website, 2015). After their initial research, more research was conducted on the effectiveness of AIT for other disorders (The Official Berard AIT Website, 2015). One author, Sally Brockett, was identified as having possible biases or conflicts of interest; Brockett is the director of the IDEA Training Center- a Berard AIT training facility- and was initially trained by Guy Berard (IDEA Training Center, n.d.).

Description of the quality and quantity of available evidence.

While there is a considerable amount of information available in regards to the effectiveness of AIT, few of these studies are consistent and conclusive. Twenty two sources regarding the effectiveness of AIT. Of these 22 sources, 18 were published journal articles, and 17 were peer-reviewed, scholarly articles. The review status of the remaining sources could not be determined with available resources. All 22 sources analyzed were either primary sources (n=10) or evidence reviews (n=11). Of the ten primary sources, five were quantitative studies, three were case studies and two studies were prospective studies. The evidence reviews included five systematic reviews (Dawson & Watling, 2000; Fresham, Beebe-Frankenberger, & Macmillian, 1999; Sinha, Silove, Hayen, & Williams, 2011; Sinha, Silove, Wheeler, & Williams, 2006; United Healthcare, 2016), one critical appraisal paper (CAP) (Andelin, 2015), and five articles of various forms (forum reviews, evidence reviews, etc.). One conceptual paper was included (Johns, 2010)

Of these authors, 13 were associated with universities (four students and nine professionals, all PhD holders), two worked with research institutes (both PhD holders), one source was produced by an insurance company, three are general medical practitioners or occupational therapists (all holding MDs or OTDs), and two reports were produced by expert groups or committees. One of these articles was produced by the Wisconsin Department of Health, while the other was a committee work, in which 17 of the 19 involved held MDs or EdDs. One source (Brockett, Lawton-Shirley, & Kimball, 2014) was produced by a non-PhD holder who was directly trained by Dr. Berard.

The resources available were primarily produced in two time periods: 1995-1999 (n=8) and 2010-2016 (n=10), with the remaining four articles being released between 2000-2009. The

quality and relevance of the articles were fairly consistent. The majority of the articles were rated to be 'Good' (n=10) quality, and 14 articles were of strong relevance to our PICO question.

Summary of current evidence and reviews of evidence.

A Cochrane Systematic Review found 7 studies that met the criteria to be included in the review (Sinha et al., 2011). There were no consistent findings that showed the effectiveness of AIT for behavioral problems, cognitive ability, sound sensitivity, listening and comprehension, language, and adverse effects (Sinha et al., 2011). It was concluded that at this time, AIT should not be considered an effective treatment, rather an experimental treatment and it should be used with caution (Sinha et al., 2011).

A systematic review conducted by Dawson & Watling (2000) compared 46 scholarly studies conducted on interventions for autism that looked at auditory, visual, and motor integration in autism. Five were directly related to AIT and children with autism spectrum disorder (ASD) (Dawson & Watling, 2000). The outcomes of the five articles varied, with one study supporting the effectiveness of AIT, while the other four found no evidence to support AIT (Dawson & Watling, 2000). The authors of the analysis concluded that the technique was not supported by the controlled studies that had been conducted at that point in time (Dawson & Watling, 2000).

A systematic review conducted by Tochel examined the effectiveness of AIT for children with ASD (Tochel, 2003). Credible research was limited so four scholarly sources were analyzed for AIT (Tochel, 2003). This review suggested AIT may be no more effective than unmodulated music for improving communication in children with ASD (Tochel, 2003). However, due to limited research and deficiencies in some of the methodology, it is difficult to generalize these findings (Tochel, 2003).

The highest quality evidence does not show AIT to be an effective treatment. There were no consistent findings for behavioral problems, cognitive ability, sound sensitivity, listening and comprehension, language, or adverse effects (Dawson & Watling, 2000; Sinha et al., 2011; Tochel, 2003). The expert review groups listed in Table 1 state there is a lack of sufficient evidence at this time. Due to the lack of research supporting AIT, great caution should be taken for further research. No conclusions can be made regarding the implications of AIT for occupational therapy practice because the outcomes of AIT for social performance, school performance, and communication are inconclusive.

Expert review table.

Table 1.

Summary of Evidence and Recommendations by Expert Review Groups for Auditory Integration Therapy

| Review Organization | Summary and Recommendations | Citation and Source |
|--|--|--|
| Wisconsin Treatment Intervention Advisory Committee | AIT is Level 5 (Untested (Experimental Treatment) &/or Potentially Harmful). No current rigorous research shows AIT as effective. | Wisconsin Department of Health Services Autism and Other Developmental Disabilities Treatment Intervention Advisory Committee (2016). https://tiac.wisconsin.gov/summary-determinations-regarding-level-evidence.htm |
| Evidence-Based Practices for Children, Youth, and Young Adults with Autism Spectrum Disorder | There is insufficient evidence on the effects of AIT. | Wong, C., Odom, S. L., Hume, K. Cox, A. W., Fettig, A., Kucharczyk, S., ... Schultz, T. R. (2013). Evidence-based practices for children, youth, and young adults with Autism Spectrum Disorder. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, Autism Evidence-Based Practice Review Group. http://autismpdc.fpg.unc.edu/sites/autismpdc.fpg.unc.edu/files/2014-EBP-Report.pdf |
| Association for Science in Autism Treatment (ASAT) | Reviews of empirical research shows that scientific standards have not been met and cannot be justly used in practice. Further research is needed. | Association for Science in Autism Treatment (n.d.) Treatments in alphabetical order. Retrieved from http://www.asatonline.org/for-parents/learn-more-about-specific-treatments/treatments-in-alphabetical-order/ |
| Cochrane Collaboration | There is no evidence at this time to show that AIT is an effective treatment. | Cochrane Collaboration (2011). http://www.cochrane.org/ |
| U.S. Department of Health and Human | AIT is a Level 3 Intervention | U.S. Department of Health and Human Services, Centers for Medicare & |

| | | |
|---|--|--|
| Services, Centers for Medicare & Medicaid Services. | (Unestablished Intervention) Any improvements seen from AIT were not maintained over time. | Medicaid Services. (2010). Autism spectrum disorders (ASDs) services final report on environmental scan. Retrieved from http://www.impaqint.com/sites/default/files/files/Autism_Spectrum_Disorders.pdf |
| National Autism Center | No information available. | National Autism Center (2015). National Standards Project, Phase 2. Retrieved from http://www.nationalautismcenter.org/national-standards-project/phase-2/ |
| American Academy of Pediatrics | Studies of Complementary and Alternative Medicines (CAM) interventions are limited or flawed. Not recommended as an evidence-based intervention. | Myers, S. M., & Johnson, C. P. (2007). Management of children with autism spectrum disorders. <i>Pediatrics</i> , 120(5), 1162-1182. http://pediatrics.aappublications.org/content/pediatrics/120/5/1162.full.pdf |

Background Learning and Evidence Searches**Table of resources.**

| Title/Name | Brief Description | Source |
|--|---|---|
| Berard Auditory Integration Technique (AIT) Training | <ul style="list-style-type: none"> -Background information on the founder and history -Basic anatomy and physiology on the ear and auditory system -Conditions AIT can be used to treat -Schedule of how therapy sessions are carried out -Organization website, not scholarly | Pinnacle Medical Services http://www.pinnaclemedicalservices.org/index.php/berard-auditory-integration-technique-ait-training |
| What is Auditory Integration Training (AIT) – for Hearing, Autism, ADHD, ADD, Dyslexia and other special needs | <ul style="list-style-type: none"> -Includes list of scholarly article summaries and critiques of the articles -Information on different types of AIT programs -Organization website, not scholarly | Sensory Clinic http://auditoryintegrationtraining.co.uk/auditory-integration-training-ait-for-hearing-autism-adhd-add-dyslexia-and-other-special-needs-2/auditory-integration-training-ait-for-hearing-autism-adhd-add-dyslexia-and-other-special-needs/ |
| What Is AIT: All About Berard Auditory Integration Training | <ul style="list-style-type: none"> -Discusses the use of AIT with many different clinical conditions (however, many are testimonials) -Includes information on the history of AIT, how it works, etc. -Organization website, not scholarly | AIT Institute http://www.aitinstitute.org/what_is_auditory_integration_training.htm |
| Auditory Training Therapy: What It Is and How It Works | <ul style="list-style-type: none"> -What AIT is and how it works -Who can provide AIT -Criticisms of AIT -Educational information website, not scholarly | Understood.org https://www.understood.org/en/learning-attention-issues/treatments-approaches/alternative-therapies/auditory-training-therapy-what-it-is-and-how-it-works |
| Berard Auditory Integration Training: | <ul style="list-style-type: none"> -Intended uses of AIT -How AIT works -Influences on Development | Autism Insights http://yt2js5ru4z.scholar.serialsolutions.com/?sid=google |

| | | |
|--|---|--|
| Behavior Changes Related to Sensory Modulation | <ul style="list-style-type: none"> -AIT for ASD diagnoses/interventions -Physiology -Previous Evaluations and Information on initial trial study -Scholarly article | <u>&auinit=SS&aualast=Brockett&atitle=Berard+auditory+integration+training:+behavior+changes+related+to+sensory+modulation&title=Autism+insights&volume=6&date=2014&spage=1&issn=1179-5964</u> |
| The Official Berard AIT Website | <ul style="list-style-type: none"> -History of Berard AIT -Intended use for AIT -How AIT works -How to become an AIT practitioner -List of books and studies about AIT -Organizational website, not scholarly | <p>The Berard AIT Website <u>http://www.berardaitwebsite.com</u></p> |

Background learning paper one.

This EBP project will focus on auditory integration interventions or therapies for individuals with hearing issues. Background learning on this topic explored definitions of auditory integration therapy (AIT), who AIT is for, the history of this therapy, and how AIT works.

Auditory Integration Therapy (AIT) is intended as an alternative treatment for a variety of conditions with auditory processing issues. AIT is described as an educational music program or an alternative therapy for adults and children with problems processing auditory input (Patino, 2014; Sensory Clinic, 2016). These problems are believed to stem from auditory processing disorder (APD) or conditions related to this type of problem (Patino, 2014). Social interaction skills and learning can be impacted by one's ability to process sound (Patino, 2014; Pinnacle Medical Services, 2014, Sensory Clinic, 2016). Individuals with APD struggle with understanding what people say, because of difficulties in processing what they heard, not because of difficulties in hearing alone (Patino, 2014). Conditions that involve auditory processing issues or distortions in hearing include: autism spectrum disorder (ASD), attention deficit disorder (ADD, or ADHD with hyperactivity), Tourette syndrome, Rett syndrome, pervasive developmental disorder, pervasive developmental delay, central auditory processing disorder (CAPD), closed head injury, learning disabilities, language impairments, dyslexia, and depression (Patino, 2014; Pinnacle Medical Services, 2014, Sensory Clinic, 2016). There are different types of AIT, The Berard Auditory Integration Training (AIT) technique will be the focus of this project.

Berard AIT has been practiced for several decades and is provided in a variety of settings.

Struggling with hearing loss himself, French Otorhinolaryngologist Dr. Guy Berard developed a technique for AIT (Pinnacle Medical Services, 2014). Finding success for himself, Berard began using his method on children with learning disabilities and ASD (Pinnacle Medical Services, n.d.). Berard believed “when individuals perceive certain frequencies far more acutely than other frequencies” sound is distorted, which may lead to comprehension and behavioral issues (Sensory Clinic, 2016). The Berard AIT technique has been used in the United States since the late 1990’s and is usually provided by teachers, audiologists, or occupational therapists trained using this particular method (Patino, 2014).

Through the use of music and technology, Berard AIT is an educational program that aims to train an individual’s sound processing capabilities. The Berard AIT program consists of 20 sessions that are completed over ten consecutive days; there are two 30 minute sessions a day with a three-hour minimum break between each of the two (Pinnacle Medical Services, 2014). Using special hearing devices and headphones, the frequency and volume of the music are randomly modulated and filtered to stimulate the auditory and vestibular systems (Pinnacle Medical Services, 2014; Sensory Clinic, 2016). “AIT providers claim this can correct abnormal ear dominance and help people hear, discriminate and remember speech sounds. This is similar to the way hearing aids work for people with hearing loss” (Patino, 2014). Changes in behavior and comprehension are seen gradually and continue long after treatment (Pinnacle Medical Services, 2014). Various theories suggest these changes are related to structures and processes of the ears and brain (Brockett, Lawton-Shirley, & Kimball, 2014). The structures of the ear are stimulated by vibrations, sending information to the brain for auditory and vestibular perception (Brockett et al., 2014). Filtering and modulating sounds or music can impact or train how these perceptions are processed by an individual (Brockett et al., 2014; Sensory Clinic, 2016). By

stimulating or training these structures and processes, expected outcomes involve improvements in behavior and comprehension.

This background summary of Berard AIT reviews assumptions and practices that promote learning and comprehension through a particular sensory stimulus. An understanding of individuals with auditory processing issues, interventions to help with these issues, history and development of AIT, and how AIT interacts with health and education, provides an important context for the project. While background information is useful for understanding auditory learning, further research evaluating outcomes of these therapies is necessary for ethical and reliable occupational therapy practice and other health interventions.

Background learning paper two.

This EBP project will focus on Auditory Integration Training. Auditory Integration Training, or AIT, is a type of therapy that claims to address auditory and sensory distortions by exposing individuals to a variety of frequencies (AIT Institute, 2016). There are at least three types of AIT that are used in practice, with Berard AIT being the most common (American Speech-Language-Hearing Association, 2004). AIT techniques are practiced worldwide (The Official Berard AIT Website, 2015). While AIT has been used in the United States since 1991, there is little credible evidence that it is effective and is still considered an experimental technique (Patino, 2014).

AIT is currently being used to treat a wide variety of conditions by claiming to improve a broad range of symptoms and problems. AIT has been used to treat problems in autism spectrum disorder, ADD, ADHD, depression, dyslexia, sensory issues, and tinnitus. (AIT Institute, 2016). Currently, it is most widely used for individuals with autism spectrum disorder (Patino, 2014). AIT makes a wide variety of claims on its effectiveness, including improved language development, sensory stimulation, concentration, social relationships, athletic abilities, and eye contact. (The Official Berard AIT Website, 2015). AIT is reportedly appropriate for individuals over the age of three years as long as the individual is able to keep the headphones on for thirty consecutive minutes (The Official Berard AIT Website, 2015).

The most common type of AIT, Berard AIT, has a specific schedule and must be conducted in a certain manner. Berard AIT is a ten day program that requires one hour every day (Brockett, 2006). During sessions, a practitioner must be present at all times (Brockett, 2006). Each day, clients must listen to two half hour recordings of music from the Approved Music List through a pair of headphones (Brockett, 2006) which include a broad range of

frequencies, tones, and volumes (Pinnacle Medical Services, 2014). A minimum of a two hour break is required between sessions (Pinnacle Medical Services, 2014). After the first five days, clients are permitted to take a one to two day break in the program if necessary (Brockett, 2006). If after ten days, more Berard AIT is necessary, clients are instructed to complete another ten day cycle rather than simply adding a few extra days (Brockett, 2006). AIT Professional Practitioners claim that other forms of therapy are more effective after AIT, so after AIT is complete, individuals should enroll in other types of therapy to build upon the progress that has been made through AIT (AIT Institute, 2016).

To complete Berard AIT correctly, there are specific requirements that must be met. At this time, Berard AIT is a therapy that must be performed in a clinic setting with a Berard AIT Professional Practitioner (The Official Berard AIT Website, 2015). The cost to complete Berard AIT in a clinical setting is between \$1,200 and \$2,000 (AIT Institute, 2016). A Listening Profile is done before all sessions, halfway through training, and upon completion of training to determine the target frequencies for therapy and if additional Berard AIT is needed (Pinnacle Medical Services, 2014). Berard AIT must be completed on one of two approved devices-the Audiokinetron or the Earducator (The Official Berard AIT Website, 2015). While there are many specific requirements for Berard AIT, some places have become more lenient and started practicing Berard AIT without certified practitioners, in homes, and with CDs to increase convenience of the program (American Speech-Language-Hearing Association, 2004).

AIT Professional Practitioners must complete special training to receive their certification. Most Berard AIT Professional Practitioners are teachers or healthcare professionals such as occupational therapists, speech pathologists, or audiologists. (Patino, 2014). To become certified, a professional must have a doctoral or master's degree or a bachelor's degree with five

years of experience working in healthcare (The Official Berard AIT Website, 2015). The certification is completed by listening to online seminars which take between twelve weeks and six months to complete (AIT Institute, 2016). Upon completion of the seminar, one must score higher than a 75% on an essay exam to become certified (AIT Institute, 2016). The cost for certification is \$2,400 (AIT Institute, 2016). Once an individual is certified, they are able to purchase one of the two approved devices, the Audiokinetron or the Earducator, to use in practice (AIT Institute, 2016). These devices range from \$800-\$1,800 (AIT Institute, 2016).

There are mixed opinions regarding AIT and its effectiveness. This paper provided a summary of the key characteristics of AIT. Further examination of this approach will be conducted to determine if AIT is an effective therapeutic technique.

Background learning paper three.

While there are many auditory/listening-based therapies in use, not all accepted techniques have been proven to be effective and reasonable. Despite controversy and few results, auditory integration training (AIT; the words training, therapy and technique are used interchangeably) is still a technique used in the treatment of children with a variety of disorders, especially autism spectrum disorder (ASD) (ASHA, 2004). In order to understand why this practice is still used (and whether it should be used), it must first be understood what AIT is, how it was developed, how it is supposed to function, and how it compares to other auditory/listening-based therapies.

A variety of auditory-based interventions are used by practitioners, and can be marginally effective when applied (Hall & Case-Smith, 2007). Psychology, speech-pathology, and occupational therapy practitioners have been using music based, listen/auditory treatments for therapeutic purposes; these therapies include treatments for a range of diagnoses including attention deficit disorders, autism, and learning disabilities (Hall & Case-Smith, 2007). Auditory integration training (AIT) is one particular technique for integrating music therapy into treatment, using modifications to the sound in order to (hopefully) decrease behaviors indicative of developmental disorders (lack of eye contact, etc.) (ASHA, 2004; Hall & Case-Smith, 2007). These techniques are said to work by using auditory input using specific sounds, frequencies, etc., to stimulate the brain; researchers believe that this input can arouse different brain regions to promote certain emotions or behaviors, such as calmness or thought organization (Hall & Case-Smith, 2007). Comparison studies have found that auditory-based programs can be effective in promoting these behaviors in small-group trials, though AIT in particular has been shown to produce highly-variable results (Hall & Case Smith, 2007).

Auditory integration training (AIT) is one auditory-based treatment that is often used in clinical settings for a number of conditions, though the technique has little scientific evidence (ASHA, Sinha, Silove, Wheeler, & Williams, 2006). There are three separate forms of AIT that are used in therapeutic treatment, but one type- referred to as the Berard method- is most often implemented and referenced (ASHA, 2004). Dr. Guy Berard began conducting case studies into the use of modulated sound for children with ASD in France in 1982, with his first results published as a book ('Sound of a Miracle') in 1991 (ASHA, 2004; Sinha et al., 2006). Despite the fact that many studies have been release discrediting the program (and many supporting studies show limitations and unreasonable conclusions), AIT use has spread over time, and is used by many decorated practitioners in a variety of countries, despite that fact that it has not received FDA approval, is expensive to the families, and has been suggested only for research purposes (ASHA, 2004; Sinha et al., 2006). Similar to the general auditory-therapy method, AIT has been used with individuals with "learning disabilities, behavior disorders, autism, pervasive developmental disorder, attention deficit disorder, attention deficit hyperactivity disorder, tinnitus, progressive deafness, and hyperacusis", amongst other mental illnesses, like depression (ASHA, 2004; Hall & Case-Smith, 2007).

The Berard method is a carefully planned practice, with rigid directions for implementation (ASHA, 2004; Hall & Case-Smith, 2007). Practitioners are instructed to use this form of AIT in 30 minute sessions a day (with at least three hours between sessions) for ten consecutive weekdays; most studies conducted regarding AIT use are based around this treatment form (ASHA, 2004; Hall & Case-Smith, 2007). This technique seems to be most often used when treating children (ASHA, 2004). The original Berard treatment was clearly outlined in format (ASHA, 2004). Using a device referred to as an 'Audiokinetron', the patient is asked to

sit wearing a pair of circumaural headphones, in an area with few external distractions (ASHA, 2004). The practitioner begins to play a music track, while the frequency and pitch of the sound is systematically adjusted, attempting to reach specific frequencies to stimulate different areas of the brain (ASHA, 2004). Given the fact that this an expensive and difficult to implement treatment, many practitioners have begun to use pre-programed sessions using CDs, as they are more readily available (ASHA, 2004, Hall & Case-Smith). Aside from critiques in regulation and training, many practitioners and groups have expressed concern regarding the specific risks of using this method on children; the frequencies used in Berard AIT sessions are within levels identified as possibly dangerous as it uses that maximum frequency possible within the Occupational Safety and Health Administration recommendations (110 dB for 30 minutes consecutively), putting the patients at possible risk for hearing loss (ASHA, 2004).

This outline is intended to provide a comprehensive general outline of the AIT process, describing the treatment process in detail, as well as the implementation of the technique and possible issues/concerns regarding its use. Given the lack of evidence regarding the use of AIT in a clinical setting- and the medical concerns associated- an in-depth analysis of this process will need to be conducted to determine the validity of its use. These concerns and the analysis will be addressed in the later stages of the EBP project, and will build upon the information provided in this report.

Evidence searches.

Library Database: Cochrane Library

About the Cochrane Library: a collection of six databases (*Cochrane Database of Systematic Reviews (CDSR)*, Cochrane Central Register of Controlled Trials (CENTRAL), Cochrane Methodology Register (CMR), Database of Abstracts of Reviews of Effects (DARE), Health Technology Assessment Database (HTA), NHS Economic Evaluation Database (EED) - seventh informs about Cochrane groups (published monthly)

Cochrane has an editorial staff and board, an oversight committee, and is published and edited by John Wiley & Sons.

- *Cochrane Database of Systematic Reviews (CDSR)*:
 - Claims to be the leading resource for systematic reviews in health care.
 - Contains all reviews from their groups.
 - Continuously published and updated through each month.
- Cochrane Central Register of Controlled Trials (CENTRAL):
 - Includes a high number of reports of randomised and quasi-randomised controlled trials.
 - Contains article abstracts, but not full text.
 - Published monthly.
- Database of Abstracts of Reviews of Effects (DARE):
 - The only database to contain abstracts of quality-assessed systematic reviews.
 - Claims to be “a key resource for busy decision-makers and can be used for answering questions about the effects of specific interventions, whether such questions arise from practice or when making policy”.

- “Covers a broad range of health related interventions and thousands of abstracts of reviews in fields as diverse as diagnostic tests, public health, health promotion, pharmacology, surgery, psychology, and the organization and delivery of health care”.
- This database “complements the *CDSR* by quality-assessing and summarising reviews that have not yet been carried out by Cochrane”.
- No new publishings since April 2015: was produced by the Centre for Reviews and Dissemination (CRD) at the University of York, UK.
- Cochrane Methodology Register (CMR):
 - A bibliography of publications that report on methods used in the conduct of controlled trials.
 - Includes journal articles, books, and conference proceedings, and the content is sourced from MEDLINE and hand searches.
 - Contains studies of methods used in reviews and more general methodological studies that could be relevant to anyone preparing systematic reviews.
 - No full text: records list title, where published, summary of article (sometimes)
 - No new publishings since July 2012: was produced by the UK Cochrane Centre, until May 2012.
- Health Technology Assessment (HTA) Database:
 - Goal for health care: improve quality and cost-effectiveness
 - Compiles specific information from worldwide health technology assessments (completed and ongoing): “studies of the medical, social, ethical, and economic implications of healthcare interventions”

- Published quarterly: produced by (CRD) at the University of York, UK, using information obtained from members of International Network of Agencies for Health Technology Assessment (INAHTA) and other health technology assessment organisations.
- NHS Economic Evaluation Database (EED):
 - Assists decision-makers by systematically identifying economic evaluations from around the world, appraising their quality, and highlighting their relative strengths and weaknesses.
 - No new updates or publishings since April 2015: was produced by (CRD) at the University of York, UK on a quarterly schedule.

Preparing for Search Process and Summary

- There are no exact matches in MeSH terms for auditory, integration, training, or technique.
- There was also no MeSH term matches for “auditory integration therapy”.
- For therapy, an exact MeSH term match listed: Therapeutics -synonyms: therapy; therapies.
- Auditory perceptual disorders (MeSH) explode tree > All cochrane reviews + trials (filter) >
 - Relevant article(s) from search:
 - Rimland, B., & Edelson, S. M. (1995). Brief report: A pilot study of auditory integration training in autism. *Journal Of Autism & Developmental Disorders*, 25(1), 61-70.

- Bettison, S. (1996). The long-term effects of auditory training on children with autism. *Journal of Autism and Developmental Disorders*, 26(3), 361-374. doi:10.1007/BF02172480
- Search all text > “auditory integration training” (filter: trials)
 - relevant article(s) from search:
 - Mudford, O. C., Cross, B. A., Breen, S., Cullen, C., Reeves, D., Gould, J., & Douglas, J. (2000). Auditory integration training for children with autism: No behavioral benefits detected. *American Journal on Mental Retardation*, 105(2), 118-129.
 - Zollweg, W., Palm, D., & Vance, V. (1997). The efficacy of auditory integration training A double blind study. *American Journal of Audiology*, 6(3), 39-47. doi: 10.1044/1059-0889.0603.39.
 - Ziring, P. R., Brazdziunas, D., Cooley, W. C., Kastner, T. A., Kummer, M. E., Pijem, L. G., ... Sandler, A. D. (1998). Auditory integration training and facilitated communication for autism. *Pediatrics*, 102(2), 431-433.
 - Edelson, S. M., Arin, D., Bauman, M., Lukas, S. E., Rudy, J. H., Sholar, M., & Rimland, B. (1999). Auditory integration training: A double-blind study of behavioral and electrophysiological effects in people with autism. *Focus on Autism and Other Developmental Disabilities*, 14(2), 73-81. doi:10.1177/108835769901400202

- Rimland, B., & Edelson, S. M. (1995). Brief report: A pilot study of auditory integration training in autism. *Journal Of Autism & Developmental Disorders*, 25(1), 61-70.
- Search all text > “auditory integration training”
 - Relevant article(s) from search:
 - Sinha, Y., Silove, N., Hayen, A., & Williams, K. (2011). Auditory integration training and other sound therapies for autism spectrum disorders (ASD). *The Cochrane Library*.
 - *Also found in another database:*
Sinha, Y., Silove, N., Wheeler, D., & Williams, K. (2006). Auditory integration training and other sound therapies for autism spectrum disorders: a systematic review. *Archives Of Disease In Childhood*, 91(12), 1018-1022. doi:10.1136/adc.2006.094649
- Search all text > “auditory integration”
 - Relevant article(s) from search:
 - Edelson, S. M., Arin, D., Bauman, M., Lukas, S. E., Rudy, J. H., Sholar, M., & Rimland, B. (1999). Auditory integration training: A double-blind study of behavioral and electrophysiological effects in people with autism. *Focus on Autism and Other Developmental Disabilities*, 14(2), 73-81. doi:10.1177/108835769901400202

Evidence Resource: AOTA

Preparing for Search Process and Documenting

- Searched “auditory integration therapy” and looked through many items to find anything related to AIT
 - This article was found in many different places and documents:
 - Al-Ayahdi, L.Y., Al-Drees, A.M., & Al-Arfaj, A.M. (2013). Effectiveness of auditory integration training in autism spectrum disorders—Prospective study. *Autism Insights*, 5, 13–20. <http://dx.doi.org/10.4137/AUI.S11463>
 - This was an article I found in a document about technology and ethics:
 - Running head: ETHICAL CONSIDERATIONS OF EMERGING TECHNOLOGY Therapy Code of Ethics and Ethics Standards (2010) (referred to as the “Code and Ethics ... Auditory integration training for children with autism: No behavioral benefits detected./~/media/Corporate/Files/Practice/Ethics/Advisory/emerging-technology.pdf”
 - Reference: Johns, P. M. (2010). Ethical Considerations Relevant to Emerging Technology-Based Interventions. Retrieved November 17, 2016, from <http://www.aota.org//media/Corporate/Files/Practice/Ethics/Advisory/emerging-technology.pdf>
 - AOTA letter regarding the American Academy Pediatrics policy statement on sensory integration therapy references:
 - Clark, F. (2012). President Florence Clark’s response on behalf of AOTA to the AAP’s policy statement on SI therapy. Retrieved from <http://www.aota.org/~media/Corporate/Files/Practice/Children/Response>

AmericanAcademyPediatricsPolicyStatementSensoryIntegrationTherapy.pdf

- Within this letter references Tochel (2003) on AIT:
 - Tochel, C. (2003). Sensory or auditory integration therapy for children with autistic spectrum disorders. *STEER*, 3(17), London, UK: Wessex Institute for Health Research and Development, University of Southampton.

Summary of 5 BEST Research Articles from both Resources/Databases

Andelin, L., & Reynolds, S. (2015). Critically appraised paper (CAP). Retrieved November 16, 2016, from http://www.aota.org/~media/Corporate/Files/Practice/EvidenceExchange/Approved-CAPs/CY/Al-Ayahdi_ASD_auditory_integratoin.pdf?la=en

From: Al-Ayahdi, L.Y., Al-Drees, A.M., & Al-Arfaj, A.M. (2013). Effectiveness of auditory integration training in autism spectrum disorders—Prospective study. *Autism Insights*, 5, 13–20. <http://dx.doi.org/10.4137/AUI.S11463>

- “... Individuals with autism spectrum disorder (ASD) are characterized by having difficulties with social interaction, communication challenges, and a tendency to engage in repetitive behaviors. In addition, people with ASD often have difficulties with sensory processing and may experience abnormal responses to sounds. Occupational therapists who treat children and adults with ASD often use a wide range of interventions, sometimes with a focus in sensory integration. Within the realm of sensory integration treatment techniques, occupational therapists sometimes use sound-based interventions, despite limited evidence to support their use. One of these sound based interventions is auditory integration training (AIT), developed by Guy Berard in 1982 (p. 14). This

research study aimed to assess the effectiveness of AIT on reducing symptoms of ASD in individuals with a diagnosis of ASD using the following outcome measures: the Childhood Autism Rating Scale (CARS), Social Responsiveness Scale (SRS), and the Autism Treatment Evaluation Checklist (ATEC). Results of the study indicate that children receiving AIT intervention had positive results on a variety of outcome measures. This study provides preliminary evidence of the possible positive effects of AIT in improvements in social skills and communication skills for children with ASD. The results of this study should be viewed with caution, however, as the study did not have a control group and outcomes were recorded 3 and 6 months post intervention, so time and other factors may have contributed to the results. In addition, there was a significant lack of reporting within the study, including where interventions were completed, who completed the interventions, and who completed the outcome evaluations, as well as lack of information about power and effect size. Furthermore, the statistical analysis used (multiple t-tests despite multiple outcome measures each containing subscales) elevated risk for finding an effect from treatment where there really was no effect present. Ultimately, clinicians should not rely solely on this research study as supporting the effect of AIT in practice.”

Johns, P. M. (2010). Ethical Considerations Relevant to Emerging Technology-Based Interventions. Retrieved November 17, 2016, from <http://www.aota.org/-/media/Corporate/Files/Practice/Ethics/Advisory/emerging-technology.pdf>

- Introduction: “The use of new intervention techniques and emerging areas of practice create the potential for various ethical concerns. Decisions about selecting the most appropriate, safe, and effective interventions should be made based on judicious clinical

reasoning, sound judgment, insight, experience, and available research evidence (Christiansen & Lou, 2001). Evidence-based practice is described as practice based on the investigation and appraisal of currently available research regarding intervention efficacy (Case-Smith & Arbesman, 2008; Christiansen & Lou, 2001). According to Christiansen and Lou (2001), practitioners also should consider relevant ethical principles such as patient benefit, truth, fairness, doing the right thing, avoiding harm, and respecting autonomy. Professional codes of ethics identify these principles to provide guidance for ethical practice and appropriate conduct. They also may be used to assist practitioners in making ethical decisions about less-traditional aspects of clinical practice. In recent years, new technology-based interventions have appeared for children who have sensory processing difficulties. This Advisory Opinion summarizes several emerging technologies in this area and relevant ethical considerations.”

Sinha, Y., Silove, N., Hayen, A., & Williams, K. (2011). Auditory integration training and other sound therapies for autism spectrum disorders (ASD). *The Cochrane Library*.

- Abstract: Objectives: To determine the effectiveness of auditory integration training (AIT) or other methods of sound therapy in people with autism spectrum disorders (ASD). Study design: A systematic review was carried out of randomised controlled trials (RCTs) of adults or children with ASD. Meta-analysis was attempted. Results: Six RCTs of AIT, including one crossover trial, were identified, with a total of 171 participants aged 3–39 years. 17 different outcome measures were used, with only two outcome measures used by three or more studies. Meta-analysis was not possible owing to very high heterogeneity or presentation of data in unusable forms. Three studies did not show any benefit of AIT over control conditions. Three studies reported improvements at 3

months in the AIT group for total mean scores of the Aberrant Behaviour Checklist (ABC), which is of questionable validity. Of these, one study also reported improvements at 3 months in the AIT group for ABC subgroup scores. No significant adverse effects of AIT were reported. Conclusion: At present there is not sufficient evidence to support its use.

Edelson, S. M., Arin, D., Bauman, M., Lukas, S. E., Rudy, J. H., Sholar, M., & Rimland, B.

(1999). Auditory integration training: A double-blind study of behavioral and electrophysiological effects in people with autism. *Focus On Autism & Other Developmental Disabilities, 14*(2), 73

- Abstract: Auditory problems are common in individuals with autism. Several previous studies have indicated that Auditory Integration Training (AIT), a sound-based intervention, may bring about significant improvement in autism. AIT entails listening to specially processed music for a total of 10 hours over a 10- to 20-day period. In the present study, 19 individuals with autism were assigned at random to either an experimental group (n = 9), who listened to AIT-processed music, or a placebo group (n = 10), who listened to the same but unprocessed music. All evaluators were blind to group assignment. Behavioral, electrophysiological (ERP), and audiometric measures were assessed prior to and following AIT. A significant decrease in Aberrant Behavior Checklist scores was observed in the experimental group at the 3-month follow-up assessment. Of the 19 participants, only three experimental group members and two placebo group members were able to perform the auditory P300 ERP task. All five participants showed abnormal P300 ERPs prior to the AIT listening sessions. Three months following AIT, all three treated participants showed a dramatic improvement in

their auditory P300 ERP, whereas none of the participants in the placebo group showed change. The participants' poor language and attention skills precluded collecting sufficient data for formal statistical evaluation of the results from the battery of audiometric tests.

Ziring, P. R., Brazdziunas, D., Cooley, W. C., Kastner, T. A., Kummer, M. E., Pijem, L. G., ... Sandler, A. D. (1998). Auditory integration training and facilitated communication for autism. *Pediatrics*, *102*(2), 431-433

Also: Committee on Children With Disabilities. (1998). Auditory integration training and facilitated communication for autism. *Pediatrics*, *102*(2), 431.

doi:10.1542/peds.102.2.431

- Abstract: This statement reviews the basis for two new therapies for autism--auditory integration training and facilitative communication. Both therapies seek to improve communication skills. Currently available information does not support the claims of proponents that these treatments are efficacious. Their use does not appear warranted at this time, except within research protocols.

Library Database: PubMed

Preparing for Search Process

- I did background research on the PubMed/MedLine database so I understood how to filter, advance search, use MeSH settings, etc.
- Auditory integration therapy, auditory integration technique, and auditory integration training are not on the MeSH headings. I tried auditory integration and spatial processing came up, which is not really related to our research topic.
- Autism Spectrum Disorder is a MeSH heading.

- Mental Disorders>Neurodevelopmental Disorders>Child Development Disorders, Pervasive>Autism Spectrum Disorder
- Occupational therapy is a MeSH heading.
 - Health Occupations>Allied Health Occupations>Occupational Therapy
- Disabled Children is a MeSH heading.
 - Persons>Disabled Persons>Disabled Children
- Term list for the data base:
 - "Auditory Integration Therapy", "Auditory Integration Technique", "Auditory Integration Training", "Occupational Therapy" [MeSH], "Autism Spectrum Disorder" [MeSH], "Auditory Therapy", "Auditory Integration", and "Child Development Disorders, Pervasive" [MeSH]
- Database filters to be tried: no filters, free full text, review, journal
- Boolean Logic Terms to be tried: I will use OR to separate Auditory Integration Therapy/Technique/Training. I will use AND to include other various terms

Summarizing a Strategic Search Process

| Filters/Years | Keywords | Total Yield / Relevant Hits | Date |
|---|---|--|----------|
| None Years: Unlimited | ("Auditory Integration Therapy" OR "Auditory Integration Technique" OR "Auditory Integration Training" AND "Occupational Therapy"[Mesh] AND "Autism Spectrum Disorder"[Mesh]) | 0/0 Try to broaden focus | 11-14-16 |
| Free Full Text Review Years: Unlimited | ("Auditory Integration Training" OR "Auditory Integration Therapy" OR "Auditory Integration Technique") | 30/2 Sinha, Silove, Wheeler, & Williams, 2006 Sinha, Silove, Hayen, & Williams, 2011 Mudford, Cross, Breen, Cullen, | 11-14-16 |

| | | | |
|-----------------------------|--|---------------------------------|--------------|
| | | Reeves, Gould, & Douglas, 2000 | |
| None Years: Unlimited | ("Auditory Therapy" AND "Autism Spectrum Disorder" [MeSH]) | 0/0 Try to broaden focus | 11- 14-16 |
| None Years: Unlimited | ("Child Development Disorders, Pervasive" [MeSH] AND "Auditory Integration") | 16/9 Rimland & Edelson, 1995 | 11- 14-16 |
| None Years: Unlimited | ("Autism Spectrum Disorder"[Mesh] and "Occupational Therapy"[Mesh]) | 15/0 Try to be more specific | 11- 14-16 |

Summary of 5 BEST Research Articles

Mudford, O. C., Cross, B. A., Breen, S., Cullen, C., Reeves, D., Gould, J., & Douglas, J. (2000).

Auditory integration training for children with autism: No behavioral benefits detected.

American Journal on Mental Retardation, 105(2), 118-129.

- This article has been cited 103 times.
- “Auditory integration training and a control treatment were provided for 16 children with autism in a crossover experimental design. Measures, blind to treatment order, included parent and teacher ratings of behavior, direct observational recordings, IQ, language, and social/adaptive tests. Significant differences tended to show that the control condition was superior on parent-rated measures of hyperactivity and on direct observational measures of ear-occlusion. No differences were detected on teacher-rated measures. Children's IQs and language comprehension did not increase, but adaptive/social behavior scores and expressive language quotients decreased. The majority of parents (56%) were unable to report in retrospect when their child had received auditory integration training. No individual child was identified as benefiting clinically or educationally from the treatment.”

Rimland, B. & Edelson, S. M. (1995). Brief report: A pilot study of auditory integration training in Autism. *Journal of Autism and Developmental Disorders*, 25(1), 61-70.

- This article has been cited 165 times
- No Abstract Available but skimmed the full article and would like to investigate it further.

Sinha, Y., Silove, N., Hayen, A., & Williams, K. (2011). Auditory integration training and other sound therapies for autism spectrum disorders (ASD). *Cochrane Database of Systematic Review*, 12. doi: 10.1002/14651858.CD003681.pub3.

- This article has been cited 43 times.
- **BACKGROUND:** Auditory integration therapy was developed as a technique for improving abnormal sound sensitivity in individuals with behavioural disorders including autism spectrum disorders. Other sound therapies bearing similarities to auditory integration therapy include the Tomatis Method and Samonas Sound Therapy. **OBJECTIVES:** To determine the effectiveness of auditory integration therapy or other methods of sound therapy in individuals with autism spectrum disorders.

SEARCH METHODS: For this update, we searched the following databases in September 2010: CENTRAL (2010, Issue 2), MEDLINE (1950 to September week 2, 2010), EMBASE (1980 to Week 38, 2010), CINAHL (1937 to current), PsycINFO (1887 to current), ERIC (1966 to current), LILACS (September 2010) and the reference lists of published papers. One new study was found for inclusion.

SELECTION CRITERIA: Randomised controlled trials involving adults or children with autism spectrum disorders. Treatment was auditory integration therapy or other sound therapies involving listening to music modified by filtering and modulation. Control

groups could involve no treatment, a waiting list, usual therapy or a placebo equivalent.

The outcomes were changes in core and associated features of autism spectrum disorders, auditory processing, quality of life and adverse events.

DATA COLLECTION AND ANALYSIS: Two independent review authors performed data extraction. All outcome data in the included papers were continuous. We calculated point estimates and standard errors from t-test scores and post-intervention means. Meta-analysis was inappropriate for the available data.

MAIN RESULTS: We identified six randomised controlled trials of auditory integration therapy and one of Tomatis therapy, involving a total of 182 individuals aged three to 39 years. Two were cross-over trials. Five trials had fewer than 20 participants. Allocation concealment was inadequate for all studies. Twenty different outcome measures were used and only two outcomes were used by three or more studies. Meta-analysis was not possible due to very high heterogeneity or the presentation of data in unusable forms. Three studies (Bettison 1996; Zollweg 1997; Mudford 2000) did not demonstrate any benefit of auditory integration therapy over control conditions. Three studies (Veale 1993; Rimland 1995; Edelson 1999) reported improvements at three months for the auditory integration therapy group based on the Aberrant Behaviour Checklist, but they used a total score rather than subgroup scores, which is of questionable validity, and Veale's results did not reach statistical significance. Rimland 1995 also reported improvements at three months in the auditory integration therapy group for the Aberrant Behaviour Checklist subgroup scores. The study addressing Tomatis therapy (Corbett 2008) described an improvement in language with no difference between treatment and

control conditions and did not report on the behavioural outcomes that were used in the auditory integration therapy trials.

AUTHORS' CONCLUSIONS: There is no evidence that auditory integration therapy or other sound therapies are effective as treatments for autism spectrum disorders. As synthesis of existing data has been limited by the disparate outcome measures used between studies, there is not sufficient evidence to prove that this treatment is not effective. However, of the seven studies including 182 participants that have been reported to date, only two (with an author in common), involving a total of 35 participants, report statistically significant improvements in the auditory intergration therapy group and for only two outcome measures (Aberrant Behaviour Checklist and Fisher's Auditory Problems Checklist). As such, there is no evidence to support the use of auditory integration therapy at this time.

Sinha, Y., Silove, N., Wheeler, D., & Williams, K. (2006). Auditory integration training and other sound therapies for autism spectrum disorders: A systematic review. *Archives of Disease in Childhood*, 91(2), 1018-1022. doi: 10.1136/adc.2006.094649

- This article has been cited 61 times

OBJECTIVES: To determine the effectiveness of auditory integration training (AIT) or other methods of sound therapy in people with autism spectrum disorders (ASD).

STUDY DESIGN: A systematic review was carried out of randomised controlled trials (RCTs) of adults or children with ASD. Meta-analysis was attempted.

RESULTS: Six RCTs of AIT, including one crossover trial, were identified, with a total of 171 participants aged 3-39 years. 17 different outcome measures were used, with only two outcome measures used by three or more studies. Meta-analysis was not possible

owing to very high heterogeneity or presentation of data in unusable forms. Three studies did not show any benefit of AIT over control conditions. Three studies reported improvements at 3 months in the AIT group for total mean scores of the Aberrant Behaviour Checklist (ABC), which is of questionable validity. Of these, one study also reported improvements at 3 months in the AIT group for ABC subgroup scores. No significant adverse effects of AIT were reported.

CONCLUSION: At present there is not sufficient evidence to support its use.

Sokhadze, E. M., Casanova, M. F., Tasman, A., & Brockett, S. (2016). Electrophysiological and behavioral outcomes of Berard Auditory Integration Training (AIT) in Children with autism spectrum disorder. *Applied Psychophysiology and Biofeedback*, 1-16.
doi:10.1007/s10484-016-9343-z

- Autism is a pervasive developmental disorder of childhood characterized by deficits in social interaction, language, and stereotyped behaviors along with a restricted range of interests. It is further marked by an inability to perceive and respond to social and emotional signals in a typical manner. This might due to the functional disconnectivity of networks important for specific aspects of social cognition and behavioral control resulting in deficits of sensory information integration. According to several recent theories sensory processing and integration abnormalities may play an important role in impairments of perception, cognition, and behavior in individuals with autism. Among these sensory abnormalities, auditory perception distortion may contribute to many typical symptoms of autism. The present study used Berard's technique of auditory integration training (AIT) to improve sound integration in children with autism. It also aimed to understand the abnormal neural and functional mechanisms underlying sound

processing distortion in autism by incorporating behavioral, psychophysiological and neurophysiological outcomes. It was proposed that exposure to twenty 30-min AIT sessions (total 10 h of training) would result in improved behavioral evaluation scores, improve profile of cardiorespiratory activity, and positively affect both early [N1, mismatch negativity (MMN)] and late (P3) components of evoked potentials in auditory oddball task. Eighteen children with autism spectrum disorder (ASD) participated in the study. A group of 16 typically developing children served as a contrast group in the auditory oddball task. Autonomic outcomes of the study reflected a linear increase of heart rate variability measures and respiration rate. Comparison of evoked potential characteristics of children with ASD versus typically developing children revealed several group difference findings, more specifically, a delayed latency of N1 to rare and frequent stimuli, larger MMN; higher P3a to frequent stimuli, and at the same time delayed latency of P3b to rare stimuli in the autism group. Post-AIT changes in evoked potentials could be summarized as a decreased magnitude of N1 to rare stimuli, marginally lower negativity of MMN, and decrease of the P3a to frequent stimuli along with delayed latency and higher amplitude of the P3b to the rare stimuli. These evoked potential changes following completion of Berard AIT course are in a positive direction, making them less distinct from those recorded in age-matched group of typical children, thus could be considered as changes towards normalization. Parental questionnaires clearly demonstrated improvements in behavioral symptoms such as irritability, hyperactivity, repetitive behaviors and other important behavioral domains. The results of the study propose that more controlled research is necessary to document behavioral and psychophysiological changes resulting from Berard AIT and to provide explanation of

the neural mechanisms of how auditory integration training may affect behavior and psychophysiological responses of children with ASD.

Evidence Resource(s): OT Seeker and Google Scholar

Preparing for Search Process

- During Project 1, I noticed one of the websites I used for my background learning had links to articles in it regarding Berard AIT. I wanted to further investigate these articles to see if they had any information that we could use for our project or if they were all bias. I went The Official Berard AIT Website, which I used for the background learning project and table, and found the listed articles.

Documenting the Search Process

- This search was simple to navigate as the studies were all listed for me on a webpage.
- I noticed that a lot of the articles listed on the websites did not even appear scholarly. Many were simply experiences from a practitioner, magazine articles that introduced AIT, bias looking websites, etc. I went through the articles on the websites and documented the ones that were from journals.
- The website listed comments on the articles. I noticed that when the article supported Berard AIT, the comment section was very brief (such as did not have a control group). However, when the article did not support Berard AIT, there was a much more thorough comment section on the flaws of the study.
- I also noticed a trend that most of the studies that supported Berard AIT were listed as presentations at conferences. However, many of the studies not supporting Berard AIT were published journal articles.

- I also noticed that Dr. Edelson and Dr. Rimland, who have written some articles about Berard AIT were authors on The Official Berard AIT Website so there is a strong possibility of conflict of interest in the studies they have done.

| Website | Total Yield / Relevant Hits | Date |
|---|---|----------|
| The Official Berard AIT Website>Study Results http://www.berardaitwebsite.com/books-and-articles/ | 9/1 Brockett, Lawton-Shirley, & Kimball, 2014 | 11-14-16 |
| The Official Berard AIT Website>Study Results>The Efficacy of Auditory Integration Training: Tabulated Summaries of 28 Reports http://www.berardaitwebsite.com/the-sait-archives-1992-2004/ | 28/6 Edelson, Arin, Bauman, Lukas, Rudy, Sholar, Rimland, 1999 Mudford, Cross, Breen, Cullen, Reeves, Gould, 2000 Rimland, & Edelson, 1994 Yencer, 1996 | 11-14-16 |

Summary of 5 BEST Research Articles

Brockett, S. S., Lawton-Shirley, N. K., & Kimball, J. G. (2014). Berard Auditory Integration Training: Behavior changes related to sensory modulation. *Autism Insights*. 6, 1-10.
doi:10.4137/AUI.S13574.

- This article has been cited twice
- OBJECTIVE: The purpose of this study was to determine if behaviors specifically related to sensory modulation showed positive changes following 10 days of Berard auditory integration training (AIT). METHOD: Cases of 54 children with disabilities (34 with autism), ages 3–10 years, who received Berard AIT, were reviewed. Children received 30

minutes of training twice a day, separated by a minimum of three hours, for 10 consecutive days. Data were collected within one week before intervention and at one, three, and six months post-intervention. RESULTS: Analysis of variance (ANOVA) indicated that Short Sensory Profile (SSP) total test scores and individual factor sections improved from pre-test to post-test ($P < 0.01$). Behavioral problems reduced on all five factors of the Aberrant Behavior Checklist (ABC) ($P < 0.01$). Most changes occurred within one month of intervention and maintained at three and six months. Correlations among the ABC and SSP factors indicate that sensory modulation as measured by the SSP is a significant contributor to four of the behavioral factors measured by the ABC. CONCLUSIONS: Although causality cannot be determined using this study design, scores on the SSP and ABC improved in a group of children who received Berard AIT.

Edelson, S. M., Arin, D., Bauman, M., Lukas, S. E., Rudy, J. H., Sholar, M., & Rimland, B.

(1999). Auditory integration training: A double-blind study of behavioral, electrophysiological, and audiometric effects in autistic subjects. *Focus on Autism and Other Developmental Disabilities, 14*, 73-81.

- This article has been cited 72 times
- Nineteen autistic subjects were assigned at random to either the experimental group ($n=9$), which listened to AIT-processed music, or a placebo group ($n=10$), which listened to the same, but unprocessed, music. All evaluations were 'blind' to group assignment. Behavioral, electro-physiological, and audiometric measures were assessed prior to and following AIT. Behavioral: A significant improvement was observed in behavioral problems (using the ABC-1) in the experimental group at the 3-month follow-up assessment. Electrophysiological: Of the 19 subjects, three experimental group and two

placebo group subjects were able to cooperate with the auditory P300 Event Related Potential (ERP) task. All five subjects showed abnormal P300 ERPs prior to the AIT listening sessions. Three months following AIT, all three subjects showed a dramatic improvement in their auditory P300 ERP. No improvement was seen in the placebo group. Audiometric: The subjects' poor communication and attention skills precluded formal statistical evaluation of the data from a battery of audiometric tests; however, an audiologist was able to assign correctly 10 of the 15 subjects for whom partial data were available to the treated and non-treated groups, on a 'blind' basis.

Mudford, O. C., Cross, B. A., Breen, S., Cullen, C., Reeves, D., Gould, J., & Douglas, J. (2000).

Auditory integration training for children with autism: No behavioral benefits detected.

American Journal on Mental Retardation, 105(2), 118-129.

- This article has been cited 103 times
- Auditory integration training and a control treatment were provided for 16 children with autism in a crossover experimental design. Measures, blind to treatment order, included parent and teacher ratings of behavior, direct observational recordings, IQ, language, and social/adaptive tests. Significant differences tended to show that the control condition was superior on parent-rated measures of hyperactivity and on direct observational measures of ear-occlusion. No differences were detected on teacher-rated measures. Children's IQs and language comprehension did not increase, but adaptive/social behavior scores and expressive language quotients decreased. The majority of parents (56%) were unable to report in retrospect when their child had received auditory integration training. No individual child was identified as benefiting clinically or educationally from the treatment.

Rimland, B. & Edelson, S. M. (1994). The effects of auditory integration training in autism.

American Journal of Speech-Language Pathology, 5, 16-24.

- This article has been cited 93 times
- This study involved an open-clinical research design which included several experimental control measures. There were 445 autistic subjects in the study, with ages ranging from 4 to 41 years. A significant reduction in sound sensitivity was found, based on the presentation of pure tones prior to and immediately following the AIT sessions. Analyses of the hearing tests conducted prior to, after 5 hours of listening, and after 10 hours of listening, showed hearing acuity to have improved slightly while the amount of variability within the audiogram decreased. Subjects were also assigned at random to one of several filtering conditions (e.g., filter auditory peaks, no filters, filter painful frequencies). No differences in the efficacy of the AIT were found among the filtering conditions.

Parents completed several different questionnaires on a monthly basis for 9 months. These included the ABC-1, CPRS, and the FAPC. The responses to these behavioral measures indicated a sharp reduction in problem behaviors, starting one month following the AIT listening sessions. These changes remained stable throughout the entire 9 months of post-AIT evaluations.

Participants were assigned at random to one of three different AIT devices. No differences were found in the efficacy of the devices.

Correlational analyses were employed to attempt to develop a profile of those individuals who may benefit from AIT. Lower functioning individuals displayed significantly greater improvement, as indicated by the ABC-1 and the CPRS.

No significant relationships were found between behavioral improvement and age, degree of sound sensitivity, and the amount of variability in the pre-AIT audiogram.

Yencer, K. A. (1996). The effects of auditory integration training for children with central auditory processing disorder (CAPD). *American Journal of Audiology*, 7, 32-44.

- This article has been cited 30 times
- Thirty-six children diagnosed with central auditory processing disorder participated in an experimental condition (i.e., listened to AIT music), a placebo condition (i.e., listened to unmodulated music), or a control condition (i.e., did not listen to music). Children with autism, pervasive developmental disorder (PDD), and multiple-handicaps were excluded from the study. A battery of tests were administered to the subjects prior to and one month following the listening sessions. These included: standard audiometric testing, the SSW test, the Phonemic Synthesis test, the Standard Progressive Matrices test, FAPC, auditory brainstem response (ABR), event-related potential (P300), and a speech-in-noise test. The P300 analyses indicated some improvement in the AIT condition (mean latency from 366.2 msec. to 348.5 msec.) versus a slight worsening in the placebo condition (mean latency from 400.8 msec. to 402.2 msec.). Significant improvements were found for the three conditions on all measures except the speech-in-noise test.

Evidence Resource(s): EBSCO: CINAHL Plus

Preparing for Search Process

- During the second week of school, our class attending a library information session; during this session the librarian discussed various databases useful to OTs, including CINAHL plus.
- I attempted to use a number of MeSH headings, and had difficulty identifying appropriate header terms. Most results came through headings related to ‘auditory perception’
- As auditory integration was not a MeSH heading, I had to enter (auditory integration training OR auditory integration technique OR auditory integration therapy) to each result
- Auditory integration led to false results in the sensory motor integration MeSH headline
- In order to retrieve all AIT related results, ‘therapy’, ‘technique’ and ‘training’ were entered into each search.
 - Subject Headings or Indexing Terms of the Database, which produced results:
 - Auditory Perceptual Disorders, Auditory Perception, Occupational Therapy Practice, Evidence-Based, Autistic Disorder
 - Database Filters to be tried: Filters: scholarly (peer reviewed) and full text, Years: Unlimited
- Boolean Logic Terms to be tried: Since I need all three terms, I will start with ‘AND’

Summarizing a Strategic Search Process

| Filters/Years | Keywords | Total Yield / Relevant Hits | Date |
|--|---|---|---------------|
| Filters: scholarly (peer reviewed) and full text Years: Unlimited | (MH "Health Care Delivery, Integrated") OR (MH "Auditory Perceptual Disorders") AND auditory integration | 5/2 Rimland & Edelson, 1995 Norrix, Plante, Vance, & Boliek, 2007 | Nov, 14, 2016 |

| | | | |
|--|---|--|---------------|
| Filters: scholarly (peer reviewed) and full text Years: Unlimited | (MM "Occupational Therapy Practice, Evidence-Based") OR (MM "Sensory Motor Integration") OR (MM "Evoked Potentials, Auditory") OR (MM "Auditory Perception") AND auditory integration training OR auditory integration technique OR auditory integration therapy | 7/6 Rimland & Edelson, 1995 LaFrance, D.F., Miguel, C.F., Donahue, J.N., & Fechter, T., 2015 Lucker, J.R., 1998 Tharpe, A.M, 1999 Madell, J.R., 1999 Dawson, G., Watling, R., 2000 | Nov, 14, 2016 |
| Filters: scholarly (peer reviewed) and full text Years: Unlimited | (MH "Auditory Neuropathy") OR (MH (MM "Systems Integration") OR (MM "Integrative Medicine") OR (MM "Auditory Threshold") AND auditory integration training OR auditory integration technique OR auditory integration therapy | 0/0 No results | Nov, 14, 2016 |
| Filters: scholarly (peer reviewed) and full text Years: Unlimited | (MM "Autistic Disorder") AND auditory integration training OR auditory integration technique OR auditory integration therapy | 2/2 Rimland & Edelson, 1995 Lucker, J.R., 1998 Dawson, G., Watling, R., 2000 | Nov, 14, 2016 |
| Filters: scholarly (peer reviewed) and full text Years: Unlimited | (MM "Child, Disabled") AND auditory integration training OR auditory integration technique OR auditory integration therapy | 0/0 No results | Nov, 14, 2016 |

Dawson, G., & Watling, R. (2000). Interventions to facilitate auditory, visual, and motor integration in autism: a review of the evidence. *Journal Of Autism & Developmental Disorders*, 30(5), 415. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.451.9134&rep=rep1&type=pdf>

- Evidence is reviewed on the prevalence of sensory and motor abnormalities in autism and the effectiveness of three interventions designed to address such abnormalities-sensory integration therapy, traditional occupational therapy, and auditory integration training. Although sensory processing and motor abnormalities are neither universal nor specific to autism, the prevalence of such abnormalities in autism is relatively high. There is, however, little controlled research on the effectiveness of interventions designed to address these abnormalities. Four objective outcome studies of sensory integration therapy were identified. These were of such small scale that no firm conclusions regarding efficacy could be made. No empirical studies of traditional occupational therapy in autism were found. Five studies of auditory integration training were found. Results of these studies provided no, or at best equivocal, support for the use of auditory integration training in autism.

LaFrance, D. L., Miguel, C. F., Donahue, J. N., & Fechter, T. R. (2015). A case study on the use of auditory integration training as a treatment for stereotypy. *Behavioral Interventions*, 30(3), 286-293. doi:10.1002/bin.1415

- The purpose of the current study was to assess the effectiveness of auditory integration training (AIT) as a treatment for motor stereotypy. The participant was a 5-year-old boy diagnosed with autism who had been prescribed AIT. We used an ABCBCA reversal design to examine the effectiveness of AIT on stereotypy. Data were collected for 5 min before, during, and after each experimental condition. Results showed that AIT did not decrease stereotypy. In fact, the total overall occurrence of stereotypy increased and remained high, suggesting that AIT was not an effective treatment for this participant.

Madell, J. (1999). Clinical forum: auditory integration training. Auditory integration training:

one clinician's view. *Language, Speech & Hearing Services In Schools*, 30(4), 371-426.

<http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=18&sid=cc4a60a5-15e2-4aa8-a58d-cf9413ed0c54%40sessionmgr4009&hid=4109>

- Auditory integration training (AIT) is a developing treatment for auditory disorders that include sensitivity to sound, auditory attention problems, and auditory processing disorders. Although there is limited published research, a growing body of anecdotal and clinical data is being reported at professional meetings. This article discusses some of the issues related to AIT and presents preliminary data indicating that word recognition scores in the presence of competing noise improves for children with a variety of disorders who have been treated with AIT.

Rimland, B., & Edelson, S. (1995). Brief report: A pilot study of auditory integration training in

autism. *Journal Of Autism & Developmental Disorders*, 25(1), 61-70.

<http://dx.doi.org/10.1007/BF02178168>

- Evaluates the effectiveness of auditory integration training (AIT) on the adaptive behavior of autistic individuals. Effects of AIT on several aspects of hearing; Criteria used to assess changes in the adaptive behavior; Tests for auditory discomfort and acuity. (From Google Scholar)

Tharpe, A. (1999). Clinical forum: auditory integration training. Auditory integration training:

the magical mystery cure. *Language, Speech & Hearing Services In Schools*, 30(4), 378-426. Retrieved from

<http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=3e1a6b52-1bd3-4bc9-aa40-6347bd006351%40sessionmgr4006&vid=5&hid=4109>

- Since its introduction in this country at the beginning of the decade, auditory integration training (AIT) has generated enthusiasm in parents and some clinicians, and harsh criticism by others. AIT has been promoted as a non-invasive treatment for auditory disorders that are believed to lead to attention and behavior problems. It has been particularly popular as a treatment for autism. Although parents cite numerous anecdotal reports of treatment success, many professionals frown on AIT's widespread practice prior to undergoing scientific scrutiny. The reasons for cautious evaluation of AIT prior to implementation in clinical practice are reviewed, along with a brief summary of current research findings.

Evidence Resource(s): Google Scholar

Preparing for Search Process

- During our class orientation, our librarian explained the pros of using Google Scholar as an initial research method, as it integrates available sources from a variety of journals and databases.
- Goal 1: Identify articles relating specifically to AIT (Berard if available), and not other intervention types (Sensory, Tomatus, Listening Program, etc.)

Documenting the Search Process

- Goal 1: Is this article directly related to auditory integration training (technique, or therapy), and not sensory integration therapy or the Listening Program.
 - *Step 1:* I conducted an initial search of the phrase 'Auditory Integration Training'- many results were available, but many were relating to sensory integration and not AIT

- *Step 2: Filters:* I used the phrase “Auditory Integration Training” in quotations to seek out AIT specific results
- *Step 3:* AIT is an older concept so I listed no date restrictions, but I only selected relevant titles with full texts available for student use. I also glanced through each article and screened reports that were not published in a peer-review (assumed) journal or that were not of standard format (brochures, fliers, etc.)

Summary of 5 BEST Research Articles

- a. Abstracts
- b. APA Reference List

Brockett, S. S., Lawton-Shirley, N. K., & Kimball, J. G. (2014). Berard auditory integration training: behavior changes related to sensory modulation. *Autism Insights, 6*, 1.

<http://dx.doi.org/10.4137/AUI.S13574>

- **Objective:** The purpose of this study was to determine if behaviors specifically related to sensory modulation showed positive changes following 10 days of Berard auditory integration training (AIT). **Method:** Cases of 54 children with disabilities (34 with autism), ages 3–10 years, who received Berard AIT, were reviewed. Children received 30 minutes of training twice a day, separated by a minimum of three hours, for 10 consecutive days. Data were collected within one week before intervention and at one, three, and six months post-intervention. **Results:** Analysis of variance (ANOVA) indicated that Short Sensory Profile (SSP) total test scores and individual factor sections improved from pre- test to post-test ($P < 0.01$). Behavioral problems reduced on all five factors of the Aberrant Behavior Checklist (ABC) ($P < 0.01$). Most changes occurred within one month of intervention and maintained at three and six months. Correlations

among the ABC and SSP factors indicate that sensory modulation as measured by the SSP is a significant contributor to four of the behavioral factors measured by the ABC.

Conclusions: Although causality cannot be determined using this study design, scores on the SSP and ABC improved in a group of children who received Berard AIT

Brown, M. M. (1999). Auditory integration training and autism: Two case studies. *The British Journal of Occupational Therapy*, 62(1), 13-18.

<http://dx.doi.org/10.1177/030802269906200105>

- Auditory integration training, a specific auditory sensory intervention, was applied to two autistic children. The results of the procedure were associated with improvements in balance, arousal and sensory modulation, speech and language, sequencing, eye control and attention. A number of hypotheses are given that may help to explain the effect of the process.

Edelson, S. M., Arin, D., Bauman, M., Lukas, S. E., & al, e. (1999). Auditory integration training: A double-blind study of behavioral and electrophysiological effects in people with autism. *Focus on Autism and Other Developmental Disabilities*, 14(2), 73.

<http://dx.doi.org/10.1177/108835769901400202>

- Auditory problems are common in individuals with autism. Several previous studies have indicated that Auditory Integration Training (AIT), a sound-based intervention, may bring about significant improvement in autism. AIT entails listening to specially processed music for a total of 10 hours over a 10- to 20-day period. In the present study, 19 individuals with autism were assigned at random to either an experimental group (n = 9), who listened to AIT-processed music, or a placebo group (n = 10), who listened to the same but unprocessed music. All evaluators were blind to group assignment. Behavioral,

electrophysiological (ERP), and audiometric measures were assessed prior to and following AIT. A significant decrease in Aberrant Behavior Checklist scores was observed in the experimental group at the 3-month follow-up assessment. Of the 19 participants, only three experimental group members and two placebo group members were able to perform the auditory P300 ERP task. All five participants showed abnormal P300 ERPs prior to the AIT listening sessions. Three months following AIT, all three treated participants showed a dramatic improvement in their auditory P300 ERP, whereas none of the participants in the placebo group showed change. The participants' poor language and attention skills precluded collecting sufficient data for formal statistical evaluation of the results from the battery of audiometric tests.

Hadaddi, P., Haghshenas, S., & Rostami, R. (2011). Rehabilitation in Autism Spectrum Disorder (ASD): A mixture of neurofeedback training and Auditory Integration Training (AIT). *Procedia-Social and Behavioral Sciences*, 30, 611-614.

<http://dx.doi.org/10.1016/j.sbspro.2011.10.118>

- Autism spectrum disorders (ASD) are a group of disorders with common impairments in three key areas - communication, social interaction and imaginative thought and play. Neurotherapy has been shown to be effective in most cases in improving the whole range of autistic problems. Neurotherapy facilitates the brain to self-regulate or “rewire” the dysfunctional brainwave patterns of the autistic child. This article shows the experience neurotherapy and auditory integration training (AIT) with 8 years old autistic boy. He received 40 sessions of NFT, 45 min / day, and 3 days a week and also 20 sessions of AIT. The main protocol which we used was inhibiting theta (3-7 Hz) and (19-30 Hz) and increasing sensory motor rhythm (SMR) activity (12-15 Hz) at Cz, F7, Fz and C4.

Results indicated a substantial decline in autistic behavior such as considerable improvements on socialization, vocalization, self-stim behaviors, flexibility, sucking and assertiveness. The frequency of repetitive stereotyped behaviors was reduced. There were improvement in speech and language indexes and subscales of language competency. These findings provide preliminary support for the use of neurofeedback as a helpful component of effective intervention in children with ASD.

Fresham, F. M., Beebe-Frankenberger, M. E., & MacMillan, D. L. (1999). A selective review of treatments for children with autism: Description and methodological considerations.

School Psychology Review, 28(4), 559. Retrieved from

<http://search.proquest.com/docview/219649192?pq-origsite=gscholar>

- Abstract. Autism is a developmental disorder whose behavioral characteristics range on a continuum from mild to severe. Autism is typically not diagnosed prior to age 2 to 3 years and the prognosis for this pervasive developmental disorder is poor. Although there is no documented "cure" for autism, research suggests that it can be managed effectively using comprehensive behavioral and educational treatment programs. This article reviews and critiques several of the most visible and most frequently cited treatment programs for children with autism: the UCLA Young Autism Project, Project TEACCH, LEAP, applied behavior analysis programs, and the Denver Health Science Program. Treatment programs having little or no empirical support such as facilitated communication, auditory integration therapy, and sensory integration therapy also are briefly reviewed. We evaluate the empirical evidence for the efficacy and effectiveness of these programs using conventional standards of research design and methodology and the Division 12 Task Force on Empirically Supported Treatments for Childhood Disorders of the

American Psychological Association. Based on these Task Force criteria, there are no well-established or probably efficacious treatments for autism, although virtually all programs show substantial developmental gains, particularly in measured IQ.

Recommendations for future research and practice are offered with guidelines for evaluating treatment programs for children with autism

Appraisal of Evidence

Initial appraisal: Primary Research Studies.

| | |
|-------------------------------------|---|
| Type of article | Overall Type: Primary Research Study Specific Type: Prospective Study |
| APA Reference | Al-Ayahdi, L.Y., Al-Drees, A.M., & Al-Arfaj, A.M. (2013). Effectiveness of auditory integration training in autism spectrum disorders—Prospective study. <i>Autism Insights</i> , 5, 13–20. http://dx.doi.org/10.4137/AUI.S11463 |
| Abstract | Objectives: To determine the effectiveness of auditory integration training (AIT) in people with Autism Spectrum Disorders (ASD). Method: Seventy two subjects with ASD aged up to 17 years old (70 male and 2 females) were recruited for the study. All subjects were screened by Diagnostic and Statistical Manual of Mental Disorders, (DSM-IV), and assessed by CARS (Childhood Autism Rating Scale). Pre-intervention scores and post-intervention (3 and 6 months) scores were calculated for each child using CARS, Social Responsiveness Scale (SRS), and the Autism Treatment Evaluation Checklist (ATEC). Auditory integration training was performed over 2 week, 30 minutes, twice a day. Results: All subjects demonstrated improvement 3 and 6 months following the AIT. ASD subject showed 22% and 26% percentage improvement in SRS scoring 3 and 6 months respectively following the AIT intervention. Those changes were attributed to statistically significant changes in social awareness, social cognition, and social communication. Similar results were achieved with the ATEC checklist: ASD subject showed 19.5% and 22.5% improvement 3 and 6 months following the AIT intervention, respectively. Those changes are due to statistically significant ($P < 0.05$) improvement in speech, communication and sociability only. Conclusions: The results of this study support the therapeutic effects of auditory integration training on social awareness, social cognition, and social communication, as well as speech and communication. |
| Author | Credentials: BBMS, MBChB, PhD, BScMedScHons (Hyperbaric Med.) Position and Institution: Professor and Consultant of neurophysiology at King Saud University; Department of Physiology; Riyadh, Riyadh, Saudi Arabia Publication History in Peer-Reviewed Journals: extensive |
| Publication | Type of Publication: scholarly peer-reviewed journal Publisher: Libertas Academica Ltd. Other: Journal is discontinued from Libertas Academica. Available in CLOCKSS. (https://www.clockss.org/clockss/Autism_Insights) |
| Date and History | Date of publication: Apr. 14, 2013 Google Scholar Cited By: 4 |
| Stated Purpose or Research Question | “The aim of the current project is to test the effectiveness of AIT in reducing ASD symptoms” (p. 14). |

| | |
|----------------------------|--|
| Author's Conclusion | “The results... support the therapeutic effects of [AIT] on social awareness, social cognition and social communication as well as on speech and communication” (p.19). |
| Relevance to PICO | <p>Overall Relevance to PICO: Strong</p> <p>Rationale: Directly or mostly relates to all aspects of PICO</p> <p>P - children with ASD</p> <p>I - AIT</p> <p>O - social awareness, social cognition, and social communication</p> |
| Overall Quality of Article | <p>Overall Quality of Article: Good</p> <p>Rationale: Based on the critical appraisal paper (CAP) by Andelin (2015), the findings should be “viewed with caution”. The article is recent, but limited</p> |

| | |
|-------------------------------------|---|
| Type of article | Overall Type: Primary Research Study Specific Type: Prospective Study/Intervention |
| APA Reference | Bettison, S. (1996). The long-term effects of auditory training on children with autism. <i>Journal of Autism and Developmental Disorders</i> , 26(3), 361-374. doi:10.1007/BF02172480 |
| Abstract | Eighty children, 3–17 years of age, with autism or Asperger syndrome and mild to severe distress in the presence of some sounds, were randomly allocated to two groups. The experimental group received auditory training and the control group listened to the same unmodified music under the same conditions. Significant improvements in behavior and severity of autism were maintained for 12 months by both groups. Informal data suggested that a range of abnormal responses to sound and other sensory abnormalities may also have improved. Verbal and performance IQ increased significantly 3 to 12 months after interventions. Findings suggest that some aspect of both auditory training and listening to selected unmodified music may have a beneficial effect on children with autism and sound sensitivity, and indicate a need for further research into the effects that led to these changes and the mechanisms involved in the sensory abnormalities commonly associated with autism. |
| Author | Credentials: B.A. (Hons.), Dip. Ed., Ph. D. research and clinical psychologist; works in the fields of intellectual disability and autism spectrum disorder. Position and Institution: Honorary Consultant Psychologist to the Autistic Children's Association of South Australia. Senior positions in State services for people with developmental disabilities in both South Australia and New South Wales. Director of Professional Services/Chief Executive Officer by the Autistic Association of New South Wales. Publication History in Peer-Reviewed Journals: moderate |
| Publication | Type of Publication: scholarly peer-reviewed journal Publisher: Kluwer Academic Publishers (original); Springer Science+Business Media Publication: Journal of Autism & Developmental Disorders |
| Date and History | Date of publication: 1996 Google Scholar Cited By: 173 |
| Stated Purpose or Research Question | The study was designed to determine whether auditory training resulted in any improvements, including reduced distress in the presence of some sounds, when compared with a control procedure, and whether any effects were maintained over 12 months (p. 363) |
| Author's Conclusion | From the results, the authors believe some aspect of both auditory training and the structured listening program led to the significant improvements found in this study. However, because both auditory training and the control condition resulted in similar improvements, it is not certain what led to these effects...However, further research is needed to confirm that these improvements were not only valid but could not have occurred naturally or by chance and, if this can be confirmed, to ascertain whether the listening task or some other aspect of both interventions was the effective component. |

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| | There is also a real need for thorough observational and normative studies to validate the Sound Sensitivity Questionnaire or, alternatively, develop other reliable methods of assessing abnormal responses to sound (p. 372) |
| Overall Relevance to PICO | <p>Overall Relevance to PICO: Strong</p> <p>Rationale: Directly or mostly relates to all aspects of PICO</p> <p>P - children with ASD</p> <p>I - AIT</p> <p>C - unmodified music</p> <p>O - behavior and severity of autism/sensitivity to sound</p> |
| Overall Quality of Article | <p>Overall Quality of Article: Moderate</p> <p>Rationale: Reputable source; 10 years old. Lacking reliability and validity and measures, and various limitations present</p> |

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| Type of Article | Overall Type: Primary Research Study Specific Type: Quantitative Study |
| APA Reference | Brockett, S. S., Lawton-Shirley, N. K., & Kimball, J. G. (2014). Berard auditory integration training: behavior changes related to sensory modulation. <i>Autism Insights</i> , 6, 1. http://dx.doi.org/10.4137/AUI.S13574 |
| Abstract | Objective: The purpose of this study was to determine if behaviors specifically related to sensory modulation showed positive changes following 10 days of Berard auditory integration training (AIT). Method: Cases of 54 children with disabilities (34 with autism), ages 3–10 years, who received Berard AIT, were reviewed. Children received 30 minutes of training twice a day, separated by a minimum of three hours, for 10 consecutive days. Data were collected within one week before intervention and at one, three, and six months post-intervention. Results: Analysis of variance (ANOVA) indicated that Short Sensory Profile (SSP) total test scores and individual factor sections improved from pre- test to post-test (P 0.01). Behavioral problems reduced on all five factors of the Aberrant Behavior Checklist (ABC) (P 0.01). Most changes occurred within one month of intervention and maintained at three and six months. Correlations among the ABC and SSP factors indicate that sensory modulation as measured by the SSP is a significant contributor to four of the behavioral factors measured by the ABC. Conclusions: Although causality cannot be determined using this study design, scores on the SSP and ABC improved in a group of children who received Berard AIT. |
| Author | Credentials: MA in Handicapped Preschool Education, Comprehensive Special Education certification, trained by Guy Berard: from http://www.ideatrainingcenter.com/about.shtml Position and Institution: “Sally Brockett is the program director of the “IDEA Training Center, from: http://www.ideatrainingcenter.com/about.shtml Publication History in Peer-Reviewed Journals: Low |
| Publication | Type of Publication: scholarly peer-reviewed journal Publisher: Libertas Academica |
| Date and Citation History | Date of Publication: 2014 Google Scholar Cited by: 2 |
| Stated Purpose or Research Question | “To determine if behaviors specifically related to sensory modulation showed positive changes following 10 days of Berard auditory integration training (AIT)” (p. 1) |

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| Author's Conclusion | “Although causality cannot be determined using this study design, scores on the SSP and ABC improved in a group of children who received Berard AIT.” (p. 1) |
| Overall Relevance to PICO | <p>Overall Relevance to PICO: Strong</p> <p>Rationale: P - directly related to primary population (ASD). I - directly related to Berard AIT use in treatment. O - conclusions are based on AIT outcomes for direct treatment</p> |
| Overall Quality of Article | <p>Overall Quality of Article: Low</p> <p>Rationale: The article is directed related to one form of AIT and is recent, but it has only been cited by 2 articles. The author was trained by Berard, and may have biases.</p> |

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| Type of Article | Overall Type: Primary Research Study Specific Type: Case Study |
| APA Reference | Brown, M. M. (1999). Auditory integration training and autism: Two case studies. <i>The British Journal of Occupational Therapy</i> , 62(1), 13-18. http://dx.doi.org/10.1177/030802269906200105 |
| Abstract | Auditory integration training, a specific auditory sensory intervention, was applied to two autistic children. The results of the procedure were associated with improvements in balance, arousal and sensory modulation, speech and language, sequencing, eye control and attention. A number of hypotheses are given that may help to explain the effect of the process. |
| Author | Credentials: M.A., PhD, specialty practice in rehabilitation medicine for geriatrics Position and Institution: Senior Occupational Therapist, currently working at the Cavon Monaghan Hospital, in Cavon, Ireland Publication History in Peer-Reviewed Journals: Low |
| Publication | Type of Publication: Scholarly peer-reviewed journal Publisher: Sagepub |
| Date and Citation History | Date of publication: January, 1999 Google Scholar Cited By: 16 |
| Stated Purpose or Research Question | - to determine if AIT use for auditory distortions could result in “behavioural changes [that] were specifically related to these changes in hearing post-AIT” (p.13), can help with coping for auditory processing issues, leading to “improved listening and language comprehension” (p. 14) and (with music) can lead to changes in “attending or focus, self-initiation of purposeful activity, arousal, and sensory modulation, balance and movement perception, gravitation insecurity, speech and language development”, etc. (p. 14) -to determine if AIT can have a direct effect on the “cerebellar-vestibular system” (p. 14) |
| Author’s Conclusion | “In a case study format, it is not possible unequivocally to attribute perceived changes to the AIT process because there are no controls and the <i>very</i> individual results preclude exact replication. <i>However</i> , it is reasonable to assume that some or all of the changes cited were a consequence of the AIT process for two reasons. The first is that the many changes for both of the children started to occur during the 10-day training programme itself. The second reason is that the sudden spurt of change in a short space of time (during and just post- AIT) was significantly greater than the rate of maturational changes that had occurred prior to the intervention. (p. 17) |

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| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: P- the study analyzes developmental disorders and ASD, our population of focus I- “auditory changes”, “sensory modulation”, “sensory attention” and “cerebellar-vestibular system”, C- pre- and post-test only. O- analyzed the long-term effects of AIT treatment |
| Overall Quality of Article | Overall Quality of Article: Low Rationale: The article provided a lot of information, but it was a case study base (not widely generalizable), the article is more than 15 years old, and it was produced by a single author. |

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| Type of Article | Overall Type: Primary Research Study Specific Type: Case Study |
| APA Reference | Hadaddi, P., Haghshenas, S., & Rostami, R. (2011). Rehabilitation in Autism Spectrum Disorder (ASD): A mixture of neurofeedback training and Auditory Integration Training (AIT). <i>Procedia-Social and Behavioral Sciences</i> , 30, 611-614. http://dx.doi.org/10.1016/j.sbspro.2011.10.118 |
| Abstract | Autism spectrum disorders (ASD) are a group of disorders with common impairments in three key areas - communication, social interaction and imaginative thought and play. Neurotherapy has been shown to be effective in most cases in improving the whole range of autistic problems. Neurotherapy facilitates the brain to self-regulate or “rewire” the dysfunctional brainwave patterns of the autistic child. This article shows the experience neurotherapy and auditory integration training (AIT) with 8 years old autistic boy. He received 40 sessions of NFT, 45 min / day, and 3 days a week and also 20 sessions of AIT. The main protocol which we used was inhibiting theta (3-7 Hz) and (19-30 Hz) and increasing sensory motor rhythm (SMR) activity (12-15 Hz) at Cz, F7, Fz and C4. Results indicated a substantial decline in autistic behavior such as considerable improvements on socialization, vocalization, self-stem behaviors, flexibility, sucking and assertiveness. The frequency of repetitive stereotyped behaviors was reduced. There were improvement in speech and language indexes and subscales of language competency. These findings provide preliminary support for the use of neurofeedback as a helpful component of effective intervention in children with ASD. |
| Author | Credentials: Doctoral student at University of Tehran Position and Institution: Department of Psychology, University of Tehran Publication History in Peer-Reviewed Journals: 6 Articles (incorrect citations on google scholar, this is likely higher) |
| Publication | Type of Publication: scholarly peer-reviewed journal Publisher: Elsevier Ltd. |
| Date and Citation History | Date of publication: 2011 Google Scholar Cited By: 4 |
| Stated Purpose or Research Question | To examine the “experience [of] neurotherapy and auditory integration training (AIT) with 8 years old autistic boy” (p. 611) |

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| Author's Conclusion | “... neurotherapy can be useful for some symptoms of mild autistic spectrum disorder. We need further researches with autistic children to support or refuse these findings” |
| Overall Relevance to PICO | <p>Overall Relevance to PICO: Weak</p> <p>Rationale: P- correct population and age, though only 1 case, I- used AIT as treatment basis C- only comparison was pre-test, O- some significant results were found with few outcomes</p> |
| Overall Quality of Article | <p>Overall Quality of Article: Low</p> <p>Rationale: While the article is recent and looks at our population of age, the study provides little detail, few outcomes were determined, and the lead author is a student.</p> |

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| Type of Article | Overall Type: Primary Case Study Specific Type: Case Study |
| APA Reference | LaFrance, D. L., Miguel, C. F., Donahue, J. N., & Fechter, T. R. (2015). A case study on the use of auditory integration training as a treatment for stereotypy. <i>Behavioral Interventions</i> , 30(3), 286-293. doi:10.1002/bin.1415 |
| Abstract | The purpose of the current study was to assess the effectiveness of auditory integration training (AIT) as a treatment for motor stereotypy. The participant was a 5-year-old boy diagnosed with autism who had been prescribed AIT. We used an ABCBCA reversal design to examine the effectiveness of AIT on stereotypy. Data were collected for 5 min before, during, and after each experimental condition. Results showed that AIT did not decrease stereotypy. In fact, the total overall occurrence of stereotypy increased and remained high, suggesting that AIT was not an effective treatment for this participant. Copyright © 2015 John Wiley & Sons, Ltd. |
| Author | Credentials: PhD Student, Institute for Behavioral Studies at Endicott College Position and Institution: H.O.P.E. Consulting, LLC, Sacramento, CA, USA, and California State University, Sacramento, CA, USA Publication History in Peer-Reviewed Journals: Low |
| Publication | Type of Publication: scholarly peer-reviewed journal Publisher: John Wiley & Sons, Ltd. |
| Date and Citation History | Date of publication: 2015 Google Scholar Cited By: Unknown |
| Stated Purpose or Research Question | “The purpose of the current study was to assess the effectiveness of auditory integration training (AIT) as a treatment for motor stereotypy” (p. 286) |
| Author’s Conclusion | “The total overall occurrence of stereotypy increased and remained high, suggesting that AIT was not an effective treatment for this participant” (p. 286) |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: P- appropriate population, but only 1 case study I- looked at AIT as a specific treatment C- only comparison was pre-test O- found little positive evidence for AIT |

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| Overall Quality of Article | Overall Quality of Article: Low Rationale: The article is new, but has never been cited, the author's credentials are with a private group, and the case only analyzes one case. |
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| Type of article | Overall Type: Primary Research Study Specific Type: Quantitative Study |
| APA Reference | Mudford, O. C., Cross, B. A., Breen, S., Cullen, C., Reeves, D., Gould, J., & Douglas, J. (2000). Auditory integration training for children with autism: No behavioral benefits detected. <i>American Journal on Mental Retardation</i> , 105(2), 118-129. http://dx.doi.org/10.1352/0895-8017(2000)105%3C0118:AITFCW%3E2.0.CO;2 |
| Abstract | Auditory integration training and a control treatment were provided for 16 children with autism in a crossover experimental design. Measures, blind to treatment order, included parents and teacher ratings of behavior, direct observational recordings, IQ, language, and social/adaptive tests. Significant differences tended to show that the control condition was superior on parent-rated measures of hyperactivity and on direct observational measures of ear-occlusion. No differences were detected on teacher-rated measures. Children's IQs and language comprehension did not increase but adaptive/social behavior scores and expressive language quotients decreased. The majority of parents (56%) were unable to report in retrospect when their child had received auditory integration training. No individual child was identified as benefiting clinically or educationally from the treatment. |
| Author | Credentials: PhD Position and Institution: University of Auckland, New Zealand. Director of Applied Behaviour Analysis Programme Publication History in Peer-Reviewed Journals: Extensive |
| Publication | Type of Publication: scholarly peer-reviewed journal Publisher: American Association on Intellectual Development Disabilities |
| Date and Citation History | Date of publication: 2000 Google Scholar Cited By: 103 |
| Stated Purpose or Research Question | "The aim of the present investigation was to replicate and extend studies by Rimland and Edelson (1994, 1995). The previous research was extended by obtaining ratings of behaviors from teachers as well as parents and by including direct observational measurement of behaviors." (p. 120) |
| Author's Conclusion | "The trend is not towards showing auditory integration training as beneficial, and there was nothing in our grouped data from parents, teachers, observers, or anecdotal report to suggest otherwise" (p. 126) |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: P - children I - AIT |

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| | C - controlled trials O - n/a |
| Overall Quality | Overall Quality of Article: Good Rationale: Reputable journal and publisher. Controlled and thorough method. Commonly cited. |

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| Type of article | Overall Type: Primary Research Study Specific Type: Quantitative Study |
| APA Reference | Rimland, B., & Edelson, S. (1995). Brief report: A pilot study of auditory integration training in autism. <i>Journal Of Autism & Developmental Disorders</i> , 25(1), 61-70. http://dx.doi.org/10.1007/BF02178168 |
| Abstract | Auditory integration training (AIT)^ has received a great deal of media coverage since the publication of the book <i>The Sound of a Miracle</i> (Stehli, 1991). In her book, Stehli wrote about the dramatic cognitive and emotional improvements seen in her autistic daughter after only 10 hours of AIT, administered in the clinic of otolaryngologist Guy Berard in Annecy, France. In this paper we report the results of a blind pilot study of the efficacy of AIT on a group of autistic children. |
| Author | Credentials: PhD Position and Institution: Founder of Autism Research Institute and Autism Society of America Publication History in Peer-Reviewed Journals: Extensive |
| Publication | Type of Publication: peer-reviewed medical journal Publisher: Springer |
| Date and Citation History | Date of Publication: 1995 Google Scholar Cited By: 165 |
| Stated Purpose or Research Question | “The primary purpose of this pilot study was to evaluate the effectiveness of AIT on the adaptive behavior of autistic individuals. A secondary purpose was to evaluate the effects of AIT on several aspects of hearing.” (p. 62) |
| Author’s Conclusion | “The main hypothesis that AIT presents a potentially beneficial treatment for autistic children is supported by findings from the ABC and FAPC. Contrary to expectation, the subsidiary hypothesis that AIT decreases sound sensitivity is not supported by our data.” (p. 69) |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: P - children I - AIT C - control group O- n/a |
| Overall Quality | Overall Quality of Article: Moderate Rationale: Established author, reputable journal, published over 10 years ago, Rimland and Edelson compiled a list of what appears to be a bias critique |

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| | of AIT studies on the Official Berard AIT Website-possible conflict of interest. Study did not list any limitations. |
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| Type of article | Overall Type: Primary Research Study Specific Type: Quantitative Study |
| APA Reference | Sokhadze, E. M., Casanova, M. F., Tasman, A., & Brockett, S. (2016). Electrophysiological and behavioral outcomes of Berard Auditory Integration Training (AIT) in Children with autism spectrum disorder. <i>Applied Psychophysiology and Biofeedback</i> , 1-16. doi:10.1007/s10484-016-9343-z |
| Abstract | <p>Autism is a pervasive developmental disorder of childhood characterized by deficits in social interaction, language, and stereotyped behaviors along with a restricted range of interests. It is further marked by an inability to perceive and respond to social and emotional signals in a typical manner. This might be due to the functional disconnectivity of networks important for specific aspects of social cognition and behavioral control resulting in deficits of sensory information integration. According to several recent theories sensory processing and integration abnormalities may play an important role in impairments of perception, cognition, and behavior in individuals with autism. Among these sensory abnormalities, auditory perception distortion may contribute to many typical symptoms of autism. The present study used Berard's technique of auditory integration training (AIT) to improve sound integration in children with autism. It also aimed to understand the abnormal neural and functional mechanisms underlying sound processing distortion in autism by incorporating behavioral, psychophysiological and neurophysiological outcomes. It was proposed that exposure to twenty 30-min AIT sessions (total 10 h of training) would result in improved behavioral evaluation scores, improve profile of cardiorespiratory activity, and positively affect both early [N1, mismatch negativity (MMN)] and late (P3) components of evoked potentials in auditory oddball task. Eighteen children with autism spectrum disorder (ASD) participated in the study. A group of 16 typically developing children served as a contrast group in the auditory oddball task. Autonomic outcomes of the study reflected a linear increase of heart rate variability measures and respiration rate. Comparison of evoked potential characteristics of children with ASD versus typically developing children revealed several group difference findings, more specifically, a delayed latency of N1 to rare and frequent stimuli, larger MMN; higher P3a to frequent stimuli, and at the same time delayed latency of P3b to rare stimuli in the autism group. Post-AIT changes in evoked potentials could be summarized as a decreased magnitude of N1 to rare stimuli, marginally lower negativity of MMN, and decrease of the P3a to frequent stimuli along with delayed latency and higher amplitude of the P3b to the rare stimuli. These evoked potential changes following completion of Berard AIT course are in a positive direction, making them less distinct from those recorded in age-matched group of typical children, thus could be considered as changes towards normalization. Parental questionnaires clearly demonstrated improvements in behavioral symptoms such as irritability,</p> |

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| | hyperactivity, repetitive behaviors and other important behavioral domains. The results of the study propose that more controlled research is necessary to document behavioral and psychophysiological changes resulting from Berard AIT and to provide explanation of the neural mechanisms of how auditory integration training may affect behavior and psychophysiological responses of children with ASD. |
| Author | Credentials: PhD Position and Institution: University of South Carolina Publication History in Peer-Reviewed Journals: Extensive |
| Publication | Type of Publication: scholarly peer-reviewed journal Publisher: Springer Google Scholar Cited By: 4 |
| Date and Citation History | Date of publication: 2016 Google Scholar Cited By: Not Listed |
| Stated Purpose or Research Question | “In this pilot research study we administered auditory tests prior to Berard AIT training and post-AIT to investigate changes in the individual’s auditory response pattern using electroencephalographic (EEG) responses.” (p. 4) |
| Author’s Conclusion | “Behavioral surveys and questionnaires showed significant symptom severity decrease on ABC, RBS, and CPI.” (p. 12) |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: P - children I - AIT C - n/a O - n/a |
| Overall Quality | Overall Quality of Article: Moderate Rationale: Established author, Reputable journal, Published within the last 10 years, no control group. |

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| Type of article | Overall Type: Primary Research Study Specific Type: Quantitative Study |
| APA Reference | Yencer, K. A. (1998). The effects of auditory integration training for children with central auditory processing disorder (CAPD). <i>American Journal of Audiology</i> , 7(2), 32-44. Retrieved from http://search.proquest.com/docview/204382724?pq-origsite=gscholar |
| Abstract | Thirty-six children diagnosed with central auditory processing disorder participated in an experimental condition (i.e., listened to AIT music), a placebo condition (i.e., listened to unmodulated music), or a control condition (i.e., did not listen to music). Children with autism, pervasive developmental disorder (PDD), and multiple-handicaps were excluded from the study. A battery of tests were administered to the subjects prior to and one month following the listening sessions. These included: standard audiometric testing, the SSW test, the Phonemic Synthesis test, the Standard Progressive Matrices test, FAPC, auditory brainstem response (ABR), event-related potential (P300), and a speech-in-noise test. The P300 analyses indicated some improvement in the AIT condition (mean latency from 366.2 msec. to 348.5 msec.) versus a slight worsening in the placebo condition (mean latency from 400.8 msec. to 402.2 msec.). Significant improvements were found for the three conditions on all measures except the speech-in-noise test. |
| Author | Credentials: PhD Position and Institution: State University of New York at Buffalo Publication History in Peer-Reviewed Journals: Minimal |
| Publication | Type of Publication: scholarly journal Publisher: American Journal of Audiology |
| Date and Citation History | Date of Publication: 1998 Google Scholar Cited By: 30 |
| Stated Purpose or Research Question | “The present study was designed to evaluate whether AIT can improve performance on tests of auditory processing or neural responses to auditory stimulation for children who have been diagnosed with central auditory processing disorders (CAPDs).” NO PAGE |
| Author’s Conclusion | ”This study was not able to support the thesis that AIT is beneficial. None of the behavioral tests, the electrophysiological tests, or the parental questionnaire data clearly indicated that AIT improves central auditory processing skills or results in changes in neural function in children with CAPDs.” NO PAGE |
| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: P - children |

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| | I - AIT C - controlled trials O - n/a |
| Overall Quality | Overall Quality of Article: Moderate Rationale: Reputable journal and publisher. Publication over 10 year old. Doctoral Dissertation. |

Initial Appraisal: Reviews of Research Studies

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| Type of article | Overall Type: Review of Research Study Specific Type: Critical Appraisal Paper (CAP) of Al-Ayahdi, Al-Drees, & Al-Arfaj (2013) |
| APA Reference | Andelin, L., & Reynolds, S. (2015). Critically appraised paper (CAP). Retrieved from the American Journal of Occupational Therapy, November 16, 2016, http://www.aota.org/~media/Corporate/Files/Practice/EvidenceExchange/Approved-CAPs/CY/Al-Ayahdi_ASD_auditory_integratoin.pdf?la=en |
| Abstract | Individuals with autism spectrum disorder (ASD) are characterized by having difficulties with social interaction, communication challenges, and a tendency to engage in repetitive behaviors. In addition, people with ASD often have difficulties with sensory processing and may experience abnormal responses to sounds. Occupational therapists who treat children and adults with ASD often use a wide range of interventions, sometimes with a focus in sensory integration. Within the realm of sensory integration treatment techniques, occupational therapists sometimes use sound-based interventions, despite limited evidence to support their use. One of these sound based interventions is auditory integration training (AIT), developed by Guy Berard in 1982 (p. 14). This research study aimed to assess the effectiveness of AIT on reducing symptoms of ASD in individuals with a diagnosis of ASD using the following outcome measures: the Childhood Autism Rating Scale (CARS), Social Responsiveness Scale (SRS), and the Autism Treatment Evaluation Checklist (ATEC). Results of the study indicate that children receiving AIT intervention had positive results on a variety of outcome measures. This study provides preliminary evidence of the possible positive effects of AIT in improvements in social skills and communication skills for children with ASD. The results of this study should be viewed with caution, however, as the study did not have a control group and outcomes were recorded 3 and 6 months post intervention, so time and other factors may have contributed to the results. In addition, there was a significant lack of reporting within the study, including where interventions were completed, who completed the interventions, and who completed the outcome evaluations, as well as lack of information about power and effect size. Furthermore, the statistical analysis used (multiple t-tests despite multiple outcome measures each containing subscales) elevated risk for finding an effect from treatment where there really was no effect present. Ultimately, clinicians should not rely solely on this research study as supporting the effect of AIT in practice. |
| Author | Credentials: MS, OTR/L, OTD candidate Position and Institution: OTD candidate at Virginia Commonwealth University Publication History in Peer-Reviewed Journals: minimal/unkown |
| Publication | Type of Publication: scholarly peer-reviewed journal Publisher: American Occupational Therapy Association (AOTA) Other: Official journal of the AOTA |
| Date and Citation History | Date of publication: 2015 Cited By: 0 (As listed) |

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| Stated Purpose or Research Question | “This study provides preliminary evidence of the possible positive effects of AIT in improvements in social skills and communication skills for children with ASD” (p. 1) |
| Author’s Conclusion | “The results of this study should be viewed with caution.... Ultimately, clinicians should not rely solely on this research study as supporting the effect of AIT in practice.” (p. 1) |
| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: Further explores/reviews research that is strongly related to PICO P - ASD I - AIT O - social/communication skills |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: Detailed review from a reputable source. Publication within last 10 years |

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| Type of article | Overall Type: Review of research studies Specific Type: State health department advisory committee review on treatment interventions. |
| APA Reference | Autism and Other Developmental Disabilities Treatment Intervention Advisory Committee. (2016, April 29). <i>Summary of Determinations Regarding Level of Evidence: Auditory Integration Training (AIT)</i> (United States, Wisconsin Department of Health Services). Retrieved November 18, 2016, from https://tiac.wisconsin.gov/tiacfiles/pdf/ait0416.pdf |
| Abstract Intro | Please find below a statement of our determination as to whether or not the committee views Auditory Integration Training (AIT) as a proven and effective treatment for children with autism spectrum disorder and/or other developmental disabilities. In subsequent sections you will find documentation of our review process including a description of the proposed treatment, a synopsis of review findings, the treatment review evidence checklist, and a listing of the literature considered. AIT is based on the assumption that sensory problems involving oversensitive hearing are hypersensitivities that affect a child's learning. These deficiencies are typically addressed with short, daily sessions (5-30 minutes) per day for 2-3 weeks. The Audiokinetron, originally designed for such training, was banned by the U.S. Food and Drug Administration because little data demonstrated efficacy. Today, many similar and unapproved machines are regularly used. |
| Author | Credentials: committee of experts with demonstrated research proficiency that is established by DHS to perform health care services review Position and Institution: Wisconsin health department advisory committee Publication History in Peer-Reviewed Journals: N/A |
| Publication | Type of Publication: Government Publisher: Council of the Wisconsin Department of Health Services Other: Summary of Determinations Regarding Level of Evidence |

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| Date and Citation History | Date of publication: April 29, 2016 Cited By: n/a |
| Stated Purpose or Research Question | “In reviewing treatments presented to us by DHS/DLTC, we implement a review process that carefully and fully considers all available information regarding a proposed treatment. Our determination is limited to a statement regarding how established a practice is in regard to quality research. We do not make funding decisions.” (p. 1) |
| Author’s Conclusion | “During this current review, no new research was identified and there are no currently available rigorous studies supporting the efficacy of AIT. In sum, it is the decision of the committee that AIT retain its efficacy rating of <i>Level 5 – Untested (Experimental Treatment) &/or Potentially Harmful.</i> ” (p. 2) |
| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: All elements of PICO are covered - directly reviews therapy P - children ASD/other DD I - AIT; C - N/A C- n/a O - hypersensitivity |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: Reputable source and publication within last 10 years - thorough review |

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| Type of article | Overall Type: Review of Research Studies Specific Type: Review statement |
| APA Reference | Committee on Children With Disabilities. (1998). Auditory integration training and facilitated communication for autism. <i>Pediatrics</i> , 102(2), 431. doi:10.1542/peds.102.2.431 |
| Abstract | This statement reviews the basis for two new therapies for autism--auditory integration training and facilitative communication. Both therapies seek to improve communication skills. Currently available information does not support the claims of proponents that these treatments are efficacious. Their use does not appear warranted at this time, except within research protocols. |
| Author | Credentials: Experts in fields regarding pediatrics Position and Institution: Various - members of committee Publication History in Peer-Reviewed Journals: N/A; moderate |
| Publication | Type of Publication: scholarly peer-reviewed journal Publisher: Elsevier Inc. Publication: <i>The Journal of Pediatrics</i> Committee still exists as another entity |
| Date and Citation History | Date of publication: 1998 Google Scholar Cited By: 90 |
| Stated Purpose or Research Question | Review the basis for two new therapies for autism - from abstract |
| Author's Conclusion | “AIT and FC are controversial treatment options for autism and other disorders... When controversial or unproven treatments are being considered by a family, the pediatrician should provide guidance and assistance in obtaining and reviewing information. The pediatrician should ensure that the child's health and safety, and the family's financial and emotional resources are not compromised. It is important for the pediatrician to obtain current data on both AIT and FC as they become available. Until further information is available, the use of these treatments does not appear warranted at this time, except within research protocols.” (p. 432) |
| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: P - ASD I - AIT C - N/A O - communication skills |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: Established committee. Reputable journal and publisher. Publication within last 10 years |

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| Type of Article | Overall Type: Research Study Review Specific Type: Systematic Review |
| APA Reference | Dawson, G., & Watling, R. (2000). Interventions to facilitate auditory, visual, and motor integration in autism: a review of the evidence. <i>Journal Of Autism & Developmental Disorders</i> , 30(5), 415. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.451.9134&rep=rep1&type=pdf |
| Abstract | Evidence is reviewed on the prevalence of sensory and motor abnormalities in autism and the effectiveness of three interventions designed to address such abnormalities—sensory integration therapy, traditional occupational therapy, and auditory integration training. Although sensory processing and motor abnormalities are neither universal nor specific to autism, the prevalence of such abnormalities in autism is relatively high. There is, however, little controlled research on the effectiveness of interventions designed to address these abnormalities. Four objective outcome studies of sensory integration therapy were identified. These were of such small scale that no firm conclusions regarding efficacy could be made. No empirical studies of traditional occupational therapy in autism were found. Five studies of auditory integration training were found. Results of these studies provided no, or at best equivocal, support for the use of auditory integration training in autism. |
| Author | Credentials: PhD Position and Institution: “Professor in Psychiatry and Behavioral Sciences, Professor in Pediatrics, Professor in the Department of Psychology and Neuroscience, Investigator in the Duke Institute for Brain Sciences, & Affiliate of the Center for Child and Family Policy, Duke University from: https://dibs.duke.edu/scholars/geraldine-dawson Publication History in Peer-Reviewed Journals: Moderate |
| Publication | Type of Publication: scholarly peer-reviewed journal Publisher: Springer |
| Date and Citation History | Date of publication: 2000 Google Scholar Cited By: 405 |
| Stated Purpose or Research Question | To “review evidence regarding the prevalence of sensory and motor abnormalities in autism and the effectiveness of three types of interventions designed to address such abnormalities: sensory integration therapy, traditional occupational therapy, and auditory integration training.” |
| Author’s Conclusion | “In the case of AIT, there is no, or at best equivocal, support for this intervention approach based on the available controlled studies” (p. 419) |

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| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: P- appropriate population (ASd) I- directly addressed AIT as an intervention C- compared AIT to sensory processing treatments in ASD patients O- made conclusions regarding ASDs use in treatment |
| Overall Quality of Article | Overall Quality of Article: Moderate The article was older, but addressed AIT directly, was created by several authors, has been cited, and uses direct information from previous works to compare treatment options |

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| Type of Article | Overall Type: Review of Research Studies Specific Type: Systematic Review |
| APA Reference | Fresham, F. M., Beebe-Frankenberger, M. E., & MacMillan, D. L. (1999). A selective review of treatments for children with autism: Description and methodological considerations. <i>School Psychology Review</i> , 28(4), 559. Retrieved from http://search.proquest.com/docview/219649192?pq-origsite=gscholar |
| Abstract | Autism is a developmental disorder whose behavioral characteristics range on a continuum from mild to severe. Autism is typically not diagnosed prior to age 2 to 3 years and the prognosis for this pervasive developmental disorder is poor. Although there is no documented "cure" for autism, research suggests that it can be managed effectively using comprehensive behavioral and educational treatment programs. This article reviews and critiques several of the most visible and most frequently cited treatment programs for children with autism: the UCLA Young Autism Project, Project TEACCH, LEAP, applied behavior analysis programs, and the Denver Health Science Program. Treatment programs having little or no empirical support such as facilitated communication, auditory integration therapy, and sensory integration therapy also are briefly reviewed. We evaluate the empirical evidence for the efficacy and effectiveness of these programs using conventional standards of research design and methodology and the Division 12 Task Force on Empirically Supported Treatments for Childhood Disorders of the American Psychological Association. Based on these Task Force criteria, there are no well-established or probably efficacious treatments for autism, although virtually all programs show substantial developmental gains, particularly in measured IQ. Recommendations for future research and practice are offered with guidelines for evaluating treatment programs for children with autism. |
| Author | Credentials: PhD, published author, Fellow with the American Association for the Advancement of Science, Lightner Witmer Award winner, from: http://www.pearsonclinical.com/authors/gresham-frank.html Position and Institution: Professor in Psychology at Louisiana State University, previous association with University of California-Riverside Publication History in Peer-Reviewed Journals: Low |
| Publication | Type of Publication: scholarly peer-reviewed journal Publisher: NASP Journals |
| Date and Citation History | Date of publication: 1999 Google Scholar Cited By: 149 |
| Stated Purpose or | To analyze a variety of treatment programs for ASD to determine their validity, use in treatment |

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| Research Question | |
| Author's Conclusion | Each treatment varied in purpose, practicality, and outcomes |
| Overall Relevance to PICO | <p>Overall Relevance to PICO: Weak</p> <p>Rationale:</p> <p>P- This article is directly related to the treatment of children with ASD, our focus population</p> <p>I- The article focused on a variety of treatments, not specifically ASD</p> <p>C- The treatments are compared to a number of intervention types</p> <p>O- The treatments were analyzed for use in practice</p> |
| Overall Quality of Article | <p>Overall Quality of Article: Moderate</p> <p>Rationale: The article is older than we would like, but it is a multi-study review, has been widely studied, and is in-depth</p> |

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| Type of Article | Overall Type: Research Study Review Specific Type: Forum Review |
| APA Reference | Madell, J. (1999). Clinical forum: auditory integration training. Auditory integration training: one clinician's view. <i>Language, Speech & Hearing Services In Schools</i> , 30(4), 371-426. http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?vid=18&sid=cc4a60a5-15e2-4aa8-a58d-cf9413ed0c54%40sessionmgr4009&hid=4109 |
| Abstract | Auditory integration training (AIT) is a developing treatment for auditory disorders that include sensitivity to sound, auditory attention problems, and auditory processing disorders. Although there is limited published research, a growing body of anecdotal and clinical data is being reported at professional meetings. This article discusses some of the issues related to AIT and presents preliminary data indicating that word recognition scores in the presence of competing noise improves for children with a variety of disorders who have been treated with AIT. |
| Author | Credentials: Phd, FAAA, CCC A/SLP, LSLS Cert AVT Position and Institution: Placements with many programs, professor/ assistant professor at 5 colleges/universities. At time of publication: director of Communicative Disorders at Long Island College Hospital Publication History in Peer-Reviewed Journals: Extensive |
| Publication | Type of Publication: scholarly journal Publisher: American Speech-Language-Hearing Association |
| Date and Citation History | Date of publication: 1999 Google Scholar Cited By: 11 |
| Stated Purpose or Research Question | To analyze AIT as presented in a public forum |
| Author's Conclusion | She put forth suggestions for research, and discussed previous works- she did appear to directly state her beliefs on AIT in practice |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: P - Autism (ASD) was used as a lens I - AIT was the direct source of analysis C - only AIT was analyzed |

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| | O - No outcomes were directly found |
| Overall Quality of Article | Overall Quality of Article: Low Rationale: The article was widely cited, but it is an older article, which analyzed a fairly narrow scope of AIT in practice |

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| Type of article | Overall Type: Review of Research Studies Specific Type: Systematic Review |
| APA Reference | Sinha, Y., Silove, N., Hayen, A., & Williams, K. (2011). Auditory integration training and other sound therapies for autism spectrum disorders (ASD). <i>Cochrane Developmental, Psychosocial and Learning Problems Group.</i> , 12, 1-38. doi:10.1002/14651858.CD003681.pub3 |
| Abstract | <p>Background: Auditory integration therapy was developed as a technique for improving abnormal sound sensitivity in individuals with behavioural disorders including autism spectrum disorders. Other sound therapies bearing similarities to auditory integration therapy include the Tomatis Method and Samonas Sound Therapy.</p> <p>Objectives: To determine the effectiveness of auditory integration therapy or other methods of sound therapy in individuals with autism spectrum disorders.</p> <p>Search methods: For this update, we searched the following databases in September 2010: CENTRAL (2010, Issue 2), MEDLINE (1950 to September week 2, 2010), EMBASE (1980 to Week 38, 2010), CINAHL (1937 to current), PsycINFO (1887 to current), ERIC (1966 to current), LILACS (September 2010) and the reference lists of published papers. One new study was found for inclusion.</p> <p>Selection criteria: Randomised controlled trials involving adults or children with autism spectrum disorders. Treatment was auditory integration therapy or other sound therapies involving listening to music modified by filtering and modulation. Control groups could involve no treatment, a waiting list, usual therapy or a placebo equivalent. The outcomes were changes in core and associated features of autism spectrum disorders, auditory processing, quality of life and adverse events.</p> <p>Data collection and analysis: Two independent review authors performed data extraction. All outcome data in the included papers were continuous. We calculated point estimates and standard errors from t-test scores and post-intervention means. Meta-analysis was inappropriate for the available data.</p> <p>Main results: We identified six randomised controlled trials of auditory integration therapy and one of Tomatis therapy, involving a total of 182 individuals aged three to 39 years. Two were cross-over trials. Five trials had fewer than 20 participants. Allocation concealment was inadequate for all studies. Twenty different outcome measures were used and only two outcomes were used by three or more studies. Meta-analysis was not possible due to very high heterogeneity or the presentation of data in unusable forms. Three studies (Bettison 1996; Zollweg 1997; Mudford 2000) did not demonstrate any benefit of auditory integration therapy over control conditions. Three studies (Veale 1993; Rimland 1995; Edelson 1999) reported improvements at three months for the auditory integration therapy group based on the Aberrant Behaviour Checklist, but they used a total score rather than subgroup scores, which is of questionable validity, and Veale's results did not reach statistical significance. Rimland 1995 also reported improvements at three months in the</p> |

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| | <p>auditory integration therapy group for the Aberrant Behaviour Checklist subgroup scores. The study addressing Tomatis therapy (Corbett 2008) described an improvement in language with no difference between treatment and control conditions and did not report on the behavioural outcomes that were used in the auditory integration therapy trials.</p> <p>Authors' conclusions: There is no evidence that auditory integration therapy or other sound therapies are effective as treatments for autism spectrum disorders. As synthesis of existing data has been limited by the disparate outcome measures used between studies, there is not sufficient evidence to prove that this treatment is not effective. However, of the seven studies including 182 participants that have been reported to date, only two (with an author in common), involving a total of 35 participants, report statistically significant improvements in the auditory integration therapy group and for only two outcome measures (Aberrant Behaviour Checklist and Fisher's Auditory Problems Checklist). As such, there is no evidence to support the use of auditory integration therapy at this time.</p> |
| Author | <p>Credentials: PhD, MD</p> <p>Position and Institution: General pediatrician and clinical pharmacologist at The Children's Hospital at Westmead Centre, special interest in children with developmental disorders</p> <p>Publication History in Peer-Reviewed Journals: Moderate</p> |
| Publication | <p>Type of Publication: Leading systematic review for healthcare, peer-reviewed</p> <p>Publisher: BMJ Publishing Group & Royal College of Paediatrics and Child Health</p> |
| Date and Citation History | <p>Date of publication: 2011</p> <p>Google Scholar Cited By: 43</p> |
| Stated Purpose or Research Question | <p>“This systematic review aimed to identify, evaluate and, if appropriate, combine any evidence of the effects of AIT or other methods of delivering sound therapy in individuals with autism spectrum disorders.” (p. 4)</p> |
| Author's Conclusion | <p>“Given the lack of evidence that auditory integration training (AIT) or other sound therapies are effective as a treatment for autism, future research is discouraged. However, we suggest that any further trials of AIT should build on existing evidence and provide high level evidence about whether this treatment is effective for outcomes that are relevant to individuals with ASD.” (p. 14)</p> |
| Overall Relevance to PICO | <p>Overall Relevance to PICO: Strong</p> <p>Rationale: P - children</p> |

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| | I - AIT C - controlled trials O - n/a |
| Overall Quality | Overall Quality of Article: Good Rationale: Systematic review. Reputable journal and publisher. Publication within last 10 years |

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| Type of article | Overall Type: Review of Research Studies Specific Type: Systematic Review |
| APA Reference | Sinha, Y., Silove, N., Wheeler, D., & Williams, K. (2006). Auditory integration training and other sound therapies for autism spectrum disorders: A systematic review. <i>Archives of Disease in Childhood</i> , 91(2), 1018-1022. doi: 10.1136/adc.2006.094649 |
| Abstract | Objectives: To determine the effectiveness of auditory integration training (AIT) or other methods of sound therapy in people with autism spectrum disorders (ASD). Study design: A systematic review was carried out of randomised controlled trials (RCTs) of adults or children with ASD. Meta-analysis was attempted. Results: Six RCTs of AIT, including one crossover trial, were identified, with a total of 171 participants aged 3–39 years. 17 different outcome measures were used, with only two outcome measures used by three or more studies. Meta-analysis was not possible owing to very high heterogeneity or presentation of data in unusable forms. Three studies did not show any benefit of AIT over control conditions. Three studies reported improvements at 3 months in the AIT group for total mean scores of the Aberrant Behaviour Checklist (ABC), which is of questionable validity. Of these, one study also reported improvements at 3 months in the AIT group for ABC subgroup scores. No significant adverse effects of AIT were reported. Conclusion: At present there is not sufficient evidence to support its use. |
| Author | Credentials: PhD, MD Position and Institution: General pediatrician and clinical pharmacologist at The Children’s Hospital at Westmead Centre, special interest in children with developmental disorders Publication History in Peer-Reviewed Journals: Moderate |
| Publication | Type of Publication: scholarly peer-reviewed journal Publisher: BMJ Journals |
| Date and Citation History | Date of publication: 2006 Google Scholar Cited By: 61 |
| Stated Purpose or Research Question | “This systematic review aimed to identify, evaluate and, if appropriate, combine any evidence of the effects of AIT or other methods of delivering sound therapy in people with autism.” (p. 1018) |
| Author’s Conclusion | “AIT continues to be practised worldwide, ³⁰ despite evidence that shows it to be still an experimental treatment at best, and one which may be only available at a considerable cost to the family”(p. 1021) |

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| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: P - children I - AIT C - controlled trials O- n/a |
| Overall Quality | Overall Quality of Article: Good Rationale: Systematic review. Reputable journal and publisher. Publication within last 10 years |

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| Type of Article | Overall Type: Research Study Review Specific Type: Forum Review |
| APA Reference | Tharpe, A. (1999). Clinical forum: auditory integration training. Auditory integration training: the magical mystery cure. <i>Language, Speech & Hearing Services In Schools</i> , 30(4), 378-426. Retrieved from http://web.a.ebscohost.com/ehost/pdfviewer/pdfviewer?sid=3e1a6b52-1bd3-4bc9-aa40-6347bd006351%40sessionmgr4006&vid=5&hid=4109 |
| Abstract | Since its introduction in this country at the beginning of the decade, auditory integration training (AIT) has generated enthusiasm in parents and some clinicians, and harsh criticism by others. AIT has been promoted as a non-invasive treatment for auditory disorders that are believed to lead to attention and behavior problems. It has been particularly popular as a treatment for autism. Although parents cite numerous anecdotal reports of treatment success, many professionals frown on AIT's widespread practice prior to undergoing scientific scrutiny. The reasons for cautious evaluation of AIT prior to implementation in clinical practice are reviewed, along with a brief summary of current research findings. |
| Author | Credentials: PhD Position and Institution: Professor of Hearing and Speech Sciences and Chair of the Department; Professor of Otolaryngology; Associate Director, Vanderbilt Bill Wilkerson Center Vanderbilt University Medical Center Publication History in Peer-Reviewed Journals: Moderate |
| Publication | Type of Publication: scholarly peer-review journal Publisher: American Speech-Language-Hearing Association |
| Date and Citation History | Date of publication: 1999 Google Scholar Cited By: 28 |
| Stated Purpose or Research Question | To discuss AIT as an intervention form, in context of a single forum. |
| Author's Conclusion | "Benefits of AIT have not been adequately demonstrated for any population" (p. 381) |
| Overall Relevance to PICO | Overall Relevance to PICO: Weak Rationale: -P- addressed AIT for a number of populations -I- uses AIT as the basis of study -C- does not compare AIT to another technique -O- does not support AIT, but thinks more research is necessary |

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| Overall Quality of Article | Overall Quality of Article: Low The article is older, has been cited few times, and is an analysis of a single forum |
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| Type of article | Overall Type: Review of Research Studies Specific Type: STEER Succinct and Timely Evaluated Evidence Review |
| APA Reference | Tochel, C. (2003). Sensory or auditory integration therapy for children with autistic spectrum disorders. <i>STEER</i> , 3(17), London, UK: Wessex Institute for Health Research and Development, University of Southampton. Retrieved from https://www.researchgate.net/profile/Claire_Tochel/publication/265106598_Sensory_or_auditory_integration_therapy_for_children_with_autistic_spectrum_disorders/links/54d4a0d50cf2464758060a64.pdf |
| Abstract | Question: What are the effects of sensory or auditory integration therapy in children with autism spectrum disorder? Population: Children with any autistic spectrum disorder, including autism; Asperger's syndrome; pervasive developmental disorder; childhood disintegrative disorder and Rett's syndrome, or other autistic symptoms. Intervention: Sensory integration therapy; auditory integration therapy. Comparators: No treatment (or placebo-type treatments such as unstructured play or unprocessed music), cognitive behavioural therapy and other psychological therapies, medication, speech and language therapy, any other therapies. Outcomes: Rigid or inflexible behaviours, quality of communication (e.g. articulation, average length of words or sounds, proportion of articulation used for communication), sound sensitivity, attention, educational attainment, measures of social interaction, physical co-ordination. Summary: Auditory integration therapy (AIT): Weak evidence from limited research suggests that AIT is unlikely to be more effective than unprocessed music in children with autistic spectrum disorders, although both AIT and unprocessed music may be associated with similar improvement in some scores from baseline. However, the clinical importance of these changes is unclear. Sensory integration therapy (SIT): We have found insufficient evidence about the clinical effects of sensory integration therapy in children with autistic spectrum disorders. |
| Author | Credentials: Ph. D. Position and Institution: Health Services Researcher; University of Southampton Publication History in Peer-Reviewed Journals: moderate |
| Publication | Type of Publication: scholarly peer-reviewed report Publisher: STEER Reports Publication: Wessex Institute for Health Research & Development, University of Southampton and Bazian Ltd. |
| Date and Citation History | Date of publication: 2003 Google Scholar Cited By: 9 |
| Stated Purpose or Research Question | "Question: What are the effects of sensory or auditory integration therapy in children with autism spectrum disorder?" (p. 5) |
| Author's Conclusion | "The evidence suggests that AIT may not be any more effective than unprocessed music for improving some aspects of communication in children with autistic spectrum disorders. However, this tentative conclusion is based on limited research |

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| | and may not be generalizable to all forms of AIT or to all children with autistic spectrum disorders.” (p. 9) |
| Overall Relevance to PICO | <p>Overall Relevance to PICO: Strong</p> <p>Rationale: P - children ASD/other DD; I - sensory integration therapy; auditory integration therapy; C - No treatment O - Rigid or inflexible behaviours, quality of communication (e.g. articulation, average length of words or sounds, proportion of articulation used for communication), sound sensitivity, attention, educational attainment, measures of social interaction, physical co- ordination</p> |
| Overall Quality of Article | <p>Overall Quality of Article: Good</p> <p>Rationale: Established author. Reputable publisher. Publication within last 10 years</p> |

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| Type of article | Overall Type: Review of Research Studies Specific Type: Systematic Review |
| APA Reference | UnitedHealthcare. (2016). <i>Sensory Integration Therapy and Auditory Integration Training</i> . Retrieved from: https://www.unitedhealthcareonline.com/ccmcontent/ProviderII/UHC/en-US/Assets/ProviderStaticFiles/ProviderStaticFilesPdf/Tools%20and%20Resources/Policies%20and%20Protocols/Medical%20Policies/Medical%20Policies/Sensory_and_Auditory_Integration_Therapy.pdf |
| Abstract | Auditory integration training (AIT) is unproven and not medically necessary. There is insufficient reliable data indicating that AIT devices significantly improve behavior, language, listening ability, or learning ability. AIT is based on the unproven theory that some disorders are caused by hearing or listening deficiencies. It is unknown if the sound levels used for AIT are harmful to hearing. |
| Author | Credentials: Health Insurance Company |
| Publication | Type of Publication: Medical Policy Publisher: United Health Care |
| Date and Citation History | Date of publication: 2016 Google Scholar Cited By: n/a |
| Stated Purpose or Research Question | “Medicare does not have a National Coverage Determination (NCD) for sensory integration therapy or auditory integration training (AIT).” (p. 7) |
| Author’s Conclusion | “The reviewers concluded that more research is needed to determine the effectiveness of AIT for autism.” (p. 6) |
| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: P - children I - AIT C- n/a O - n/a |
| Overall Quality | Overall Quality of Article: Good Quality Rationale: Includes. Publication within last 10 years. Overview of how an insurance company handles AIT. |

Initial Appraisal: Conceptual or Theoretical Articles

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| Type of article | Overall Type: Conceptual or Theoretical Article Specific Type: Advisory Opinion summary |
| APA Reference | Johns, P. M. (2010). Ethical Considerations Relevant to Emerging Technology-Based Interventions. Retrieved from the American Journal of Occupational Therapy, November 17, 2016, https://www.aota.org/Practice/Ethics/Advisory.aspx |
| Abstract | In recent years, new technology-based interventions have appeared for children who have sensory processing difficulties. This Advisory Opinion summarizes several emerging technologies in this area and relevant ethical considerations. |
| Author | Credentials: OTD, OTR/L Position and Institution: The author was an OTD Student at Creighton University at the time of this writing Publication History in Peer-Reviewed Journals: N/A; unknown |
| Publication | Type of Publication: scholarly paper for Advisory Opinion for the Ethics Commission Publisher: American Occupational Therapy Association (AOTA) Other: Official journal of the AOTA |
| Date and Citation History | Date of publication: 2010 Cited By: N/A |
| Stated Purpose or Research Question | “In recent years, new technology-based interventions have appeared for children who have sensory processing difficulties. This Advisory Opinion summarizes several emerging technologies in this area and relevant ethical considerations.” (p. 1) |
| Author’s Conclusion | “Nontraditional technologies and interventions can have positive applications to occupational therapy clients but also can pose ethical challenges to occupational therapy practitioners seeking to integrate them into their practice....Above all, occupational therapy practitioners have an obligation to promote benefit for the good of their clients.” (p. 9) |
| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: Directly related to all or most elements of PICO |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: More of a scholarly paper. Reputable journal and publisher. Publication within last 10 years |

Critical Appraisals

Tochel, C. (2003). Sensory or auditory integration therapy for children with autistic spectrum disorders. *STEER*, 3(17), London, UK: Wessex Institute for Health Research and Development, University of Southampton.

Sinha, Y., Silove, N., Hayen, A., & Williams, K. (2011). Auditory integration training and other sound therapies for autism spectrum disorders (ASD). *Cochrane Developmental, Psychosocial and Learning Problems Group.*, 12, 1-38. doi:10.1002/14651858.CD003681.pub3

Dawson, G. & Watling, R. (2000). Interventions to facilitate auditory, visual, and motor integration in autism: A review of the evidence. *Journal of Autism and Developmental Disorders*, 30(5), 415-421. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.451.9134&rep=rep1&type=pdf>

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<http://dx.doi.org/10.1177/030802269906200105>
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<http://www.aota.org/~//media/Corporate/Files/Practice/Children/ResponseAmericanAcademyPediatricsPolicyStatementSensoryIntegrationTherapy.pdf>
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<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.451.9134&rep=rep1&type=pdf>
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<http://dx.doi.org/10.1177/108835769901400202>

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The Listening Program

Reviewed by: Bryden Giving, Alex Hein, Rachel Kramer

Executive Summary

Final EBP question and PICO.

Are selected auditory integration interventions (The Listening Program) used in occupational therapy for children and adolescents with autism spectrum disorder (ASD) effective in improving social participation, school performance, and communication?

Table 1.

PICO Table for The Listening Program (TLP)

| | Keywords (Our Subgroups) | More Broad and Narrow Keywords (General - Total Group) | Keyword synonyms, abbreviations, and spelling variants |
|---|---|--|--|
| P - Patient/Population Problem | Children, school, clinic | Vulnerable children children with ASD, children with disabilities | Kids, pediatrics, juvenile, adolescent, youth, teenager, teen, instructor, learning deficits |
| I - Intervention | Therapeutic Listening, The Listening Program, Advanced Brain Technologies, Auditory Integration Therapy | Audiology, therapy, music therapy, adaptation, sensory integration, auditory integration, listening therapy, rehabilitation | OT, TLP |
| C - Comparison | | | |

| | Keywords (Our Subgroups) | More Broad and Narrow Keywords (General - Total Group) | Keyword synonyms, abbreviations, and spelling variants |
|--------------------|---|---|--|
| O - Outcome | Quality of Life, School Performance, Communication, Social Participation, Executive Functioning, Sleep | Cost of Therapies, Cost of Equipment, Degree of Training, Level of Participation, Level of Independence | ADL, IADL, Well-Being, Accurate Auditory/ Sensory Processing |

Themes.***Description of intervention.***

The Listening Program (TLP) is a music-based intervention that claims to address hypersensitivity and mend auditory processing problems to help users live healthy lives (Advanced Brain Technologies [ABT], 2016a). Using an ABC modular design for each session, this program claims to exercise the brain with a gradual warm-up, intense stimulation, and slow cool-down by utilizing specific frequency zones for sound stimulation (ABT, 2016a). The proposed benefits of TLP include increasing, “executive functioning, communication, auditory processing, social and emotional regulation, reduction in stress, motor coordination and creative expression” (Vargas & Lucker, 2016, p. 207).

The cost of TLP varies based on selected criteria. An individual full-access monthly membership for a single listener costs \$34.95 per month, while a yearly membership costs \$335.40 (ABT, 2016a). In addition to the membership, TLP also recommends the purchase of headphones, which cost between \$70 and \$150, but can cost as much as \$995 (ABT, 2016a). While the program may be individualized, each session lasts about 15 minutes, either once or twice daily, and are usually conducted five days a week (NACD, 2016). To implement TLP, an individual must be trained as an authorized provider. (Francis & Banai, 2011; NACD, 2016). An authorized provider, including occupational therapists, audiologists, and speech-language pathologists, must attend training sessions to learn how to properly manage and individualize the program to meet the specific needs of the individual (ABT, 2016a; Francis, 2011; NACD 2016). Advanced Brain Technologies (ABT) claims that TLP has been implemented in over 35 countries and works for children, teenagers, and adults (ABT, 2016a). They propose it also may benefit those with a range of disorders and skill sets, such as individuals with autism spectrum

disorder (ASD), learning disabilities, arthritis, and auditory processing disorder (Vargas & Lucker, 2016).

Developers/proponents, researchers, and organization/company.

TLP is a creation of ABT, founded by Alex Doman in 1998 (ABT, 2016a). Doman focused his career on music, technology, and manipulating sounds to improve brain performance and overall health (ABT, 2016b). Many of the researchers investigating the effectiveness of TLP in children who have ASD are either producers/distributors of TLP or the case studies were found on ABT's website (ABT, 2016d; Esteves, Stein-Blum, Cohen, & Tischler, 2009; Gee, Thompson, Pierce, Toupin & Holst, 2015; Gee, Thompson, & St. John, 2014; Jeyes & Newton, 2010; Lucker & Doman, 2015; Vargas & Lucker, 2016). ABT provides an assortment of interventions for auditory processing and brain stimulation (ABT, 2016a). Many of the products for the intervention are sold directly on the ABT website (ABT, 2016a). ABT is an approved provider of continuing education for the American Occupational Therapy Association (AOTA) and the interventions are internationally distributed (ABT, 2016c).

Description of available evidence.

A comprehensive search for evidence yielded 14 articles that were the most relevant to our EBP question. Of the 14 articles we found, seven of them were primary research studies published in peer-reviewed journals (Francis & Banai, 2011; Gee, Thompson, Pierce, Toupin & Holst, 2015; Gee, Thompson & St. John, 2014; Jeyes & Newton, 2010; Nwora & Gee, 2009; Schoen, Miller & Sullivan, 2015; Villasenor & Vargas-Colon, 2012). Using the AOTA Levels of Evidence (2016) adapted by Sackett, Rosenberg, Gray, Haynes, & Richardson (1996), the primary research studies were all Level IV - Single-Subject Design. The relevance of the articles to our PICO question was moderate, and the quality of the research was good. In addition, four

articles were reviews of research in peer-reviewed journals (Dunn et al., 2016; Polatajko & Cantin, 2010; Vargas & Lucker, 2016; Watling & Hauer, 2015). They are all rated as Level I - Systematic Reviews using the AOTA Levels of Evidence (American Occupational Therapy Association [AOTA], 2016). The overall relevance of the review of research articles to our PICO question was moderate, and the quality of the articles was good. Furthermore, we found one peer-reviewed conceptual article (Lucker & Doman, 2015). It proposes how listening interventions can improve auditory pathway performance. Due to it not concerning the use of trials, it was not assigned an AOTA Level of Evidence (AOTA, 2016). It was strongly related to our PICO but was a poor quality source. Two sources we found were not peer-reviewed (Blum, 2015; Esteves, Stein-Blum, Cohen & Tischler, 2009). Esteves et al. (2009) was strongly related to our PICO, but was poor quality because it was published in a book and not peer-reviewed. Blum (2015) was moderately related to our PICO and the quality was moderate because it was a doctoral dissertation and not peer-reviewed. Finally, none of our articles were specifically reviewed by the seven expert review groups.

Summary of current evidence and reviews of evidence.

After completing an initial appraisal of the evidence, three articles were selected for a comprehensive critical review (Francis & Banai, 2011; Gee, Thompson, Pierce, Toupin, and Holst 2015; Vargas & Lucker, 2016). Francis and Banai (2011) suggested that therapists and other providers should be hesitant in accepting and applying the conclusion that TLP has a greater impact on behavioral outcomes than regular classical music for individuals with PMLD. Vargas & Lucker (2016) stated that when children with autism spectrum disorder (ASD) undergo TLP, one can expect to see improvements in auditory processing. Gee et al., (2015) suggested that TLP may show positive trends in reducing auditory sensory over-responsivity in

individuals with ASD, but a stronger research design and additional research is necessary to determine the true effectiveness.

All of the articles examined the effectiveness of TLP with children and adolescents (Francis & Banai, 2011; Gee et al., 2015; Vargas & Lucker, 2016). Our reviews suggested that there could be a slight positive effect of TLP concerning children and adolescents, but some of the available evidence is not examining the effects of TLP on occupational performance and participation. Limitations from our studies included small sample sizes, limited control groups, and the inability to generalize findings. The studies exhibited a variety of biases, including co-intervention, memory, evaluator, timing, site and professional bias. Stated recommendations for continuing research include further examination of the effects of TLP on auditory processing. More control groups and increased sample sizes are also necessary. Finally, none of the primary research articles addressed the entire PICO question concerning occupational therapy outcomes in children with ASD.

Expert review table.

Table 2.

Summary of Evidence and Recommendations by Expert Review Groups for The Listening Program (TLP)

| Review Organization | Summary and Recommendations | Citation and Source |
|--|-----------------------------|--|
| Wisconsin Treatment Intervention Advisory Committee | Not Reviewed | Wisconsin Department of Health Services Autism and Other Developmental Disabilities Treatment Intervention Advisory Committee (2016). https://tiac.wisconsin.gov/summary-determinations-regarding-level-evidence.htm |
| Evidence-Based Practices for Children, Youth, and Young Adults with Autism Spectrum Disorder | Not Reviewed | Wong, C., Odom, S. L., Hume, K. Cox, A. W., Fettig, A., Kucharczyk, S., ... Schultz, T. R. (2013). <i>Evidence-based practices for children, youth, and young adults with Autism Spectrum Disorder</i> . Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, Autism Evidence-Based Practice Review Group. http://autismpdc.fpg.unc.edu/sites/autismpdc.fpg.unc.edu/files/2014-EBP-Report.pdf |
| Association for Science in Autism Treatment (ASAT) | Not Reviewed | Association for Science in Autism Treatment (n.d.) Treatments in alphabetical order. http://www.asatonline.org/for-parents/learn-more-about-specific-treatments/treatments-in-alphabetical-order/ |
| Cochrane Collaboration | Not Reviewed | Cochrane Collaboration (2016). http://www.cochrane.org/ |
| U.S. Department of Health and Human Services, Centers for Medicare & Medicaid Services. | Not Reviewed | U.S. Department of Health and Human Services, Centers for Medicare & Medicaid Services. (2010). Autism spectrum disorders (ASDs) services final report on environmental scan. Retrieved from http://www.impaqint.com/sites/default/files/files/Autism_Spectrum_Disorders.pdf |
| National Autism Center | Not Reviewed | National Autism Center (2015). National Standards Project, Phase 2. Retrieved from |

| | | |
|--------------------------------|--|---|
| | | http://www.nationalautismcenter.org/national-standards-project/phase-2/ |
| American Academy of Pediatrics | Studies of Complementary and Alternative Medicines (CAM) interventions are limited or flawed. Not recommended as an evidence-based intervention. | Myers, S. M., & Johnson, C. P. (2007). Management of children with autism spectrum disorders. <i>Pediatrics</i> , 120(5), 1162-1182. http://pediatrics.aappublications.org/content/pediatrics/120/5/1162.full.pdf |

Background Learning and Evidence Searches**Table of resources.**

Table 3.

Journals and Resources that Address Components of The Listening Program (TLP)

| Title/Name | Brief Description | Source |
|---|--|---|
| Occupational Therapy International | Up-to date, reliable, peer-reviewed journal. Articles emphasize previous research with evidence-based practice and contain great background knowledge to supplement case. Free full-text once requested, with public open access starting January 2017. | John Wiley & Sons LTD Accessible from St. Kate's Library |
| Autism Research and Treatment Journal | Great comprehensive source while also providing background information and recommendations. Provides open access articles distributed under the Creative Commons Attribution License (public access) and can be used from a wide variety of disciplines. | Hindawi Publishing Corporation https://www.hindawi.com/journals/aurt/ |
| National Association for Child Development | The website is easily accessible and has up-to date information about TLP. The NACD aims to gather information about different interventions that have reported benefits. | NACD International http://www.nacd.org/center-for-speech-sound-tsi-tlp-programs/the-listening-program-tlp/ |
| International Journal of Therapy and Rehabilitation | This peer-reviewed journal publishes scholarly articles with an interdisciplinary approach. Focuses mainly on therapy and rehabilitation and presents international original research. | MA Healthcare Limited Available on St. Kate's Library website. |

| | | |
|-----------------------------|--|--|
| Advanced Brain Technologies | Substantial amount of information about The Listening Program from the direct source, therefore, it may be bias due to its stake in the program. The website is easily accessible for information. | Advanced Brain Technologies http://www.advancedbrain.com/ |
|-----------------------------|--|--|

Background learning paper one.

The focus of this EBP project is to explore The Listening Program (TLP) intervention that is applied mostly for individuals with autism spectrum disorder (ASD). Therefore, background learning on TLP examined characteristics, accessibility, the target population, and reported benefits of TLP.

TLP is a therapeutic intervention that has several defining characteristics. Doman and Lawrence (2003) define TLP as, “a music based sound stimulation program” (para. 3), while The Listening Program (2016) defines it as a program to, “improve [one’s] sound brain fitness” (para. 1). In 1998, TLP was designed by Advanced Brain Technologies (ABT) (Doman & Lawrence, 2003). ABT noticed a need for an intervention program that worked for auditory integration, yet was simple enough that one could complete at home with the help of a trained professional (Doman & Lawrence, 2003).

The purpose of the program was to, “enhance listening skills and to train the brain to process sound in a more appropriate way” (NACD, 2016, para. 1), while also being cost-effective, accessible and enjoyable for the user (NACD, 2016). The Listening Program (2016) claimed there is a link between listening to certain types of music and improved health and brain performance. Therefore, after completing TLP, an individual should see improvements in, “attention, memory, listening, creativity, and communication, while reducing stress, and enhancing [one’s] cognitive health, mood and sense of well-being” (The Listening Program, 2016, para. 1).

To achieve these improvements, one must follow the process of TLP, which includes multiple steps. TLP is intended to work through, “8 one-hour audio CDs that contain specially processed classical music and nature sounds plus a 112 page guidebook” (Doman & Lawrence,

2003, para. 3). Each listening session is about 15 minutes and occurs once or twice daily for five days a week. It is particularly important to use the proper stereo headphones while listening to the CDs (Doman & Lawrence, 2003). The program typically lasts eight to sixteen weeks and it can be repeated or modified as necessary (Doman & Lawrence, 2003).

In order to access TLP, one needs to have a TLP provider who is trained in the program and who can make recommendations about which treatment will work best based on the individual's specific needs (NACD, 2016). Trained providers are typically occupational therapists or speech pathologists (NACD, 2016). The NACD (2016) provides an online application to find a provider who can consult via email and telephone. The Listening Program (2016) offers multiple buying options for TLP including: a seven-day free trial, a basic package including sixty 15-minute listening sessions (\$99) and a full access package that gives the client access to personalized program options and progress tracking (pricing not listed). As previously mentioned, the headphones are an integral part of the process therefore one must purchase a pair of headphones, which cost between 200-995 dollars (The Listening Program, 2016). While home use accessibility is a stated purpose of TLP, there is a significant process one must follow to access the program and acquire the necessary tools.

TLP is most often used by individuals with autism spectrum disorder (ASD). Individuals with ASD are believed to be hypersensitive to sounds, which results in negative behaviors and fear in response to these sounds (Lucker & Doman, 2015). Therefore, TLP aims to address these symptoms including increased engagement through locating his or her body in space as well as auditory processing through increasing the accuracy of sound perception. The result of increased skills in these areas may include improved communication skills (Doman and Lawrence, 2003). Improved auditory processing is particularly believed to be beneficial for individuals with ASD

because they may become actively engaged in their environment when they no longer feel nervous around sounds (Doman & Lawrence, 2003).

Gathering background information on TLP yielded information on the characteristics, steps, target population, and the reported benefits of the Listening Program. Further exploration into this topic must critically analyze existing research on the effectiveness of this program, particularly with the target population.

Background learning paper two.

This EBP project will analyze The Listening Program (TLP), an auditory-based intervention program. Background learning on this intervention examined the history of TLP and proposed method of operation, requirements and cost necessary to complete the program, target population and suggested benefits, as well as the mandatory training required to implement the program.

The music-based technique, TLP, is a component of a larger grouping of auditory programs, but it contains specific attributes that make it a unique method of sound intervention. Advanced Brain Technologies (ABT) developed TLP in 1999 partially based on the theory of Auditory Integration Training (AIT), which states that music modification may alter auditory processing (Francis, 2011; Nwora & Gee, 2009). TLP uses that idea to attempt to improve neural processing and brain plasticity, which is claimed to be important for an individual to acquire or improve functional skills (Francis, 2011). The creators believe a unique aspect of TLP is that it considers the frequency zones behind the chosen music, as they propose that these zones may be associated with an individual's level of functioning due to stimulation of neural pathways (Nwora & Gee, 2009). One source claims the founders have established three different zones relating to high and low frequency sounds that have associated characteristics of functioning within them (Nwora & Gee, 2009). These zones include sounds that contain lower, midrange, and high frequency information (Nwora & Gee, 2009). Each frequency level allegedly relates to specific skills, such as balance, body orientation, memory, speech, and creativity, and TLP was developed to intentionally modify music to fit within these particular frequency zones (Advanced Brain Technologies [ABT], 2016; Nwora & Gee, 2009). Information from the TLP website describes four different zones, each corresponding to a different color (ABT, 2016). These zones,

including green, blue, red, and orange, emphasize different ranges of sound frequencies and have associated skills within them (ABT, 2016). The discrepancy in the description of the zones suggests inconsistencies in the actual method of operation for this program. Regardless, TLP creators believe that a listener will be able to enhance particular skills due to increased auditory processing from the full range of frequencies an individual is receiving within one session (Francis, 2011).

The creators of TLP claim that their intervention benefits a variety of individuals and improves a diverse set of skills. Some of the proposed benefits of this intervention program include increasing an individual's "executive functioning, communication, auditory processing, social and emotional regulation, reduction in stress, motor coordination and creative expression" (Vargas & Lucker, 2016, p. 207). The founders state that TLP has been implemented in over 35 countries and works for children, teenagers, and adults (ABT, 2016). They propose it also may benefit those with a range of disorders and skill sets, such as individuals with Autism Spectrum Disorder, learning disabilities, arthritis, and Auditory Processing Disorder (Vargas & Lucker, 2016).

There are essential products to purchase and specific requirements to follow in order for an individual to participate in TLP. The original form, TLP Classic, contains eight CD's, a manual, and a listening journal, and a client can participate in the program in an academic or therapeutic environment, or it can be completed at home (National Association for Child Development [NACD], 2016). A variety of additional products have also been created, such as TLP Level One, and it is now possible to complete online learning (ABT, 2016). Each listening session lasts around 15 minutes, and sessions can be completed twice daily for accelerated completion of the program (Francis, 2011). While the TLP website states the whole program

generally lasts around 20 to 40 weeks, another source claimed it can be completed in 8 to 16 weeks (ABT, 2016; Francis, 2011). Sessions are usually conducted five days a week, but it also may be individualized based on the needs and wants of the client (NACD, 2016). TLP also recommends that individuals complete at least 40 hours of training to see improvement in their desired skill set (Francis, 2011). There is an ABC modular design to each session, which is meant to exercise the brain by starting with a gradual warm-up, transitioning to intense stimulation, and ending with a slow cool-down (ABT, 2016). The music included in the program varies based on the selected program with TLP. TLP Level One consists of modified classical music, especially from the works of Mozart and Haydn, chosen specifically because TLP creators suggest that this type of music contains the largest range of sound frequencies, which may facilitate optimal learning (Francis, 2011). On the other hand, the founders of TLP state that the music in the TLP inTime program contains global music based on percussion, wind, and string instruments (ABT, 2016). Current membership costs depend on the number of listeners, with an individual monthly membership costing \$34.95 per month and an individual yearly membership costing \$335.40 (ABT, 2016). In addition to the membership, TLP also recommends the purchase of audio equipment through their website, such as headphones, which generally cost between \$70 and \$150, but can cost as much as \$995 (ABT, 2016).

TLP also requires specialized training in order to become a facilitator of the program. Each individual participating in TLP has a designated trainer, called an authorized provider, who manages his or her training program (Francis, 2011). An authorized provider must attend training sessions to learn the components of TLP and how to properly implement and individualize the program (ABT, 2016). Examples of individuals who may become authorized providers include teachers, occupational therapists, audiologists, and counselors, among many other types of

professionals (Francis, 2011). Overall, the background knowledge obtained from research on TLP, especially the history, method of operation, requirements, proposed population and benefits, as well as the necessary training, may be an important aspect to consider when examining the effectiveness of different interventions used in occupational therapy.

Background learning paper three.

Every day, we process auditory information from the external world using auditory pathways. It has been proposed that auditory pathways may misinterpret stimuli and process information incorrectly, leading to a condition entitled hypersensitivity. The Listening Program is a method that claims to address hypersensitivity and mend auditory processing problems and help users live healthy lives (Advanced Brain Technologies, 2016).

The Listening Program is likened to brain fitness working with sound and therapeutic listening (Advanced Brain Technologies, 2016). The Listening Program is a creation of Advanced Brain Technologies, founded by Alex Doman in 1998 (Advanced Brain Technologies, 2016). The Listening Program uses nature sounds and the calming effect nature elicits (Advanced Brain Technologies, 2016). Some areas that The Listening Program claims to address are “executive functioning, communication, auditory processing, social and emotional regulation, reducing stress, motor coordination, and creative expression” (Vargas & Lucker, 2016, p. 205). It is recommended that the Listening Program be adapted into daily routines until it has become a habit (Advanced Brain Technologies, 2016). Advanced Brain Technologies offers to coach throughout the process of using The Listening Program to maximize the usage of their products (Advanced Brain Technologies, 2016).

Many testimonials from customers and users of The Listening Program are available (Vargas & Lucker, 2016). Users of The Listening Program include hospitals, schools, clinics, therapists, and the military and Veterans Administration (Advanced Brain Technologies, 2016). The Listening Program is reportedly used to alleviate stress, improve focus, memory and other cognitive functions (Vargas & Lucker, 2016). The Listening Program’s techniques and equipment are proposed to aid therapeutic listening and cognitive functioning for persons with

disabilities (Advanced Brain Technologies, 2016). These different programs are called Spectrum, Achieve, and the Level One series (Advanced Brain Technologies, 2016).

Evidence searches.***Library database: Medline/PubMed.******Preparing for Search Process***

a. I began by doing background research on the contents of PubMed/MEDLINE to see what types of articles and references they include. I found they include relevant citations for conducting searches for The Listening Program and other keyword searches.

I then identified possible MeSH headings. Auditory integration and The Listening Program are not MeSH headings. On the other hand, I identified Occupational Therapy and Autism as MeSH headings used for conducting searches. Two options appeared for Occupational therapy and I used the general term because it seemed the most applicable.

b. Other keywords I identified for the search were The Listening Program, Auditory Integration, Advanced Brain Technologies and Auditory Integration Therapy. I used these keywords combined with the MeSH headings to yield results.

c. Subject Headings or Indexing Terms of the Database:

Analytical, Diagnostic and Therapeutic Techniques and Equipment
Category>Therapeutics>Rehabilitation>Occupational Therapy

Psychiatry and Psychology>Mental Disorders>Neurodevelopmental Disorders>Child Development Disorders, Pervasive>Autistic Disorder

d. Final Concept or Term List for the Database

“The Listening Program,” Autism [MeSH], Occupational Therapy [MeSH], “Auditory Integration,” “Auditory Integration Therapy”

e. Database filters to be tried: I will use no filters because I want to see all the research available.

f. I will use with “AND” because I want all of the terms to be included in the search.

Summarizing a Strategic Search Process

| Filters/Years | Keywords | Total Yield/Relevant Hits | Date Accessed |
|-----------------------------|---|--|---------------|
| None Years: Unlimited | “The Listening Program” | 5/3 Vargas & Lucker, 2016 Gee, Thompson, & John, 2013 Nwora & Gee, 2009 | 11/14/16 |
| None Years: Unlimited | Occupational Therapy [MeSH] AND Auditory Integration | 0/0 | 11/14/16 |
| None Years: Unlimited | Occupational Therapy [MeSH] AND “The Listening Program” | 0/0 | 11/14/16 |
| None Years: Unlimited | “Advanced Brain Technologies” | 1/1 Lucker & Doman, 2015 | 11/14/16 |
| None Years: Unlimited | Autism [MeSH] AND “Auditory Integration Therapy” | 2/1 Sinha, Silove, Wheeler, & Williams, 2004 | 11/14/16 |

Abstracts of five best research articles from the database.

1. Vargas & Lucker (2016)

A quantitative summary of existing research examining the effects of The Listening Program (TLP) on various functions in children is presented. Nine studies were used, looking at TLP intervention effects across studies, within each study and for various outcome measures. The studies looked at TLP intervention on children with autism spectrum disorder, Down syndrome, learning disabilities, auditory processing disorders, attention deficit hyperactivity

disorders, Rhett syndrome, dyspraxia, cerebral palsy, fibromyalgia, arthritis and stroke. The magnitude of the TLP effect size revealed a mean value of 0.41 across all studies. For each individual study, effect size ranged from 0.23 to 1.28. Two studies yielded significantly larger effect size than the other studies. One of these studies (effect size 1.19) examined the improvement in auditory processing for children identified with autism. The other study (effect size 1.28) examined improvement in academically related skills of underachieving school children. Larger effect sizes were obtained for research that examined auditory processing/listening skills (mean effect size 0.72) than for research looking at non-auditory areas (mean effect size 0.31), although all revealed positive changes. The effect size of various outcome measures is discussed in order to identify variables that might affect the outcomes as well as what these results mean to occupational therapists who would consider TLP intervention for clients. Copyright © 2016 John Wiley & Sons, Ltd.

2. Sinha, Silove, Wheeler & Williams (2004)

BACKGROUND:

Autism spectrum disorders (ASD) are a heterogeneous group of disorders encompassing Autistic Disorder, Asperger's Disorder, Semantic-Pragmatic disorder and Pervasive Developmental Disorder Not Otherwise Specified. Auditory integration therapy (AIT) was developed as a technique for improving abnormal sound sensitivity in individuals with behavioural disorders including autism. Other sound therapies bearing similarities to AIT include the Tomatis Method and Samonas Sound Therapy.

OBJECTIVES:

To determine the effectiveness of AIT or other methods of sound therapy in individuals with ASD.

SEARCH STRATEGY:

We searched the Cochrane Central Register of Controlled Trials (Cochrane Library Issue 2, 2003), MEDLINE (1966 - February 2002), EMBASE (1980 - February 2002), CINAHL (1982 - December 2001), PsycINFO (1887 - February 2002), ERIC (1965 - December 2001) and LILACS (1982 - March 2002). Reference lists of articles identified electronically were searched for further relevant publications.

SELECTION CRITERIA:

Randomized controlled trials of adults or children with ASD. Treatment was auditory integration therapy (AIT) or other sound therapies involving listening to music modified by filtering and modulation. Control groups could be no treatment, waiting list, usual therapy or placebo equivalent. Outcomes sought were changes in core and associated features of ASD, auditory processing, quality of life and adverse events.

DATA COLLECTION AND ANALYSIS:

All outcome data reported in included papers were continuous. Initial intention was to undertake meta-analyses using mean difference and standard deviation to take into account differences between treatment and control groups at baseline. These data were not available. Instead, point estimates and standard errors were calculated from t-test scores and post intervention means. Meta-analysis was attempted but deemed inappropriate at present.

MAIN RESULTS:

No trials assessing sound therapies other than AIT were found. Six RCTs of AIT, including one cross-over trial, were identified with a total of 171 individuals aged 3-39 years. Four trials had fewer than 20 participants. Allocation concealment was inadequate for all of the studies. Seventeen different outcome measures were used. Only two outcomes were used by

three or more studies: Aberrant Behaviour Checklist (ABC) (5) and Fisher's Auditory Problems Checklist (FAPC) (3). Meta-analysis was not possible due to very high heterogeneity (Aberrant Behaviour Checklist subscores), or presentation of data in unusable forms. Three studies (Bettison 1996, Zollweg 1997, Mudford 2000) did not demonstrate benefit of AIT over control conditions. The remaining trials (Veale 1993, Rimland 1995, Edelson 1999) reported improvements at 3 months for the AIT group based on improvements of total mean scores for the ABC, which is of questionable validity. Rimland 1995 also reported improvements at 3 months in the AIT group for ABC subgroup scores. No significant adverse effects of AIT were reported.

REVIEWER'S CONCLUSIONS:

More research is needed to inform parents', carers' and practitioners' decision making about this therapy for individuals with autism spectrum disorders.

3. Gee, Thompson & St. John (2014).

Sound-based interventions (SBIs) are being used by paediatric occupational therapists to help children with autism spectrum disorders and co-morbid sensory processing disorders. A limited yet growing body of evidence is emerging related to the efficacy of SBIs in reducing sensory processing deficits among paediatric clients with co-morbid conditions. The current study employed an ABA single-subject case-controlled design, implementing The Listening Program® with a 7-year-old child diagnosed with autism spectrum disorder who demonstrated auditory sensory over-responsivity (SOR). The intervention consisted of 10 weeks of psycho-acoustically modified classical music that was delivered using specialized headphones and amplifier and a standard CD player. Repeated measures were conducted during the A(1), B and A(2) phases of the study using the Sensory Processing Measure, a subjective caregiver questionnaire, and the Sensory Over-Responsivity Scales, an examiner-based assessment

measure to track changes of the participant's auditory SOR-related behaviours. The results indicated that the participant exhibited a decrease in the number of negative (avoidant, verbal and physical negative) and self-stimulatory behaviours. The decreases in negative and self-stimulatory behaviour may have been due to the therapeutic effect of the repeated exposure to the Sensory Over-Responsivity Scales or The Listening Program SBI.

4. Nwora & Gee (2009)

The aim of this study was to determine the efficacy of The Listening Program (TLP) in treating a child with pervasive developmental disorder-not otherwise specified (PDD-NOS). Using a single-subject case study design, one child with PDD-NOS was administered a 20-week TLP intervention focused on improving sensory processing and language function. Data collection included pre- and post-evaluations using video footage, and Sensory Profile and Listening Checklist questionnaires. Results of the study indicated improved behaviour and sensory tolerance in the post-intervention video footage, including active participation in singing and movements to song. Sensory Profile and Listening Checklist questionnaires indicated significant improvements in sensory processing, receptive/expressive listening and language, motor skills, and behavioural/social adjustment at the post-intervention assessment. Although small in scope, this study highlights the need for continued research by occupational therapists into sound-based interventions. Particularly, occupational therapists need to perform larger-scale studies utilizing TLP to verify the efficacy of this alternative treatment method.

5. Lucker & Doman (2015)

Professionals working with children diagnosed with autism spectrum disorder (ASD) may find that these children are overly sensitive to sounds. These professionals are often concerned as to why children may have auditory hypersensitivities. This review article discusses

the neural mechanisms identified underlying hypersensitive hearing in people. The authors focus on brain research to support the idea of the nonclassical auditory pathways being involved in connecting the auditory system with the emotional system of the brain. The authors also discuss brain mechanisms felt to be involved in auditory hypersensitivity. The authors conclude with a discussion of some treatments for hypersensitive hearing. These treatments include desensitization training and the use of listening therapies such as The Listening Program.

Database: OT organizations (AOTA/AOTF/WFOT).

Preparing for Search Process

a. I began by signing in to AOTA to be sure I had access to all of the resources possible. I will search in multiple areas on AOTA. First, I will try a site wide search by typing keywords in the search bar at the top of the site. Next, I will click on the “Publications & News” tab at the top of the AOTA homepage to access different resources there including the *American Journal of Occupational Therapy* and OT Practice Magazine.

For the AOTF website, I will click on the “Resources & WLW Library” tab at the top of the page and access the *OTJR: Occupation, Participation and Health* journal. I will type in identified keywords to find resources.

It appears there are no specific journals associated with the WFOT website after investigating the different tabs. Therefore, I will conduct a search by entering in specific keywords at the top of the page in the “search” bar.

b. Possible keywords I identified for the search were The Listening Program, Auditory Integration, Autism and Advanced Brain Technologies. I might pair the keywords while searching depending on what information is coming up.

c. I will not use filters or year limits so I can view all of the research on the topic I am searching. I will use “AND” to find more specific information about multiple keywords.

Summarizing a Strategic Search Process

AOTA

| Filters/years | Keywords | Total Yield/Relevant Hits | Date Accessed |
|--|---|--|---------------|
| None (website wide search) | “The Listening Program” | 2/0 | 11/14/16 |
| <i>American Journal of Occupational Therapy</i> | “The Listening Program” | 1/1 Watling & Hauer, 2015 | 11/14/16 |
| <i>American Journal of Occupational Therapy</i> | Autism AND “Auditory integration” | 4/2 Polatajko & Cantin, 2010 Watling & Hauer, 2015 | 11/14/16 |
| <i>OT Practice Magazine</i> Sensory Processing Issue-July 2016 | “The Listening Program,” & “Auditory integration” | 0/0 | 11/14/16 |
| <i>American Journal of Occupational Therapy</i> | “Auditory integration therapy” | 0/0 | 11/15/16 |
| <i>American Journal of Occupational Therapy</i> | “Advanced Brain technologies” | 0/0 | 11/15/16 |

AOTF

| Filters/years | Keywords | Total Yield/Relevant Hits | Date Accessed |
|--|-------------------------|---|---------------|
| <i>OTJR: Occupation, Participation, and Health</i> | “The Listening Program” | 1/1 Dunn, Little, Dean, Robertson, & Evans, 2011 | 11/14/16 |

| | | | |
|--|--------------------------------------|-----|----------|
| <i>OTJR: Occupation, Participation, and Health</i> | Autism AND “Auditory Integration” | 1/0 | 11/14/16 |
| <i>OTJR: Occupation, Participation, and Health</i> | “Advanced Brain Technologies” | 0/0 | 11/14/16 |
| <i>OTJR: Occupation, Participation, and Health</i> | “Auditory integration therapy” | 0/0 | 11/15/16 |

WFOT

| Filters/Years | Keywords | Total Yield/Relevant Hits | Date Accessed |
|---------------|----------------------------|------------------------------|------------------|
| None | “The Listening Program” | 1/0 | 11/14/16 |

Abstracts of the best evidence from AOTA/WFOT/AOTF

1. Watling & Hauer (2015).

This systematic review examines the literature published from January 2006 through April 2013 related to the effectiveness of Ayres Sensory Integration (ASI) and sensory-based interventions (SBIs) within the scope of occupational therapy for people with autism spectrum disorder to improve performance in daily life activities and occupations. Of the 368 abstracts screened, 23 met the inclusion criteria and were reviewed. Moderate evidence was found to support the use of ASI. The results for sensory-based methods were mixed. Recommendations include performing higher level studies with larger samples, using the Fidelity Measure in studies of ASI, and using carefully operationalized definitions and systematic methods in examination of SBIs.

2. Polatajko & Cantiin (2010)

This literature review was completed as part of the Evidence-Based Literature Review Project of the American Occupational Therapy Association to explore the effectiveness of occupational therapy interventions with children and adolescents experiencing difficulty processing and integrating sensory information. This part of the review focused on interventions other than the sensory integration approach. Twenty articles (reporting on 21 studies) met the inclusion criteria. This systematic review found that children with difficulty processing and integrating sensory information and difficulties with the performance of daily occupations can benefit from intervention. However, the great variability that characterizes this literature in terms of populations, interventions, and study quality precludes the formation of any firm conclusions regarding specific approaches. There is an urgent need for well-controlled studies examining the effectiveness of frequently used pediatric occupational therapy interventions with well-defined, homogeneous populations on outcomes that target participation in everyday life

3. Dunn, Little, Dean, Robertson, & Evans (2016)

The objective of this study was to identify and synthesize research about how sensory factors affect daily life of children. We designed a conceptual model to guide a scoping review of research published from 2005 to October 2014 (10 years). We searched MEDLINE, CINAHL, and PsycINFO and included studies about sensory perception/processing; children, adolescents/young adults; and participation. We excluded studies about animals, adults, and review articles. Our process resulted in 261 articles meeting criteria. Research shows that children with conditions process sensory input differently than peers. Neuroscience evidence supports the relationship between sensory-related behaviors and brain activity. Studies suggest that sensory processing is linked to social participation, cognition, temperament, and participation. Intervention research illustrates the importance of contextually relevant practices.

Future work can examine the developmental course of sensory processing aspects of behavior across the general population and focus on interventions that support children's sensory processing as they participate in their daily lives.

***NOTE: There were duplicate articles I found under some keywords as noted in the table. These three were the only three relevant articles I found between sources in AOTA/AOTF/WFOT, which is why there are only three abstracts listed instead of five.

Library database: PSYCInfo.

Preparing for Search Process.

- a. The first step I took in finding research for this project was searching for the PSYCInfo database on the St. Kate's website in order to complete the search process. After I decided on different terms I wanted to include in my searches relating to our EBP PICO and my specific intervention, I went to the thesaurus on PSYCInfo to look up different index terms for each of the terms I planned to use. This helped me find more broad and narrow terms to use in my searches. Under the "Advanced Search" tab on the main page of the database is a button to search the thesaurus.
- b. To look up a term on the thesaurus, I typed a specific word in the search box and looked for the most relevant term in the indexing term list. For example, when I typed in 'Occupational Therapy', it showed the root tree starting at Treatment, leading to Rehabilitation, and then ending on Occupational Therapy (Treatment > Rehabilitation > Occupational Therapy). I did this for each of my selected terms.
- c. I also looked at the MeSH headings for the overall ProQuest database to see if that would assist in my search. I found that these MeSH headings were more related to medicine and drugs, mainly found in articles on the MEDLINE and PubMed databases. Thus, I decided to use the indexing terms I found previously from the thesaurus.
- d. Once I made the list of subject headings and terms directly from the PSYCInfo database to use in my search, listed below, I chose to add certain terms into the search bar for each subsequent search in order to look for relevant articles under the Advanced Search portion of the database (Example: Occupational Therapy, The Listening Program, and Disorders). I also chose certain filters (Years and Type of Literature) and Boolean terms (AND, BUT, and OR) at this time to narrow down my search even further. PSYCInfo

requires quotation marks around words included in a phrase. Finally, I came up with a search idea similar to (“Occupational Therapy” AND “The Listening Program” AND Disorders).

- e. Although most terms had other indexing terms in the thesaurus, The Listening Program (TLP) did not have an individual heading or root tree because it is a specific intervention. Therefore, the term included in the search was the full name, “The Listening Program,” in order to find articles particularly relating to that intervention.
- f. Advanced Brain Technologies and Auditory Integration were other search terms I used, which were also not listed in the indexing terms on the database.
- g. Once I typed in my selected keywords into the advanced search bar on the database, I clicked ‘search’ and the list of the total yield for that search appeared. I then read through each abstract on the list to see if it was specifically relevant to my selected intervention.
- h. For the articles that were relevant, I wrote the in-text citation in the table and looked at each abstract by clicking on the article to obtain the details about the abstract to use for my best evidence resources.
- i. Subject Headings or Indexing Terms (Root Tree) of the Database:
 - Treatment > Rehabilitation > Occupational Therapy
 - Disorders > Mental Disorders > Autism Spectrum Disorders
 - Perception > Intersensory Processes > Sensory Integration
 - Treatment > Creative Arts Therapy > Music Therapy
 - Ability > Cognitive Ability (Use for Executive Functioning)
 - >”The Listening Program”
 - >”Advanced Brain Technologies”

>”Auditory Integration”

j. Final Concept or Term List for the Database:

“The Listening Program”, “Occupational Therapy”, Disorders, “Rehabilitation”, Autism Spectrum Disorders, “Music Therapy”, “Sensory Integration”, and “Cognitive Ability”, “Advanced Brain Technologies”, “Auditory Integration”

k. Database Filters: *Years*: Some searches included a filter to look at articles with a maximum publishing date ranging from 10-20 years old. *Type of Article*: Some searches included a filter specifically searching for scholarly journal articles.

l. Boolean Logic Terms: I included ‘AND’ in most of my searches as all terms used in the search were necessary to narrow down my results in order to find relevant articles.

Summarizing a Strategic Search Process

| Filter/Years | Keywords | Total Yield/Relevant Hits | Date |
|--------------------------|-------------------------------|--|-------------------|
| None Years: Unlimited | (“The Listening Program”) | 10/8 Blum, 2015 Erin, 2012 Esteves, Stein-Blum, Cohen, & Tischler, 2009 Gee, Thompson, & John, 2014 Jeyes & Newton, 2010 Nwora & Gee, 2009 Vargas & Lucker, 2016 Villasenor & Vargas-Colon, 2012 | November 13, 2016 |
| None Years: Unlimited | “Advanced Brain Technologies” | 2/2 Erin, 2012 Gee, Thompson, & John, 2014 | November 13, 2016 |

| | | | |
|--|--|--|-------------------|
| None Years: Unlimited | “Occupational Therapy” AND Disorders AND (“The Listening Program”) | 3/3 Gee, Thompson, & John, 2014 Nwora & Gee, 2009 Vargas & Lucker, 2016 | November 13, 2016 |
| None Years: Unlimited | “Sensory Integration” AND (“The Listening Program”) | 2/2 Esteves et al., 2009 Blum, 2015 | November 13, 2016 |
| None Years: Unlimited | (“Rehabilitation”) AND “Autism Spectrum Disorders” AND (“The Listening Program”) | 1/1 Nwora & Gee, 2009 | November 13, 2016 |
| None Years: Unlimited | “Cognitive Ability” AND (“The Listening Program”) | 1/1 Jeyes & Newton, 2010 | November 13, 2016 |
| None Years: Unlimited | (“The Listening Program”) AND “Auditory Integration” | 0/0 Search too narrow, include more broad terms | November 13, 2016 |
| None Years: Unlimited | (“Rehabilitation”) AND Disorders AND “Music Therapy” | 196/- Continue to narrow down the focus | November 13, 2016 |
| Type of Journal: Scholarly Journal Years: 10 years (Publication dates of 2006-2016) | (“Rehabilitation”) AND Disorders AND “Music Therapy” | 116/- Focus still too broad; narrow even further | November 13, 2016 |
| Type of Journal: Scholarly Journal Years: 20 years (Publication dates of 1996-2016) | “Rehabilitation” AND (“The Listening Program”) | 2/2 Erin, 2012 Nwora & Gee, 2009 | November 13, 2016 |

Summary of 5 BEST research articles.

1. Jeyes, G., & Newton, C. (2010)

It is well documented that children with Down syndrome have difficulty with auditory processing and language development. This pilot study was undertaken to trial tests and questionnaires for suitability for use with the children to determine if any benefit could be established from the use of The Listening Training Program as a prelude to a more formal study. Nine children between the ages of 5 and 12 years took part acting as their own controls. They used The Listening Program over a 10-week period, and this involved each child listening to acoustically modified music, through headphones, for two 15-min sessions, 5 days a week, over 10 weeks. A battery of tests, recommended by specialists in speech and language and human communication, were performed before and after intervention, and questionnaires were completed at the end by parents and teachers involved. Because the children are educated in a variety of settings, main stream, special school, and part time in both, the testing took place on a Saturday and the children were drawn from the Down Support Group, Nottingham. Where possible, the Program was implemented in school, but where this was not possible, it was undertaken in the home setting.

2. Vargas, S., & Lucker, J. R. (2016)

A quantitative summary of existing research examining the effects of The Listening Program (TLP) on various functions in children is presented. Nine studies were used, looking at TLP intervention effects across studies, within each study and for various outcome measures. The studies looked at TLP intervention on children with autism spectrum disorder, Down syndrome, learning disabilities, auditory processing disorders, attention deficit hyperactivity disorders, Rhett syndrome, dyspraxia, cerebral palsy, fibromyalgia, arthritis and stroke. The magnitude of the TLP effect size revealed a mean value of 0.41 across all studies. For each individual study, effect size ranged from 0.23 to 1.28. Two studies yielded significantly larger

effect size than the other studies. One of these studies (effect size 1.19) examined the improvement in auditory processing for children identified with autism. The other study (effect size 1.28) examined improvement in academically related skills of underachieving school children. Larger effect sizes were obtained for research that examined auditory processing/listening skills (mean effect size 0.72) than for research looking at non-auditory areas (mean effect size 0.31), although all revealed positive changes. The effect size of various outcome measures is discussed in order to identify variables that might affect the outcomes as well as what these results mean to occupational therapists who would consider TLP intervention for clients.

3. Gee, B. M., Thompson, K., & John, H. S. (2014)

Sound-based interventions (SBIs) are being used by paediatric occupational therapists to help children with autism spectrum disorders and co-morbid sensory processing disorders. A limited yet growing body of evidence is emerging related to the efficacy of SBIs in reducing sensory processing deficits among paediatric clients with co-morbid conditions. The current study employed an ABA single-subject case-controlled design, implementing The Listening Program® with a 7-year-old child diagnosed with autism spectrum disorder who demonstrated auditory sensory over-responsivity (SOR). The intervention consisted of 10 weeks of psycho-acoustically modified classical music that was delivered using specialized headphones and amplifier and a standard CD player. Repeated measures were conducted during the A(1), B and A(2) phases of the study using the Sensory Processing Measure, a subjective caregiver questionnaire, and the Sensory Over-Responsivity Scales, an examiner-based assessment measure to track changes of the participant's auditory SOR-related behaviours. The results indicated that the participant exhibited a decrease in the number of negative (avoidant, verbal

and physical negative) and self-stimulatory behaviours. The decreases in negative and self-stimulatory behaviour may have been due to the therapeutic effect of the repeated exposure to the Sensory Over-Responsivity Scales or The Listening Program SBI.

4. Nwora, A. J., & Gee, B. M. (2009)

The aim of this study was to determine the efficacy of The Listening Program (TLP) in treating a child with pervasive developmental disorder-not otherwise specified (PDD-NOS). Using a single-subject case study design, one child with PDD-NOS was administered a 20-week TLP intervention focused on improving sensory processing and language function. Data collection included pre- and post-evaluations using video footage, and Sensory Profile and Listening Checklist questionnaires. Results of the study indicated improved behavior and sensory tolerance in the post-intervention video footage, including active participation in singing and movements to song. Sensory Profile and Listening Checklist questionnaires indicated significant improvements in sensory processing, receptive/expressive listening and language, motor skills, and behavioral/social adjustment at the post-intervention assessment. Although small in scope, this study highlights the need for continued research by occupational therapists into sound-based interventions. Particularly, occupational therapists need to perform larger-scale studies utilizing TLP to verify the efficacy of this alternative treatment method.

5. Villasenor, R., & Vargas-Colon, K. (2012)

This Practice Perspectives essay describes two students attending the REACH program (in which students are actively preparing for adult roles and responsibilities) at the Lavelle School for the Blind. These two students used The Listening Program (TLP), a music-based auditory stimulation program for students with visual impairments, and they also received occupational and speech therapy and orientation and mobility (O&M) services. Although there

were a number of students using TLP at the school, Anna and Larry (pseudonyms) were the only two students within the 2009-2010 school year that were able to complete one cycle of TLP. Improvement in the behavior of each student was reported by their teacher and two service providers, who were interviewed informally. Decreased body rocking, better sitting posture, more verbal communication among peers and teachers, better balance on unstable surfaces, and improved learning ability were reported. Although many factors may impact students' progress in school—including other services like O&M, speech and occupational therapy, school curriculum, classroom environment, growth and development of the student— this positive findings of this essay warrants further study on the use of music-based auditory stimulation with visually impaired students. Integration of TLP into the school curriculum is a necessity in order to ensure daily listening, in addition to use of objective data collection of functional outcomes.

Evidence resource: Google Scholar.

Preparing for Search Process.

- a. I was looking to search for any additional research that had been completed related to The Listening Program (TLP) other than the articles I found from my previous database search so I decided to look into Google Scholar.
- b. Google Scholar seems have helpful features such as a date-range filter and sorting based on author or journal. It is also relatively user-friendly and makes browsing for various forms of academic literature fairly simple. It allows you to see the number of times the articles have been cited by others and provides recommendations on other material that may also be related.

- c. Many of the results from searches on Google Scholar include research from scholarly articles and books. Another benefit is that many of the PDF's of the articles are also available online free of charge with open-access.
- d. I found it very helpful that you can search for literature with specific phrases. Even though you can look up specific phrases, I found it somewhat difficult to search for the specific "The Listening Program" intervention. This was because when I typed the phrase in the search bar, it found many articles that simply included the phrase "the listening program" within the article, rather than looking only for articles discussing "The Listening Program" intervention.
- e. Therefore, I found it easier to find articles directly relating to The Listening Program when I included the acronym (TLP) within my searches.
- f. Many of the terms I used in my Google Scholar search were similar to those that I used in my previous database search and they are listed below. These terms relate to my specific intervention, as well as the EBP PICO as a whole. There also were no specific indexing terms or root trees to use for this resource so I utilized the knowledge I obtained from the subject headings from my PSYCInfo search and used some of those for this search as well.
- g. To search for articles on Google Scholar, I first went to the main Google website and searched for Google Scholar. Once on that webpage, I clicked on the little down arrow on the search bar, next to the blue search button, in order to find the Advanced Scholar Search. I entered my search criteria, listed in the table below, in the space that states "with the exact phrase". I included the Boolean term 'AND' between my words in select searches. For the search that included a set date-range, I went to the 'return articles dated

between' blanks, and typed in 2011-2016 in order to get a 5-year range. Those with an unlimited range of years required no additional filters.

- h. When I entered all of the necessary information into the advanced search, I hit 'search' and I was able to see the total yield. I looked to see which abstracts related to my intervention and determined the number of relevant hits.
- i. I included the necessary in-text citation in the table for relevant articles and searched for each abstract in order to find them for the best evidence resources. I also looked for the APA reference at this time as well.
- j. Final Term List for the Resource Search: "The Listening Program", "The Listening Program (TLP)", Disorders, "Rehabilitation," "Music Therapy", and "Auditory Integration".
- k. Filters: Years: While most of my searches included an 'unlimited' number of years, I included a 5 year maximum on one search to look at literature that had been published most recently.
- l. Boolean Logic Terms: The word 'AND' was used in some of my searches because I wanted each of those terms included within the search to look for detailed articles and to narrow down my information.

Summarizing Strategic Search Process

| Filter/Years | Keywords (search words) | Total Yield/Relevant Hits | Date |
|--------------------------|-------------------------------|--|----------------------|
| None Years: Unlimited | "The Listening Program" | 391/- Search was too broad; need to narrow down focus | November 14, 2016 |
| None Years: Unlimited | "The Listening Program (TLP)" | 30/16 | November 14, 2016 |

| | | | |
|---|---|---|---|
| | | <p>-Search says ‘About 32 articles, and finds 30’ Bonelli, Christman, & Tree, 2016 Blum, 2015 Doman, 2004 Esteves, Stein-Blum, Cohen, & Tischler, 2009 Francis & Banai, 2011 Gee, Devine, Werth, & Phan, 2013 Gee, Thompson, & John, 2014 Gee, Thompson, Pierce, Toupin, & Holst, 2015 Hoffmann, 2010 Jeyes, 2004 Lucker, 2012 Lucker & Doman, 2015 Nwora & Gee, 2009 Vargas & Lucker, 2016 Villasenor & Vargas-Colon, 2012 Wiseman, 2015</p> | |
| <p>None Years: 5 years (Publication dates of 2011-2016)</p> | <p>“The Listening Program (TLP)”</p> | <p>19/10 Blum, 2015 Francis & Banai, 2011 Gee, Devine, Werth, & Phan, 2013 Gee, Thompson, & John, 2014 Gee, Thompson, Pierce, Toupin, & Holst, 2015 Lucker, 2012 Lucker & Doman, 2015 Vargas & Lucker, 2016 Villasenor & Vargas-Colon, 2012 Wiseman, 2015</p> | <p>November 14, 2016</p> |
| <p>None Years: Unlimited</p> | <p>“Rehabilitation” AND “The Listening Program (TLP)”</p> | <p>18/7 Blum, 2015 Bonelli, Christman, & Tree, 2016 Francis & Banai, 2011</p> | <p>November 14, 2016</p> |

| | | | |
|-----------------------------|---|---|----------------------|
| | | Gee, Devine, Werth, & Phan, 2013 Gee, Thompson, & John, 2014 Gee, Thompson, Pierce, Toupin, & Holst, 2015 Hoffmann, 2010 | |
| None Years: Unlimited | “Auditory Integration” AND “The Listening Program (TLP)” | 8/5 Blum, 2015 Gee, Devine, Werth, & Phan, 2013 Hoffmann, 2010 Lucker, 2012 Nwora & Gee, 2009 | November 14, 2016 |
| None Years: Unlimited | “Disorders” AND “Music Therapy” AND “The Listening Program (TLP)” | 7/3 Blum, 2015 Francis & Banai, 2011 Nwora & Gee, 2009 | November 14, 2016 |

Summary of 5 BEST Research Articles

Some of the best research articles I found in this search were also included in my PSYCInfo database search (ex: Nwora & Gee, 2009/Vargas & Lucker, 2016) so I did not include them in this list or the APA references in order to find 10 total resources.

1. Blum, S. S. (2015)

Some children have difficulty communicating due to a lack of age-appropriate language and social skills. Researchers have explored how music and language share features that shape language processing. The purpose of this interpretive phenomenological analysis was to explore the experiences of caregivers of preschool children who participated in a music-based program and to understand their perspectives related to children's language and social skill development. Learning style and sensory integration processing theories were used as framework to provide foundations of skills in this study. Research questions addressed caregivers' choices related to

this program for their children, their experiences of their children's participation in the program, and how the caregivers perceive their children's language and social skills change as they participated in the program. Data from 8 participants were collected using narrative journals and interviews and were analyzed by identifying relationships and themes. Identified themes included the importance of choice of quality music program, improved language skills, improved social skills, and improvement in other areas. Caregivers reported that their children's language and social skills developed in the early weeks of participation in The Listening Program. Primary recommendations included providing opportunities to educate other parents and professionals about the benefits of music-based programs. Contributions to positive social change include the value of music-based programs as a complementary technique to aid language and social skill development in preschool aged children, and that children who participate become more effective communicators and interact more appropriately with others.

2. Francis, H., & Banai, K. (2011)

Background: 'The Listening Program' (TLP), a commercially available music-based auditory stimulation technique, claims to positively affect behaviour and learning in people with autism and dyslexia through targeting auditory processing difficulties. The author investigated changes in mood (calm vs anxious), attention to task, and person engagement in young people with profound and multiple learning difficulties (including auditory processing deficit) who participated in TLP. These behaviours were also examined following exposure to regular classical music.

Methods: In a multiple single case study twelve participants aged 9-19 years completed TLP plus a shorter placebo regular classical music cycle. Assessment procedures included video recording,

observational checklists, the school's 'Profound Education' Curriculum, and a post-study questionnaire for carers.

Results: Greater indications of positive change were seen in attention to task and person engagement after TLP than with regular music. These positive changes were more apparent in participants with sensory processing difficulties, particularly those with Rett Syndrome. Participants with predominantly motor impairment (cerebral palsy) did not show measurable change. Some improvement in mood was observed following both regular classical music and TLP for those with sensory processing difficulty. Conclusions: The challenge posed by carrying out studies with this client group is addressed and decision making for subsequent clinical practice is examined.

3. Gee, B., Thompson, K., Pierce, A., Toupin, M., & Holst, J. (2015).

Background/Aim: The Listening Program (TLP) is a sound-based intervention that claims to treat the behavioural challenges of children diagnosed on the autism spectrum with sensory processing difficulties. There is a paucity of peer-reviewed evidence supporting its use. The purpose of this study was to determine whether TLP reduces sensory over-responsivity (SOR) to auditory stimuli.

Methods: Data were collected over a 28-week period using an ABAB multiple events case-control design of testing and treatment intervals to capture the responses of three participants to TLP.

Results: Graphs from repeated measures data were drawn to analyse the direction and level of trend lines. There was a high variability of responses, with participants responding positively and others negatively at different stages of the study.

Conclusions: The results lend some support to the use of TLP with children on the autism spectrum who are experiencing auditory SOR.

4. Esteves, J., Stein-Blum, S., Cohen, J., & Tischler, A. (2009)

The Listening Program® (TLP) is a music-based auditory stimulation method. The program is used as a safe and effective method that gently trains the auditory system to process sounds for improved listening, learning, attention, and communication. The program is also used in providing advanced auditory training to the ear and the brain through systematic delivery of psychoacoustically modified music. According to therapists qualified in the application of the program, areas of commonly reported change include: attention and concentration, listening and auditory processing, speech and language, memory, social skills, reading, sensory processing, self-regulation, balance and coordination, vocal performance and musical ability, organization and planning skills, self confidence and motivation. The pilot study was developed to determine the effectiveness of The Listening Program® (TLP) on children who present with sensory processing disorder (SPD) and auditory processing concerns.

5. Lucker, J. R., & Doman, A. (2015)

Professionals working with children diagnosed with autism spectrum disorder (ASD) may find that these children are overly sensitive to sounds. These professionals are often concerned as to why children may have auditory hypersensitivities. This review article discusses the neural mechanisms identified underlying hypersensitive hearing in people. The authors focus on brain research to support the idea of the nonclassical auditory pathways being involved in connecting the auditory system with the emotional system of the brain. The authors also discuss brain mechanisms felt to be involved in auditory hypersensitivity. The authors conclude with a

discussion of some treatments for hypersensitive hearing. These treatments include desensitization training and the use of listening therapies such as The Listening Program.

Database: OT Search and OT Seeker.***Preparing for Search Process for OT Search.***

- a. Sound-based intervention and auditory processing are two Mesh headings that yield different results; keep this in mind when searching. They are not synonymous.
- b. Simply typing in “the listening program” yielded only eight results within OT Search. Typing in “advanced brain technologies” yielded zero results within OT Search.
- c. Many articles available include a study that included listening and/or a program, but do not pertain to “the listening program.” Be aware of that the phrase “the listening program” generalizes all studies that included.
- d. Due to the low number of articles available for “the listening program” no filters will be necessary.
- e. Boolean Logic Terms Tried: ‘AND.’
- f. If I try typing in “the listening program into OT Seeker’s search box, an error occurs every time; I am unable to search “the listening program” as a journal article title or within the content matter.
- g. Typing in “listening program” yields only four articles within OT Seeker and none of them pertain to “the listening program.”
- h. Term List for Searches: “Adolescent” [Mesh], “Auditory” [Mesh], Auditory Processing [Mesh], “Rehabilitation” [Mesh], “Sound-based intervention” [Mesh], “Autism Spectrum Disorder” [Mesh], “Listening Program” [words or phrases]

| Filters / Years | Keywords | Total Yield / Relevant Hits | Date Accessed |
|-----------------------------|---|---|---------------|
| None Years: Unlimited | “Adolescent” [Mesh] AND “Auditory” [Mesh] | 824 / - Try to narrow focus | Nov. 14, 2016 |
| None Years: Unlimited | “Auditory Processing” [Mesh] AND “Rehabilitation” [Mesh] | 4/1 Schoen, Miller, & Sullivan, 2015 | Nov. 14, 2016 |
| None Years: Unlimited | “Sound-based intervention” [Mesh] AND “Autism Spectrum Disorder” [Mesh] | 1/1 Gee, Thompson, & St John, 2014 | Nov. 14, 2016 |
| None Years: Unlimited | “The Listening Program”[Words or Phrases] | 8/3 Nwora & Gee, 2009 Other two citations already listed above | Nov. 14 2016 |

Summary of Five Best Research Articles.

1. Gee, B. M., Thompson, K., & St John, H. (2014)

Sound-based interventions (SBIs) are being used by pediatric occupational therapists to help children with autism spectrum disorders and co-morbid sensory processing disorders. A limited yet growing body of evidence is emerging related to the efficacy of SBIs in reducing sensory processing deficits among pediatric clients with co-morbid conditions. The current study employed an ABA single-subject case-controlled design, implementing The 7-year-old child diagnosed with autism spectrum disorder who demonstrated auditory sensory over-responsivity (SOR). The intervention consisted of 10 weeks of psycho-acoustically modified classical music that was delivered using specialized headphones and amplifier and a standard CD player. Repeated measures were conducted during the A(1), B and A(2) phases of the study using the Sensory Processing Measure, a subjective caregiver questionnaire, and the Sensory Over-Responsivity Scales, an examiner-based assessment measure to track changes of the participant’s

auditory SOR-related behaviors. The results indicated that the participant exhibited a decrease in the number of negative (avoidant, verbal and physical negative) and self-stimulatory behaviors. The decreases in negative and self-stimulatory behavior may have been due to the therapeutic effect of the repeated exposure to the Sensory Over-Responsivity Scales or The Listening Program SBI.

2. Nwora, A., & Gee, B. (2009)

The aim of this study was to determine the efficacy of The Listening Program (TLP) in treating a child with pervasive developmental disorder-not otherwise specified (PDD-NOS). Using a single-subject case study design, one child with PDD-NOS was administered a 20-week TLP intervention focused on improving sensory processing and language function. Data collection included pre- and post-evaluations using video footage, and Sensory Profile and Listening Checklist questionnaires. Results of the study indicated improved behavior and sensory tolerance in the post-intervention video footage, including active participation in singing and movements to song. Sensory Profile and Listening Checklist questionnaires indicated significant improvements in sensory processing, receptive/expressive listening and language, motor skills, and behavioral/social adjustment at the post-intervention assessment. Although small in scope, this study highlights the need for continued research by occupational therapists into sound-based interventions. Particularly, occupational therapists need to perform larger-scale studies utilizing TLP to verify the efficacy of this alternative treatment method.

3. Schoen, S. A., Miller, L. J., & Sullivan, J. (2015, July/August).

This pilot study explored the effects of Integrated Listening Systems (iLs) Focus Series on individualized parent goals for children with sensory processing impairments. A nonconcurrent multiple baseline, repeated measure across participants, single-case study design

was employed ($n = 7$). The 40-session intervention was delivered at home and in the clinic.

Individualized family goals served as the repeated measure. Exploratory analyses included the evaluation of physiological arousal. Participants showed improvement in home and education-related goals. Changes in physiologic arousal were noted in five of seven participants.

Standardized scales demonstrated sensitivity to change. Thus, the iLS program may be beneficial for school- or clinic-based intervention.

Preparing for Search Process for OT Seeker.

- a) Typing in the term of “Listening Program” resulted in four hits with none of them concerning the targeted The Listening Program.
- b) I then tried using “Sound-Based Intervention” [Mesh] as a term, resulted in ten hits but none of the articles were applicable to our search/
- c) I used the two terms “Adolescent” [Mesh] AND “Auditory Intervention” [Mesh] and it resulted with zero hits.
- d) I did not use any filters for my search due to the already low number of applicable hits.
- e) Term List for Searches: (“Sound-Based Intervention” [Mesh], “Adolescent” [Mesh], “Auditory Intervention” [Mesh], “Listening Program” [words or phrases]

Summarizing a Strategic Search Process for OT Seeker

| Filters / Years | Keywords | Total Yield / Relevant Hits | Date Accessed |
|-----------------------------|--|-----------------------------|------------------|
| None Years: Unlimited | “Sound-Based Intervention” [Mesh] | 10 / 0 | Nov. 14, 2016 |
| None Years: Unlimited | “Listening Program” [words or phrases] | 4 / 0 | Nov. 14, 2016 |

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| None Years: Unlimited | “Adolescent” [Mesh] AND “Auditory Intervention” [Mesh] | 0 / 0 | Nov. 14, 2016 |
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*****NOTE: Due to there being no relevant articles found in my search, no abstracts were obtained for review.**

Appraisal of Evidence

Initial appraisal of evidence: Primary Research Studies.

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| Type of article | Overall Type: Primary Research Study Specific Type: A Single-Subject Controlled Design |
| APA Reference | Gee, B. M., Thompson, K., & St John, H. (2014). Efficacy of a sound-based intervention with a child with an autism spectrum disorder and auditory sensory over-responsivity. <i>Occupational Therapy International</i> , 21(1), 12-20. doi:10.1002/oti.1359 |
| Abstract | Sound-based interventions (SBIs) are being used by pediatric occupational therapists to help children with autism spectrum disorders and co-morbid sensory processing disorders. A limited yet growing body of evidence is emerging related to the efficacy of SBIs in reducing sensory processing deficits among pediatric clients with co-morbid conditions. The current study employed an ABA single-subject case-controlled design, implementing The 7-year-old child diagnosed with autism spectrum disorder who demonstrated auditory sensory over-responsivity (SOR). The intervention consisted of 10 weeks of psycho-acoustically modified classical music that was delivered using specialized headphones and amplifier and a standard CD player. Repeated measures were conducted during the A(1), B and A(2) phases of the study using the Sensory Processing Measure, a subjective caregiver questionnaire, and the Sensory Over-Responsivity Scales, an examiner-based assessment measure to track changes of the participant's auditory SOR-related behaviors. The results indicated that the participant exhibited a decrease in the number of negative (avoidant, verbal and physical negative) and self-stimulatory behaviors. The decreases in negative and self-stimulatory behavior may have been due to the therapeutic effect of the repeated exposure to the Sensory Over-Responsivity Scales or The Listening Program SBI. |
| Author | Credentials: Bryan M. Gee - PhD(c), MEd, OTR/L, BCP Position and Institution: Associate Professor, Program Director, and Assistant Department Chair of Department of Physical and Occupational Therapy, Idaho State University Publication History in Peer-Reviewed Journals: Moderate |
| Publication | Type of Publication: Scholarly Peer-Reviewed Journal Publisher: John Wiley & Sons, Inc. Other: Wiley Online Journal |
| Date and Citation History | 2014 Cited By: 4 |

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| Stated Purpose or Research Question | “There is a paucity of peer-reviewed evidence supporting the use of TLP with children diagnosed with ASD; most information is anecdotal at the time of this study. In a single case study, Nwora and Gee (2009) reported mild to moderate improvement in behavioral and sensory tolerance in a 5-year-old child with pervasive developmental disorder using TLP. The improvements were determined by comparing pre-data and post-data through the Sensory Profile, the Listening Checklist and clinical observations. Thus, the purpose of this study was to determine if a 10-week sound-based auditory stimulation method reduced SOR to auditory stimuli and decreased self-stimulatory behavior in a child diagnosed with an ASD.” (p. 14) |
| Author’s Conclusion | “The purpose of this study was to determine if a 10-week sound-based auditory stimulation method reduced SOR to auditory stimuli and decreased self-stimulatory behavior in a child diagnosed with ASD. The results of this case study have several implications that may inform pediatric occupational therapy practice. The participant’s performance on the SensOR Scales was not an indicator of an overall improvement in auditory SOR.” (p. 17) |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: This specific research study looked into “The Listening Program” in children, which is related to what our PICO is looking into (P = Pediatrics, I = The Listening Program) |
| Overall Quality | Overall Quality of the Article: Good Rationale: This article was published only two years ago and contains its own limitations section, which is detailed and thorough. |
| Type of article | Overall Type: Primary Research Study Specific Type: A Single-Subject Case Study |
| APA Reference | Nwora, A., & Gee, B. (2009). A case study of a five-year-old child with pervasive developmental disorder-not otherwise specified using sound-based interventions. <i>Occupational Therapy International</i> , 16(1), 25-43. doi:10.1002/oti.263 |
| Abstract | The aim of this study was to determine the efficacy of The Listening Program (TLP) in treating a child with pervasive developmental disorder-not otherwise specified (PDD-NOS). Using a single-subject case study design, one child with PDD-NOS was administered a 20-week TLP intervention focused on improving sensory processing and language function. Data collection included pre- and post-evaluations using video footage, and Sensory Profile and Listening Checklist questionnaires. Results of the study indicated improved behavior and sensory tolerance in the post-intervention video footage, including active participation in singing and movements to song. Sensory Profile and Listening Checklist |

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| | questionnaires indicated significant improvements in sensory processing, receptive/expressive listening and language, motor skills, and behavioral/social adjustment at the post-intervention assessment. Although small in scope, this study highlights the need for continued research by occupational therapists into sound-based interventions. Particularly, occupational therapists need to perform larger-scale studies utilizing TLP to verify the efficacy of this alternative treatment method. |
| Author | Credentials: Amy Nwora - PhD & OTR Position and Institution: Director of Health Professions and Associate Professor in Occupational Therapy at D'Youville College in New York Publication History in Peer-Reviewed Journals: 1 |
| Publication | Type of Publication: Scholarly Peer-Reviewed Journal Publisher: John Wiley & Sons, Inc. Other: Wiley Online Journal |
| Date and Citation History | Date of publication: 2009 Cited By: 26 |
| Stated Purpose or Research Question | “This study used a single-subject case study design to determine the efficacy of TLP on overall sensory performance and receptive/expressive language. As sound-based intervention’s effects on sensory processing have only been minimally investigated from an occupational therapy (OT) standpoint, it was determined that a single case could be broken down to determine both the efficacy and the need for future research.” (p. 29 - 30) |
| Author’s Conclusion | “Results of the study indicated improved behaviour and sensory tolerance in the post-intervention video footage, including active participation in singing and movements to song.” (p. 37) |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: This article is very relevant to our PICO due to it assessing “The Listening Program” with a child with a developmental disorder to improve sensory tolerance. |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: This article was published recently (2009) and has a thorough methods section. One critique would be the non-existence of a limitations section. |

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| Type of article | Overall Type: Primary Research Study Specific Type: Pilot Case Study |
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| APA Reference | Schoen, S. A., Miller, L. J., & Sullivan, J. (2015). A pilot study of integrated listening systems for children with sensory processing problems. <i>Journal of Occupational Therapy, Schools, & Early Intervention</i> , 8(3), 256-276. doi:10.1080/19411243.2015.1055418 |
| Abstract | This pilot study explored the effects of Integrated Listening Systems (iLs) Focus Series on individualized parent goals for children with sensory processing impairments. A nonconcurrent multiple baseline, repeated measure across participants, single-case study design was employed (n = 7). The 40-session intervention was delivered at home and in the clinic. Individualized family goals served as the repeated measure. Exploratory analyses included the evaluation of physiological arousal. Participants showed improvement in home and education-related goals. Changes in physiologic arousal were noted in five of seven participants. Standardized scales demonstrated sensitivity to change. Thus, the iLs program may be beneficial for school- or clinic-based intervention. |
| Author | Credentials: Sarah A Schoen - Ph.D, OTR Position and Institution: Associate Director of Research at Sensory Processing Disorder Foundation. Previously taught in the Occupational Therapy department at New York University. Publication History in Peer-Reviewed Journals: 2 |
| Publication | Type of publication: Scholarly Peer-Reviewed Journal Publisher: Taylor & Francis Group, LLC Other: Published in <i>Journal of Occupational Therapy, Schools, & Early Intervention</i> |
| Date and Citation History | Date of publication: 2015 Cited By: 0 |
| Stated Purpose or Research Question | “Thus, the primary aim of this pilot study was to explore the effects of a newly developed auditory program, known as Integrated Listening Systems (iLs).” (p. 258) |
| Author’s Conclusion | “This pilot study provides preliminary evidence that the iLs program is effective in ameliorating conditions for some of the children with sensory over-responsivity and auditory processing impairments. Notable changes were reported in parent-developed individualized child goals such as following directions, completing daily tasks (e.g., homework, morning routine, putting away belongings) in a timely manner, and reducing emotional outbursts— problems that affect functioning at home and school.” (p. 269) |

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| Overall Relevance to PICO | Overall Relevance to PICO: Limited Rationale: Though this article touches on auditory processing with children, this article does not discuss “The Listening Program.” |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: This article has a detailed methods section and includes a thorough limitations section. This article was also published very recently (2015). |

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| Type of article | Overall Type: Primary Research Study Specific Type: Multiple Single Case Study |
| APA Reference | Francis, H., & Banai, K. (2011). [Commentary on] Effects of 'The Listening Program' on children with profound and multiple learning difficulties. <i>International Journal Of Therapy & Rehabilitation</i> , 18(11), 611-621. doi: 10.12968/ijtr.2011.18.11.611 |
| Abstract | <p>Background: 'The Listening Program' (TLP), a commercially available music-based auditory stimulation technique, claims to positively affect behaviour and learning in people with autism and dyslexia through targeting auditory processing difficulties. The author investigated changes in mood (calm vs anxious), attention to task, and person engagement in young people with profound and multiple learning difficulties (including auditory processing deficit) who participated in TLP. These behaviours were also examined following exposure to regular classical music.</p> <p>Methods: In a multiple single case study twelve participants aged 9-19 years completed TLP plus a shorter placebo regular classical music cycle. Assessment procedures included video recording, observational checklists, the school's 'Profound Education' Curriculum, and a post-study questionnaire for carers.</p> <p>Results: Greater indications of positive change were seen in attention to task and person engagement after TLP than with regular music. These positive changes were more apparent in participants with sensory processing difficulties, particularly those with Rett Syndrome. Participants with predominantly motor impairment (cerebral palsy) did not show measurable change. Some improvement in mood was observed following both regular classical music and TLP for those with sensory processing difficulty.</p> <p>Conclusions: The challenge posed by carrying out studies with this client group is addressed and decision making for subsequent clinical practice is examined.</p> |
| Author | <p>Credentials: Helen Francis, SLT (UK)</p> <p>Position and Institution: Specialist SLT, The School for Profound Education, The Children's Trust, Tadworth, UK</p> <p>Publication History in Peer-Reviewed Journals: Limited</p> |
| Publication | <p>Type of publication: Scholarly Peer-Reviewed Journal</p> <p>Publisher: MA Healthcare Limited (International Journal of Therapy & Rehabilitation)</p> <p>Other: Interdisciplinary journal; Discuss multiple aspects within rehabilitation</p> |

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| Date and Citation History | 2011 Cited By: 4 |
| Stated Purpose or Research Question | “The aim of this study was to examine whether the claims that TLP improves behavioural outcome in (i) increased attention, concentration and engagement, and (ii) decreased anxiety in children with autism and dyslexia, could also be demonstrated in learners with PMLD. An additional aim was to begin to look at the effect of TLP versus regular classical music on those behaviours.” (p. 613) |
| Author’s Conclusion | “This study of a clinical practice used with learners with PMLD suggests that regular, consistent exposure to this commercially available musical auditory stimulation programme had a positive effect for most (8/10) participants. Trends indicated that TLP itself had a beneficial effect on increasing engagement and decreasing anxiety in learners with PMLD. There are also indications that participants with underlying sensory processing difficulties may benefit most from TLP.” (p. 619-620) |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: Partially related to the O (executive functioning: attention/concentration), but the focus of P was individuals with profound and multiple learning difficulties (PMLD) rather than solely ASD. It specifically used TLP (I) and no C group was given in this study. |
| Overall Quality | Overall Quality of Article: Good Rationale: Published within the last 5 years in a scholarly, peer-reviewed journal. Article contains a detailed methods section. |

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| Type of article | Overall Type: Primary Research Study Specific Type: Pre- to Post- Case Study |
| APA Reference | Esteves, J., Stein-Blum, S., Cohen, J., & Tischler, A. (2009). Identifying the effectiveness of a music-based auditory stimulation method, on children with sensory integration and auditory processing concerns: a pilot study. In R. Haas & V. Brandes (Eds.), <i>Music that works: Contributions of biology, neurophysiology, psychology, sociology, medicine and musicology</i> (pp. 321-328). New York, New York: Springer Wien. |
| Abstract | The Listening Program® (TLP) is a music-based auditory stimulation method. The program is used as a safe and effective method that gently trains the auditory system to process sounds for improved listening, learning, attention, and communication. The program is also used in providing advanced auditory training to the ear and the brain through systematic delivery of psychoacoustically modified music. According to therapists qualified in the application of the program, areas of commonly reported change include: attention and concentration, listening and auditory processing, speech and language, memory, social skills, reading, sensory processing, self- regulation, balance and coordination, vocal performance and musical ability, organization and planning skills, self confidence and motivation. The pilot study was developed to determine the effectiveness of The Listening Program® (TLP) on children who present with sensory processing disorder (SPD) and auditory processing concerns. |
| Author | Credentials: John Esteves, OTR/L, TLP CP-BC Position and Institution: Occupational Therapist, Advanced Pediatric Systems Clinic; Margate, Florida Publication History in Peer-Reviewed Journals: Limited |
| Publication | Type of publication: Tertiary Source - Textbook (Music that works) Publisher: Springer Wein, New York |
| Date and Citation History | 2009 Cited By: 4 |
| Stated Purpose or Research Question | “The pilot study was developed to determine the effectiveness of The Listening Program® (TLP) on children who present with sensory processing disorder (SPD) and auditory processing concerns.” (p. 321) |
| Author’s Conclusion | “As demonstrated by the scores taken from pre-TLP and post-TLP testing, compared to scores taken prior to the start of the program base/pre-testing (4 children receiving services at APS): there was a significant improvement in the progress made by all the children who completed the program, as |

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| | <p>compared to just therapy alone. This demonstrated that The Listening Program is effective in helping increase functional skills and outcomes in children who present with sensory integration and auditory processing concerns, when used along with skilled therapies to help achieve maximum potential and independence in everyday tasks/skills.” (p. 328)</p> |
| <p>Overall Relevance to PICO</p> | <p>Overall Relevance to PICO: Strong Rationale: Moderately related to P as it looked at SPD (in which some diagnoses included ASD). Directly related to the O (executive functioning: attention/comprehension and communication/social skills), but also looked at fine/gross motor functioning. Used TLP (I) for the study, but did not use a C group.</p> |
| <p>Overall Quality</p> | <p>Overall Quality of Article: Poor Rationale: Book was published within the past 10 years and contains a detailed methods section within the study, but it was not published in a scholarly journal.</p> |

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| Type of article | Overall Type: Primary Research Study Specific Type: ABAB multiple events case–control design; Pilot Study |
| APA Reference | Gee, B., Thompson, K., Pierce, A., Toupin, M., & Holst, J. (2015). The effectiveness of auditory stimulation in children with autism spectrum disorders: A case–control study. <i>International Journal of Therapy and Rehabilitation</i> , 22(1), 36-46. |
| Abstract | <u>Background/Aim:</u> The Listening Program (TLP) is a sound-based intervention that claims to treat the behavioural challenges of children diagnosed on the autism spectrum with sensory processing difficulties. There is a paucity of peer-reviewed evidence supporting its use. The purpose of this study was to determine whether TLP reduces sensory over-responsivity (SOR) to auditory stimuli. <u>Methods:</u> Data were collected over a 28-week period using an ABAB multiple events case–control design of testing and treatment intervals to capture the responses of three participants to TLP. <u>Results:</u> Graphs from repeated measures data were drawn to analyse the direction and level of trend lines. There was a high variability of responses, with participants responding positively and others negatively at different stages of the study. <u>Conclusions:</u> The results lend some support to the use of TLP with children on the autism spectrum who are experiencing auditory SOR. |
| Author | Credentials: Bryan M. Gee, PhD, OTR/L, BCP Position and Institution: Associate Professor; Department of Physical & Occupational Therapy, Idaho State University, Pocatello, Idaho, USA Publication History in Peer-Reviewed Journals: Moderate |
| Publication | Type of publication: Scholarly Peer-Reviewed Journal Publisher: MA Healthcare Limited (International Journal of Therapy & Rehabilitation) Other: Interdisciplinary journal; Discuss multiple aspects within rehabilitation |
| Date and Citation History | 2015 Cited By: 0 |
| Stated Purpose or Research Question | “This study aimed to determine whether the use of a sound-based intervention (TLP) would reduce SOR (sensory over-responsivity) to auditory stimuli in three children who had been diagnosed with ASD and auditory SOR.” (p. 38) |

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| Author's Conclusion | “While the results are mixed, the positive trends that emerged from each case provide evidence that TLP may be a valuable intervention for children with ASD and auditory sensory processing difficulties. Additional and more rigorous research must be conducted into using TLP for individuals with ASD. Therapists must also continue to scrutinise such interventions and their appropriateness given factors such as the best available evidence, client factors, contextual elements and financial resources.” (p. 45) |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: Directly targeted ASD (P), but specifically those experiencing SOR. The O looked at reduction of auditory SOR using TLP (I). No C group in this study. |
| Overall Quality | Overall Quality of Article: Good Rationale: Author has a moderate publication history and the study is in a credible, scholarly journal containing up-to-date information, but the article currently has no citation history. |

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| Type of article | Overall Type: Primary Research Study Specific Type: Empirical, Pilot Study (Still waiting on article for full methods section) |
| APA Reference | Jeyes, G., & Newton, C. (2010). Evaluation of The Listening Program in assessing auditory processing and speech skills in children with Down syndrome. <i>Music and Medicine</i> , 2(4), 208-213. |
| Abstract | It is well documented that children with Down syndrome have difficulty with auditory processing and language development. This pilot study was undertaken to trial tests and questionnaires for suitability for use with the children to determine if any benefit could be established from the use of The Listening Training Program as a prelude to a more formal study. Nine children between the ages of 5 and 12 years took part acting as their own controls. They used The Listening Program over a 10-week period, and this involved each child listening to acoustically modified music, through headphones, for two 15-min sessions, 5 days a week, over 10 weeks. A battery of tests, recommended by specialists in speech and language and human communication, were performed before and after intervention, and questionnaires were completed at the end by parents and teachers involved. Because the children are educated in a variety of settings, mainstream, special school, and part time in both, the testing took place on a Saturday and the children were drawn from the Down Support Group, Nottingham. Where possible, the Program was implemented in school, but where this was not possible, it was undertaken in the home setting. |
| Author | Credentials: Gwyneth Jeyes, M.Ed. in Educational Psychology/Special Needs; TLP Provider Position and Institution: Chuter Ede County Primary School, Nottinghamshire, United Kingdom Publication History in Peer-Reviewed Journals: Minimal |
| Publication | Type of publication: Scholarly Peer-Reviewed Journal Publisher: The International Association for Music & Medicine (Music and Medicine); SAGE Publications |
| Date and Citation History | 2010 Cited By: 3 |
| Stated Purpose or Research Question | “This pilot study was undertaken to trial tests and questionnaires for suitability for use with the children to determine if any benefit could be established from the use of The Listening Training Program as a prelude to a more formal study.” (p. 209) |

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| Author's Conclusion | “The children on the study have shown improvements from the use of the program in that they have clearer speech, more extensive vocabulary, and they are using a greater number of words which are more effectively sequenced.” (p. 212) |
| Overall Relevance to PICO | <p>Overall Relevance to PICO: Moderate</p> <p>Rationale: Targeted to a different P (Down syndrome, not ASD), but the participants used TLP (I), and the participants acted as their own C group. The outcomes (O) looked at communication skills and auditory processing.</p> |
| Overall Quality | <p>Overall Quality of Article: Good</p> <p>Rationale: Author has minimal research history, but the article was published in a scholarly journal within the past 10 years.</p> |

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| Type of article | Overall Type: Primary Research Study Specific Type: Empirical Case Study |
| APA Reference | Villasenor, R., & Vargas-Colon, K. (2012). Using auditory stimulation with students at Lavelle School for the Blind. <i>Journal of Visual Impairment & Blindness</i> , 106(9), 564-567. |
| Abstract | <p>This Practice Perspectives essay describes two students attending the REACH program (in which students are actively preparing for adult roles and responsibilities) at the Lavelle School for the Blind. These two students used The Listening Program (TLP), a music-based auditory stimulation program for students with visual impairments, and they also received occupational and speech therapy and orientation and mobility (O&M) services. Although there were a number of students using TLP at the school, Anna and Larry (pseudonyms) were the only two students within the 2009-2010 school year that were able to complete one cycle of TLP. Improvement in the behavior of each student was reported by their teacher and two service providers, who were interviewed informally. Decreased body rocking, better sitting posture, more verbal communication among peers and teachers, better balance on unstable surfaces, and improved learning ability were reported. Although many factors may impact students' progress in school—including other services like O&M, speech and occupational therapy, school curriculum, classroom environment, growth and development of the student—this positive findings of this essay warrants further study on the use of music-based auditory stimulation with visually impaired students. Integration of TLP into the school curriculum is a necessity in order to ensure daily listening, in addition to use of objective data collection of functional outcomes.</p> |
| Author | Credentials: Romana Villasenor, M. P. H., OTR, Position and Institution: Occupational Therapist, Lavelle School for the Blind; Bronx, New York Publication History in Peer-Reviewed Journals: Limited |
| Publication | Type of publication: Scholarly Peer-Reviewed Journal Publisher: American Foundation for the Blind (Journal of Visual Impairment & Blindness) |
| Date and Citation History | 2012 Cited By: 2 |
| Stated Purpose or Research Question | “This Practice Perspectives essay describes two students attending the REACH program (in which students are actively preparing for adult roles and responsibilities) at the Lavelle School for the Blind who used TLP, while also receiving occupational and speech therapy and orientation and mobility (O&M) services.” (p. 564) |

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| Author's Conclusion | <p>“The results of the use of TLP with two students at Lavelle described in this essay demonstrate that TLP may be positively impact the way in which students process information. In addition, it may improve the learning ability and functional skills of students with visual impairments. TLP can help to facilitate learning and the development of functional skills in a school for individuals with visual impairments and developmental disabilities.” (p. 567)</p> |
| Overall Relevance to PICO | <p>Overall Relevance to PICO: Moderate Rationale: Partially related to the O (sensory processing, attention, and class participation), but focused on a different P (individuals with visual impairments, rather than ASD). Participants used TLP (I) and there was an absence of a C group.</p> |
| Overall Quality | <p>Overall Quality of Article: Poor Rationale: Primary author holds significant credentials, but she has a limited publication history and the study contained a small number of participants. Article included primarily subjective information (informal interview) to gather results without any quantitative data.</p> |

Initial Appraisal: Review of Research Studies.

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| Type of article | Overall Type: Review of Research Study Specific Type: Meta-Analysis |
| APA Reference | Dunn, W., Little, L., Dean, E., Robertson, S., & Evans, B. (2016). The state of the science on sensory factors and their impact on daily life for children. <i>OTJR: Occupation, Participation and Health</i> , 36(2), 3S-26S. doi: 10.1177/1539449215617923 |
| Abstract | The objective of this study was to identify and synthesize research about how sensory factors affect daily life of children. We designed a conceptual model to guide a scoping review of research published from 2005 to October 2014 (10 years). We searched MEDLINE, CINAHL, and PsycINFO and included studies about sensory perception/processing; children, adolescents/young adults; and participation. We excluded studies about animals, adults, and review articles. Our process resulted in 261 articles meeting criteria. Research shows that children with conditions process sensory input differently than peers. Neuroscience evidence supports the relationship between sensory-related behaviors and brain activity. Studies suggest that sensory processing is linked to social participation, cognition, temperament, and participation. Intervention research illustrates the importance of contextually relevant practices. Future work can examine the developmental course of sensory processing aspects of behavior across the general population and focus on interventions that support children's sensory processing as they participate in their daily lives. |
| Author | Credentials: Winnie Dunn - Ph.D Position and Institution: Professor of Occupational Therapy Department Education Publication History in Peer-Reviewed Journals: Extensive |
| Publication | Type of publication: Scholarly Peer-Reviewed Article Publisher: Sage Journals Other: Published in OTJR: Occupation, Participation, and Health |
| Date and Citation History | Date of publication: 2016 Cited By: 1 |
| Stated Purpose or Research Question | "We used a scoping review methodology to map the literature about the relationships among sensory factors and daily life of children. Our purpose was to identify key concepts, determine journals where research is published about related topics, summarize findings, and create an action plan for future research and practice." (p. 4S) |

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| Author's Conclusion | “Studies suggest that sensory processing is linked to social participation, cognition, temperament, and participation. Intervention research illustrates the importance of contextually relevant practices.” (p. 3S) |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: Though it lists “The Listening Program” within the study, it is a meta-analysis and is not the focus of this review. |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: Provides a detailed narrative regarding the selected studies while including a thorough section on insights for future work. |

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| Type of article | Overall Type: Review of Research Studies Specific Type: Evidence-Based Literature Review Project |
| APA Reference | Polatajko, H. J., & Cantin, N. (2010). Exploring the effectiveness of occupational therapy interventions, other than the sensory integration approach, with children and adolescents experiencing difficulty processing and integrating sensory information. <i>American Journal of Occupational Therapy</i> , 64, 415–429. doi: 10.5014/ajot.2010.09072 |
| Abstract | This literature review was completed as part of the Evidence-Based Literature Review Project of the American Occupational Therapy Association to explore the effectiveness of occupational therapy interventions with children and adolescents experiencing difficulty processing and integrating sensory information. This part of the review focused on interventions other than the sensory integration approach. Twenty articles (reporting on 21 studies) met the inclusion criteria. This systematic review found that children with difficulty processing and integrating sensory information and difficulties with the performance of daily occupations can benefit from intervention. However, the great variability that characterizes this literature in terms of populations, interventions, and study quality precludes the formation of any firm conclusions regarding specific approaches. There is an urgent need for well-controlled studies examining the effectiveness of frequently used pediatric occupational therapy interventions with well-defined, homogeneous populations on outcomes that target participation in everyday life. |
| Author | Credentials: Helene J. Polatajko Doctoral, OT(C), OT Reg. (Ont.), FCAOT Position and Institution: Professor, Department of Occupational Therapy, Faculty of Medicine, University of Toronto Publication History in Peer-Reviewed Journals: Extensive |
| Publication | Type of publication: Scholarly peer-reviewed journal Publisher: American Journal of Occupational Therapy |
| Date and Citation History | Date of publication: 2010 Cited By: 45 |
| Stated Purpose or Research Question | “It is our intention in this review to provide a synthesis and appraisal of the evidence reporting on the effectiveness of occupational therapy interventions, other than the sensory integrative approach, with children and adolescents experiencing difficulty processing and integrating sensory information.” (p. 415) |
| Author’s Conclusion | “Taken as a whole, this review can offer the practicing clinician little clarity because the large degree of heterogeneity relative to the small number of studies precludes the formation of any overall conclusion regarding |

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| | intervention. Accordingly, the first and certainly most important finding from this review is that there is an urgent need for well-controlled studies examining the effectiveness of frequently used pediatric occupational therapy interventions with well-defined, homogeneous populations on outcomes that target participation in everyday life. (p. 427) |
| Overall Relevance to PICO | Overall Relevance to PICO: Limited Rationale: PICO: Only one article in the review included The Listening Program (I) and the target population was SPD, not Autism (P). |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: Publication was within last 10 years and it is from a peer-reviewed journal. |

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| Type of article | Overall Type: Review of Research Study Specific Type: Quantitative summary of existing research |
| APA Reference | Vargas, S., & Lucker, J.R. (2016). A quantitative summary of The Listening Program (TLP) efficacy studies: What areas were found to improve TLP intervention? <i>Occupational Therapy International</i> , 23(2), 206-217. doi: 10.1002/oti.1425 |
| Abstract | A quantitative summary of existing research examining the effects of The Listening Program (TLP) on various functions in children is presented. Nine studies were used, looking at TLP intervention effects across studies, within each study and for various outcome measures. The studies looked at TLP intervention on children with autism spectrum disorder, Down syndrome, learning disabilities, auditory processing disorders, attention deficit hyperactivity disorders, Rhetts syndrome, dyspraxia, cerebral palsy, fibromyalgia, arthritis and stroke. The magnitude of the TLP effect size revealed a mean value of 0.41 across all studies. For each individual study, effect size ranged from 0.23 to 1.28. Two studies yielded significantly larger effect size than the other studies. One of these studies (effect size 1.19) examined the improvement in auditory processing for children identified with autism. The other study (effect size 1.28) examined improvement in academically related skills of underachieving school children. Larger effect sizes were obtained for research that examined auditory processing/listening skills (mean effect size 0.72) than for research looking at non-auditory areas (mean effect size 0.31), although all revealed positive changes. The effect size of various outcome measures is discussed in order to identify variables that might affect the outcomes as well as what these results mean to occupational therapists who would consider TLP intervention for clients. Copyright © 2016 John Wiley & Sons, Ltd. |
| Author | Credentials: Sadako Vargas, OTR Position and Institution: Pediatric Occupational Therapist, Tiny Tot Therapy Inc. Scotch Plains, NJ USA Publication History in Peer-Reviewed Journals: Moderate |
| Publication | Type of publication: Peer-reviewed scholarly journal Publisher: Wiley & Sons, Ltd. Other: From Occupational Therapy International |
| Date and Citation History | Date of publication: 2016 Cited By: 0 |
| Stated Purpose or Research Question | (1) “What is the average magnitude effect of TLP intervention? (2) In which functional areas is the largest effect observed following TLP intervention? |

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| | <p>(3) What factors may have influenced the magnitude of the TLP intervention effect?</p> <p>(4) What does the present analysis reveal regarding the needs for future research?" (p. 207)</p> |
| Author's Conclusion | <p>"Overall, when grouping all studies together, the ES was significantly different from zero (e.g. ES of 0.41), which indicates that some improvement was observed in children after completing TLP intervention." (p. 213)</p> |
| Overall Relevance to PICO | <p>Overall Relevance to PICO: Strong</p> <p>Rationale: Directly related to children with autism (P), while looking at differences before and after using TLP (I).</p> |
| Overall Quality of Article | <p>Overall Quality of Article: Moderate</p> <p>Rationale: The credentials of the author are uncertain (addressed as Dr. at the end of the article but clear credentials not listed). One of the authors also has a conflict of interest being that he is on the Scientific Advisory Board of ABT (the creators of TLP).</p> |

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| Type of article | Overall Type: Review of Research Studies Specific Type: Systematic review of literature on Ayres Sensory Integration |
| APA Reference | Watling, R., & Hauer, S. (2015). Effectiveness of Ayres Sensory Integration and sensory-based interventions for people with autism spectrum disorder: A systematic review. <i>American Journal of Occupational Therapy</i> , 69(5), 1-12. doi: 10.5014/ajot.2015.018051 |
| Abstract | This systematic review examines the literature published from January 2006 through April 2013 related to the effectiveness of Ayres Sensory Integration (ASI) and sensory-based interventions (SBIs) within the scope of occupational therapy for people with autism spectrum disorder to improve performance in daily life activities and occupations. Of the 368 abstracts screened, 23 met the inclusion criteria and were reviewed. Moderate evidence was found to support the use of ASI. The results for sensory-based methods were mixed. Recommendations include performing higher level studies with larger samples, using the Fidelity Measure in studies of ASI, and using carefully operationalized definitions and systematic methods in examination of SBIs. |
| Author | Credentials: Renee Watling, PhD, OTR/L, FAOTA Position and Institution: Visiting Assistant Professor, School of Occupational Therapy, University of Puget Sound, Tacoma, WA. Publication History in Peer-Reviewed Journals: Extensive |
| Publication | Type of publication: Scholarly peer-reviewed journal Publisher: AOTA |
| Date and Citation History | Date of publication: 2015 Cited By: 10 |
| Stated Purpose or Research Question | “What is the evidence for sensory integration intervention and SBIs within the scope of occupational therapy practice to improve performance in daily life activities and occupations for children with autism spectrum disorders?” (para. 15) |
| Author’s Conclusion | “Taken together, findings related to SBIs suggest that active participation in multisensory experiences may be more powerful than single-sensory interventions in affecting functional skills and behaviors characteristic of ASD. However, the methodological limitations of the studies (e.g., small sample sizes, lack of blinded evaluation, low-level designs, and limited |

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| | descriptions of the participants and interventions) reduce the certainty of the findings.” (para. 46) |
| Overall Relevance to PICO | Overall Relevance to PICO: Limited Rationale: Directly related to kids with autism (P) and how it impacts their daily lives (O), however the (I) does not include TLP directly, and is much too broad to apply to TLP specifically. |
| Overall Quality of Article | Overall Quality of Article: Moderate Rationale: It is a peer-reviewed article from a scholarly journal, however it has limited participants and has been cited few times. |

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| Type of article | Overall Type: Review of Research Studies Specific Type: Doctoral Dissertation, Interpretative Phenomenological Analysis |
| APA Reference | Blum, S. S. (2015). <i>An interpretative phenomenological analysis of caregivers' support for their preschool children's language and social skills development</i> (Doctoral dissertation). Retrieved from Google Scholar. (1816086864; 2016-26522-284) |
| Abstract | Some children have difficulty communicating due to a lack of age-appropriate language and social skills. Researchers have explored how music and language share features that shape language processing. The purpose of this interpretive phenomenological analysis was to explore the experiences of caregivers of preschool children who participated in a music-based program and to understand their perspectives related to children's language and social skill development. Learning style and sensory integration processing theories were used as framework to provide foundations of skills in this study. Research questions addressed caregivers' choices related to this program for their children, their experiences of their children's participation in the program, and how the caregivers perceive their children's language and social skills change as they participated in the program. Data from 8 participants were collected using narrative journals and interviews and were analyzed by identifying relationships and themes. Identified themes included the importance of choice of quality music program, improved language skills, improved social skills, and improvement in other areas. Caregivers reported that their children's language and social skills developed in the early weeks of participation in The Listening Program. Primary recommendations included providing opportunities to educate other parents and professionals about the benefits of music-based programs. Contributions to positive social change include the value of music-based programs as a complementary technique to aid language and social skill development in preschool aged children, and that children who participate become more effective communicators and interact more appropriately with others. |
| Author | Credentials: Sheri Stein Blum Position and Institution: Walden University, candidate for Doctor of Philosophy, Early Childhood Education Publication History in Peer-Reviewed Journals: Limited |
| Publication | Type of publication: Doctoral Dissertation Publisher: Walden University ScholarWorks |
| Date and Citation History | Date of publication: 2015 Cited By: 0 |

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| Stated Purpose or Research Question | “1. How do caregivers choose a music-based program for their preschool children? 2. How do caregivers of preschool children experience their children’s participation in TLP? 3. How do caregivers of preschool children perceive their children’s language skills as they participate in TLP? 4. How do caregivers of preschool children perceive their children’s social skills as they participate in TLP?” (p. 6) |
| Author’s Conclusion | “1. The caregiver’s selection of a quality of music program played an important role. 2. The participant’s experiences reflect that TLP had a positive impact in the development of their children’s language skills. 3. The participant’s experiences reflect that TLP had a positive impact in the development of their children’s social skills. 4. The participant’s experiences reflect that TLP had a positive impact on other areas in their children’s development.” (p. 88) |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: Directly relates to TLP (I), and quality of life, communication and school performance, which are most of the outcomes (O) in our PICO. However, the population (P) used is broad and does not directly examine children with autism. |
| Overall Quality of Article | Overall Quality of Article: Moderate Rationale: It is not a peer-reviewed scholarly work, however it is a dissertation and it was defended and accepted by a board of scholars. |

Initial Appraisal: Conceptual or Theoretical Article.

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| Type of article | Overall Type: Conceptual or Theoretical Article Specific Type: A Review of Neural Mechanisms Involved With Hyper-sensitive |
| APA Reference | Lucker, J.R., Doman, A. (2015). Neural mechanisms involved in hypersensitive hearing: Helping children with ASD who are overly sensitive to sounds. <i>Autism Research and Treatment</i> . doi: 10.1155/2015/369035 |
| Abstract | Professionals working with children diagnosed with autism spectrum disorder (ASD) may find that these children are overly sensitive to sounds. These professionals are often concerned as to why children may have auditory hypersensitivities. This review article discusses the neural mechanisms identified underlying hypersensitive hearing in people. The authors focus on brain research to support the idea of the nonclassical auditory pathways being involved in connecting the auditory system with the emotional system of the brain. The authors also discuss brain mechanisms felt to be involved in auditory hypersensitivity. The authors conclude with a discussion of some treatments for hypersensitive hearing. These treatments include desensitization training and the use of listening therapies such as The Listening Program. |
| Author | Credentials: Jay R. Lucker - Doctorate Position and Institution: Doctorate in Audiology specializing in neuropsychology of auditory processing, Certified by the American Speech-Language-Hearing Association (ASHS) in Audiology and Speech-Language Pathology Publication History in Peer-Reviewed Journals: Extensive |
| Publication | Type of publication: Scholarly Peer-Reviewed Publisher: Hindawi Publishing Corporation Other: Published in Autism Research and Treatment journal |
| Date and Citation History | Date of publication: 2015 Cited By: 0 |
| Stated Purpose or Research Question | “Lucker and Doman [1] and Lucker [2] discussed the fact that auditory hypersensitivity in children with ASD is more of an emotional based problem than a specific auditory system problem. In these publications, the authors state that underlying auditory hypersensitivity (or oversensitivity to sounds) involves what are called the non-classical auditory pathways and limbic system connections.” (p. 1) |

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| Author's Conclusion | “The underlying theme throughout this paper is that the primary neural mechanisms in hypersensitive hearing involve negative emotional reactions to sound via connections between the auditory system and the limbic system as well as the limbic system and other parts of the body. Research has demonstrated issues involving the auditory system connecting with the limbic system as well as frontal lobe involvement that can contribute to negative emotional reactions.” (p. 7) |
| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: This article has a high amount of relevance to our PICO because it talks about “The Listening Program” and other interventions to aid in hyper-sensitive hearing. |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: Provides a detailed analysis of the auditory pathways and why “The Listening Program” aids in hyper-sensitive hearing. |

Critical Appraisals.

Vargas, S., & Lucker, J.R. (2016). A quantitative summary of The Listening Program (TLP) efficacy studies: What areas were found to improve TLP intervention? *Occupational Therapy International*, 23(2), 206-217. doi: 10.1002/oti.1425

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Wong, C., Odom, S. L., Hume, K. Cox, A. W., Fettig, A., Kucharczyk, S., ... Schultz, T. R. (2013). Evidence-based practices for children, youth, and young adults with Autism Spectrum Disorder. Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, Autism Evidence-Based Practice Review Group.

Therapeutic Listening

Reviewed by: Taylor Heidebrink, Lauren Koelker, & Aimee Lindstrom

Executive Summary

Final EBP question and PICO.

Are selected auditory integration interventions (Therapeutic Listening) used in occupational therapy for individuals with autism spectrum disorder (ASD) effective in improving social participation, school performance, and communication?

Table 1.
PICO table for Therapeutic Listening

| | Keywords (Our Subgroups) | More Broad and Narrow Keywords (General - Total Group) | Keyword synonyms, abbreviations, and spelling variants |
|---|---|--|---|
| P - Patient/Population Problem | Children, school, clinic, | Vulnerable children, children with ASD, children with disabilities, adults with disabilities | Kids, pediatrics, juvenile, adolescent, youth, teenager, teen, teacher, learning deficits, adults |
| I - Intervention | Therapeutic Listening | Audiology, therapy, music therapy, adaptation, sensory integration, auditory integration, listening therapy | Auditory Integration Therapy/Technique/T raining (AIT), OT |
| C - Comparison | Listening therapy | | |
| O - Outcome | Quality of life, school performance, communication, social participation, executive functioning, sleep, brain functionality | Cost of therapies, cost of equipment, degree of training, level of participation, level of independence | ADL, IADL, quality of life, improved auditory/ sensory processing |

Themes.***Origination.***

Sheila Frick is the founder of Vital Links and the creator of Therapeutic Listening (Vital Links, 2016b). Frick is a pediatric occupational therapist and specializes in sensory processing dysfunction, auditory interventions such as Therapeutic Listening, and sensory integration (Vital Links, 2016b). Sheila's husband, Ron, also contributed to her development of Therapeutic Listening as they have both been previously trained in AIT. They created TL to increase the accessibility of auditory interventions in the home setting (Vital Links, 2016b). Frick combined child-specific music with movement and observed improvements in individuals with sensory processing disorder (Vital Links, 2016b).

Vital Links is the organization under which Therapeutic Listening was created and is the primary source of information for this intervention. It is based out of Madison, WI and is home to the private clinic of Sheila Frick (Vital Links, 2016b). Besides Therapeutic Listening, the site offers a variety of other courses including Astronaut Training, Auditory Defensiveness, Designing Sensory Diets, and Vestibular Treatment Perspectives (Vital Links, 2016a). The stated mission of Vital Links is to create and provide effective therapy interventions for a variety of settings and help encourage the professional growth of therapists (Vital Links, 2016b).

Sheila Frick, the founder of TL and Vital Links, posted her own research studies on Vital Links, however these studies, along with others on the site, were not accessible for further review on other databases. Vital Links (2016c) claims their research supports the effectiveness of Therapeutic Listening, but none of these studies exclusively looked at children with autism spectrum disorder (ASD). The designs were weak and the manuscripts were not peer-reviewed (Vital Links, 2016c).

Additionally, out of the multiple research articles we found, three peer reviewed articles, two master's theses, and the case studies completed by Frick were completed by credible and registered/ licensed occupational therapists. Only two of these therapists had prior publications in peer reviewed journals.

Available Evidence.

During our extensive research searches on various databases that include OT search, American Occupational Therapy Association, PubMed, and PsycInfo we were only able to locate three peer-reviewed research articles, of which, two were moderate to strong relevance to Therapeutic Listening as used in OT with individuals with ASD (Bazyk et al., 2010; Hall & Case-Smith, 2007). Both of these articles were pretest and posttest: level III nonrandomized studies and were good quality. These articles were also easily accessible throughout each database. The third peer-reviewed article we found was good quality and was a case report: level V, however it had poor relevance to our PICO question (Shoener et al., 2008). This article discussed TL as used with an individual with ASD, however it was not the primary intervention focused on in this study. We found seven non peer-reviewed articles using the Google Scholar database. These articles were case studies (trade literature) or master's theses/ senior projects (grey literature). These studies were a variety of levels of design types. Two of the studies were poor relevance, three were moderate relevance, and only two were strong relevance. However, only two of these studies were good quality, while the rest of them were poor quality. Both of the two studies that had strong relevance had poor quality (Vital Links, n.d.; & Abbott, 2011). We only found one expert review article, which was a systematic review of Therapeutic Listening by the Wisconsin Department of Health Services. This review showed strong relevance and strong

quality. In the review, researchers classified Therapeutic Listening as a level 5- untested (experimental treatment) and/or potentially harmful (see table 1).

Summary of Evidence.

The three best research studies we looked at had limited gender variance, small sample size, lack of control/placebo group in pre and post tests, lack of follow up, poor data collection, and multiple biases. The multiple biases seen throughout these studies included administration by the parent as a home program, use of co-interventions, short length of duration, contamination in treatment protocol, and memory bias from parents. Two of these sources used Therapeutic Listening as an occupational therapy intervention for children with ASD, however only one of them was peer-reviewed. Additionally, all of the studies stated that there was a change in the outcome when looking at pretest and posttest for participants who received TL. However, because of the chosen research design, no conclusions can be made that TL caused differences in the outcomes. Overall, there is not enough credible evidence to support the use of Therapeutic Listening in OT for children with autism spectrum disorder. Additional research needs to improve these stated gaps and limitations to verify the intervention is effective in improving outcomes.

Expert review table.

Table 2.

Summary of Evidence and Recommendations by Expert Review Groups for Therapeutic Listening

| Review Organization | Summary and Recommendations | Citation and Source |
|--|--|--|
| Wisconsin Treatment Intervention Advisory Committee | Reviewed, limited peer reviewed evidence, not recommended. “Level 5- Untested (Experimental treatment) &/or Potentially Harmful” | Wisconsin Department of Health Services Autism and Other Developmental Disabilities Treatment Intervention Advisory Committee (2015). https://tiac.wisconsin.gov/summary-determinations-regarding-level-evidence.htm |
| Evidence-Based Practices for Children, Youth, and Young Adults with Autism Spectrum Disorder | Not reviewed | Wong, C., Odom, S. L., Hume, K. Cox, A. W., Fettig, A., Kucharczyk, S., ... Schultz, T. R. (2013). <i>Evidence-based practices for children, youth, and young adults with Autism Spectrum Disorder</i> . Chapel Hill: The University of North Carolina, Frank Porter Graham Child Development Institute, Autism Evidence-Based Practice Review Group. http://autismpdc.fpg.unc.edu/sites/autismpdc.fpg.unc.edu/files/2014-EBP-Report.pdf |
| Association for Science in Autism Treatment (ASAT) | Not reviewed | Association for Science in Autism Treatment (n.d.) Treatments in alphabetical order. http://www.asatonline.org/for-parents/learn-more-about-specific-treatments/treatments-in-alphabetical-order/ |
| Cochrane Collaboration | Not reviewed | Cochrane Collaboration (2016). http://www.cochrane.org/ |

| | | |
|---|--|--|
| U.S. Department of Health and Human Services, Centers for Medicare & Medicaid Services. | Not reviewed | U.S. Department of Health and Human Services, Centers for Medicare & Medicaid Services. (2010). Autism spectrum disorders (ASDs) services final report on environmental scan. Retrieved from http://www.impaqint.com/sites/default/files/files/Autism_Spectrum_Disorders.pdf |
| National Autism Center | Not reviewed | National Autism Center (2015). National Standards Project, Phase 2. Retrieved from http://www.nationalautismcenter.org/national-standards-project/phase-2/ |
| American Academy of Pediatrics | Studies of Complementary and Alternative Medicines (CAM) interventions are limited or flawed. Not recommended as an evidence-based intervention. | Myers, S. M., & Johnson, C. P. (2007). Management of children with autism spectrum disorders. <i>Pediatrics</i> , 120(5), 1162-1182. http://pediatrics.aappublications.org/content/pediatrics/120/5/1162.full.pdf |

Background Learning and Evidence Searches**Table of resources.**

Table 3.

Informational Websites and Journal Articles that Address Therapeutic Listening

| Title/Name | Brief Description | Source |
|---|---|---|
| Thesis from Virginia Commonwealth University (2011) | OT graduate student's published thesis Therapeutic Listening with preschool children that have autism spectrum disorder Study across two subjects Explains proposed benefits | https://digarchive.library.vcu.edu/bitstream/handle/10156/3628/Abbott_Robin_MS.pdf?sequence=1 |
| Therapeutic Listening | A developer of Therapeutic Listening Headphone information Target population Clinic website Straightforward information about the intervention | http://sensationalkidsot.com.au/home/therapeutic-listening/ |
| Texas Children's Hospital (2016) | Ranked 4th best children's hospital in U.S. by U.S. News and World Report Easy to read Definition Who it benefits Necessary equipment for therapy | https://www.texaschildrens.org/departments/therapeutic-listening |

| | | |
|---|---|--|
| <p>Therapeutic Listening Evidence Brief</p> | <p>Information from Vital Links Not the most credible being a .com site Many article references to look into Definition and proposed benefits Stories of children's experience with Therapeutic Listening Founder of Therapeutic Listening</p> | <p>http://www.catalysttherapy.com/wp-content/uploads/2012/08/Therapeutic-Listening-Evidence-Based-Brief.pdf</p> |
| <p>American Journal of Occupational Therapy, Volume 61 (2007)</p> | <p>Synthesizes published articles to provide background information and proposed benefits Occupational Therapy oriented Few related articles in following volumes published in AJOT Free to AOTA members Peer reviewed article</p> | <p>American Occupational Therapy Association www.ajot.aota.org</p> |
| <p>Vital Links (2016)</p> | <p>Target population Founders of therapeutic listening Training Proposed benefits/outcomes Recommended frequency/duration Case studies/research</p> | <p>https://vitallinks.com</p> |

Background learning paper one.

This EBP project will focus on Therapeutic Listening in children with autism spectrum disorder (ASD). Background learning on this topic explored components that make up the intervention, proposed benefits of Therapeutic Listening, training required for therapists, appropriate equipment needed for Therapeutic Listening, and the target population in which the intervention is most successful.

Therapeutic Listening is an intervention involving sensory integrative activities to address children's behavior that are related to the autism spectrum disorder. Autism spectrum disorder is a developmental disorder that includes characteristics that vary for every individual (National Institute of Mental Health, 2016). The symptoms vary on the spectrum from mildly impaired to severely disabled (National Institute of Mental Health, 2016). Repetitive behaviors, difficulty communicating and social problems are all common in individuals on the autism spectrum disorder (National Institute of Mental Health, 2016). Therapeutic Listening Therapeutic Listening is a form of auditory integration (Case-Smith, Arbesman, 2008). The intervention involves the auditory system along with sensory systems, which reportedly influences behavior (Vital Links, 2016). This intervention is individualized for clients to meet their goals (Vital Links, 2016). Progressions are made at a pace that works best for the client, and therapists use clinical reasoning to determine the music program that will be most beneficial to their client (Vital Links, 2016).

For individuals with autism spectrum disorder (ASD), the intervention of Therapeutic Listening has proposed benefits that claim to help social and developmental behavior. Children with autism spectrum disorder would reportedly benefit from Therapeutic Listening if they have difficulty with impulsive behavior, communicating, focusing, or following directions among other

problems (Texas Children's Hospital, 2016). Therapeutic Listening claims to improve sensitivities in eye contact, communication skills, and emotional treatment, while the intervention should decrease sensitivities to sound, tantrums, distraction, and irritability (Washington Hospital, 2016). Although therapists, clinics, and hospitals claim Therapeutic Listening is beneficial in children with autism spectrum disorder, a study states that other therapy services in addition to Therapeutic Listening is effective in development for children with developmental disabilities (Bazyk, S., Cimino, J., Hayes, K., Goodman, G., & Farrell, P., 2010).

The developers of Therapeutic Listening designed the intervention for individuals with sensory impairments and behavior challenges. The idea of Therapeutic Listening came from ideas that are implemented in the Tomatis Listening Program, Auditory Integration Training, and Sensory Integrative Framework (Sensational Kids OT, n.d). The developer, Sheila Frick, used her knowledge from working with people with sensory processing disorders (Sensational Kids OT, n.d). Therapeutic Listening "Is designed to enhance the accuracy of sensory information sent from the vestibular-cochlear system of the ear to its multiple connections throughout the nervous system" (Sensational Kids OT, n.d., n.p.). This is believed to improve coordination, visual spatial skills, and emotional responses (Sensational Kids OT, n.d).

Therapists are required to have professional training in order to implement TL in a clinical setting with clients who are believed to benefit from the intervention. There are live and online course options to choose from and fits many types of learning style (Vital Links, 2016). One website reports that highly trained therapists use high quality headphones to provide their clients with the best results (Sensational Kids OT, n.d.). The Therapeutic Listening program is offered by trained therapists in settings that include home, school, childcare, or in a clinic (Sensational Kids OT, n.d.).

This background summary of Therapeutic Listening emphasizes the key components of the intervention and the population it benefits. Developing an understanding of proposed benefits in Therapeutic Listening, the individuality of every therapy session, and equipment needed for an effective therapy session provides a greater awareness regarding the intervention.

Background learning paper two.

This EBP project will focus on the use of Therapeutic Listening as an intervention for sensory processing disorders, specifically autism spectrum disorder. Background learning on this topic explored the definition and origination of Therapeutic Listening, proposed benefits of Therapeutic Listening, the use of Therapeutic Listening for various deficits and settings, and training and equipment required for use.

Definition.

Therapeutic Listening is a sound-based intervention that incorporates developmental and sensory integration techniques (Vital Links, 2016). It claims to use sound patterns to directly stimulate the vestibular-cochlear system and indirectly stimulate the entire nervous system and body as a whole (Vital Links, 2016). Therapeutic Listening uses headphones and a variety of compact discs (CDs) in a prescribed manner along with other sensory activities to provide a holistic treatment approach (Sensational Kids Occupational Therapy (OT), n.d.; Bazyk, Cimino, Hayes, Goodman, & Farrell, 2010). Bazyk et al. (2010) asserts, “The overall intent of Therapeutic Listening is to speed up progress made toward intervention goals” (p. 125). Therapeutic Listening is a sound-based intervention that stems from auditory integration training (AIT) (Case-Smith & Arbesman, 2008).

Origination.

Dr. Alfred Tomatis, an ear, nose, and throat specialist in Europe founded AIT in the mid-1900s (Bazyk et al., 2010). “He viewed the ear as an “integrator” in the structural organization of the nervous system at all levels, especially between the vestibular and auditory systems” (Bazyk et al., 2010, p. 125). In Tomatis’ approach he “required listening to progressively filtered recordings, specifically with sounds rich in high frequencies, to retrain the ear to enhance

focused listening, attention, and language” (Bazyk et al., 2010, p. 125). In 1997 Sheila Frick used Tomatis’ findings to propose the Therapeutic Listening program in the United States for individuals with sensory processing disorders (Bazyk et al., 2010). Frick also founded Vital Links, which is now the main provider of Therapeutic Listening programs (Vital Links, 2016).

Implementation.

Vital Links provides training for therapists to take to get trained on how to implement the Therapeutic Listening program in their practice. The two-day online course costs \$365 (Vital Links, 2016). Therapeutic Listening uses specifically designed headphones and CDs that can be personally purchased from Sensational Kids OT or other therapy vendors (Sensational Kids OT, n.d.). CDs involve music that varies in type, pitch and loudness, and level of complexity in content (Vital Links, 2016). The therapist determines the type and sequence of music, activities completed during listening, and listening times based on each child and their goals (Vital Links, 2016). Typically clients listen to the music twice a day for thirty minutes each (Vital Links, 2016). The CDs used throughout this intervention are replaced every two to three weeks to prevent accommodation (Texas Children’s Hospital, 2016) and are implemented for an average of three to six months (Hall & Case-Smith, 2007). Therapeutic Listening can be implemented in a variety of settings, some of which can include home, clinic, or school settings (Vital Links, 2016).

Target populations.

Therapeutic Listening has been used with a diverse group of individuals having various sensory processing deficits (Sensational Kids OT, n.d.). Client factors that Therapeutic Listening proposes to address include attention, social interaction, transitioning, communicating, following directions, navigating, sequencing, posturing, motor planning, and responding (Vital Links,

2016). It has also been a proposed intervention for individuals that have difficulties with bladder and bowel control, eating, sleeping, level of arousal, sensation, visual perception, and emotional stability (Vital Links, 2016). Sensational Kids OT (n.d.) stated that this intervention is appropriate for specific diagnoses including individuals with autism spectrum disorder, sensory processing disorders, Downs syndrome, and other learning or developmental disorders. Therapeutic Listening is believed to be helpful in improving client factors for these individuals.

Proposed benefits.

Researchers propose that individuals with sensory processing deficits may benefit from Therapeutic Listening in various ways. Bazyk et al. (2010) stated that improvements might be seen in “academic and nonacademic education-related occupations including schoolwork, social participation, play, and activities of daily living” (p. 125). They added that improvements in these areas might lead to increased “attention, organization of behavior, self regulation, refinement and mastery of postural and motor skills, bilateral motor coordination, articulation, emergence of praxis and fine motor skills” (p. 125). Other proposed benefits might include improved toilet training, sleep patterns, visual motor integration, eating habits, and increased interaction with others (Sensational Kids OT, n.d.).

Conclusion.

This background summary of Therapeutic Listening emphasizes how it is used as an intervention in occupational therapy with children with sensory processing disorders, specifically autism spectrum disorder. An understanding of definitions, origination, requirements for use, populations it is used for, and the stated benefits of Therapeutic Listening provide an important context for the project.

Background learning paper three.

The topic of this EBP project is the use of Therapeutic Listening (TL) as an occupational therapy intervention for children with autism spectrum disorder (ASD). Therapeutic Listening is a therapy approach that has gained the interest of many occupational therapists and families over the past few decades. There are many components important to Therapeutic Listening including what it is, where it originated, required training for occupational therapists, necessary equipment for families, the claimed benefits, and who may benefit from the approach.

Therapeutic Listening falls under the category of auditory interventions (Bazyk, Cimino, Hayes, Goodman, & Farrell, 2010). It has been described as a therapy approach rather than a program (Vital Links, 2016). TL claims to use music in addition to sensory integration therapy to directly stimulate and exercise the auditory and vestibular portions of the vestibulo-cochlear system (Sensational Kids Occupational Therapy, n.d.; Texas Children's Hospital, 2016 & Washington Hospital, 2016). TL has electronically altered music, which is believed to stimulate body movement and attention by helping the child hear certain portions of the sound (Cincinnati Children's, 2016 & Texas Children's Hospital, 2016). This intervention has been used during therapy sessions as well as with a home regimen (Hall & Case-Smith, 2007). In-home, it is recommended the child listen with their specialized headphones to the electronically altered music twice per day for no more than 30 minutes each time for about three to six months (Hall & Case-Smith, 2007).

Other listening programs have been around since the mid 1900s, but TL was developed in the 1990's by an occupational therapist named Sheila Frick (Bazyk et al., 2010). She had previously worked with Auditory Integration Therapy (AIT), but stated she wanted to develop Therapeutic Listening as a treatment that families and therapists were better able to access, (Vital

Links, 2016). Frick claimed to focus on how specific music for individual children affected their movements (Vital Links, 2016). Since she founded Therapeutic Listening there are over 14,000 occupational therapists who have been trained in implementing the approach.

The only training found for occupational therapists was through the Vital Links website. The course is called Listening with the Whole Body and is offered online over the course of two days (Vital Links, 2016). The class teaches therapists how to implement Therapeutic Listening, how to create TL programs, the connection of sensory integration with listening, and shows case studies of individuals with sensory and listening problems including those with autism spectrum disorder (Vital Links, 2016). The course costs \$365.00, is about eight hours on both a Saturday and Sunday, includes a quiz at the end of the second day, and has an optional treatment guidelines book at an addition cost of \$49.00 (Vital Links, 2016). The Vital Links website also says that they are approved by AOTA to provide therapists with continuing education and this particular course on Therapeutic Listening gives credit for 12.5 hours or 1.25 AOTA CEUs (Vital Links, 2016). In addition to being costly for occupational therapists to be trained in TL, it is also costly for families with children participating in Therapeutic Listening.

TL requires the use of specialty headphones along with CDs or disks with specialized music of varying frequencies, which are switched out every few weeks (Texas Children's Hospital, 2016). The equipment needed for TL can be bought or rented from some therapy sites. The headphones needed are HD500A Sennheiser stereo headphones (Sensational Kids Occupational Therapy, n.d.). Although there is a cost to therapists and possibly to families as well, there are many claimed benefits of Therapeutic Listening.

There are many perceived benefits for children who use TL. These reported benefits include improvement in communication skills, sleep patterns, eating habits, impulsive behavior,

tantrums, attention, sensory defensive behaviors, visual perception, fine motor skills, movement patterns, following directions, and transitions along with many others (Bazyk et al., 2010; Texas Children's Hospital, 2016; Vital Links, n.d. & Washington Hospital, 2016).

TL appears to be used with a wide variety of disorders and problems in children. Therapeutic Listening has been recommended for individuals with autism spectrum disorder, down syndrome, sensory processing disorders, and attention deficit hyperactivity disorder (Sensational Kids Occupational Therapy, n.d.). Other children who may benefit from LT include those with poor attention, delayed motor skills, planning, or balance, difficulty communicating, poor social skills, irregular behavioral and emotional responses, dysfunctional sleep or eating patterns, difficulties learning, impulsive behaviors, & irregular toilet training just to name a few (Cincinnati Children's, 2016; Texas Children's Hospital, 2016 & Vital Links, n.d.).

The summary of information related to Therapeutic Listening includes the definition, where it started, the required training for occupational therapists, the necessary equipment, the claimed benefits, and who the intervention is used with. These are important components in understanding the use of TL as an auditory integration technique. It is necessary to understand these concepts while further researching this topic.

Evidence searches.

Name of Library and Online Databases: St. Catherine University Library- OT Search

Preparing for Search Process

- a. This library database did not have MeSH headings and instead only had a search bar. The only options for filtering search terms including looking up terms as words or phrases, author names, title, series, etc. I used most of the terms we had identified in our group PICO.
- b. When finding these articles on the database, most of them were “find it” articles that led me to other databases, such as SAGE journals, American Journal of Occupational Therapy (AJOT), and google scholar, in order to find the full text article. Some articles that were “find it” I was not able to access anywhere online. Some of these articles included the articles written by Sheila Frick, the founder of Therapeutic Listening.
- c. This database did not yield many relevant results for this intervention.

Summarizing a Strategic Search Process

| Filters/Years | Keywords | Total Yield / Relevant Hits | Date |
|--|------------------------------------|---|---------------|
| None (Words or phrase) Years: Unlimited | “Effects of Therapeutic Listening” | 1/1 Hall & Case-Smith, 2007 | Nov, 14, 2016 |
| None (Words or phrase) Years: Unlimited | “Therapeutic Listening” | 10/4 Bazyk, 2010 Yancosek, 2011 Frick, 2000 Hall & Case-Smith, 2007 | Nov, 14, 2016 |
| None (Words or phrase) Years: Unlimited | “Auditory Intervention” | 19/0 | Nov, 14, 2016 |

| | | | |
|--|-------------------------------------|--|------------------|
| None (Words or phrase) Years: Unlimited | “Frick” | 8/1 Frick, 2000 | Nov, 14, 2016 |
| None (Words or phrase) Years: Unlimited | “Sensory integration AND listening” | 5/2 Hall & Case-Smith, 2007 Frick, 2000 | Nov, 14, 2016 |
| None (Words or phrase) Years: Unlimited | “Auditory therapy AND autism” | 6/0 | Nov, 14, 2016 |

Summary of 5 BEST Research Articles

Bazyk et al., 2010: A one-group pretest–posttest design was used to measure developmental outcomes in 15 preschoolers receiving Therapeutic Listening in addition to their typical therapy services. Six assessments measuring fine-motor, visual-motor, social, language, and sensory processing were used. Statistically significant improvements were found in all areas except sensory processing and the behavior subtest of the Social Skills Rating System. Proportional Change Index scores indicated an accelerated rate of development in fine-motor, visual-motor, nonverbal ability, and language. Observations from parents, teachers, and therapists were consistent with these results. Findings suggest that the use of Therapeutic Listening in addition to typical therapy services may have a role in supporting the development for children with developmental disabilities.

Hall & Case-Smith, 2007: This study investigated the effects of a sensory diet and therapeutic listening intervention program, directed by an occupational therapist and implemented by parents, on children with sensory processing disorders (SPD) and visual–motor delays. A convenience sample was used of 10 participants, ages 5 to 11 years, with SPD and visual–motor delays. In the first phase, each participant completed a 4-week sensory diet program, then an 8-

week therapeutic-listening and sensory diet program. The Sensory Profile was completed by the participants' parents before and after both study phases. The Draw-A-Person test, Developmental Test of Visual Motor Integration (VMI), and Evaluation Tool of Children's Handwriting (ETCH) were administered before and after each phase. Over 12 weeks, the participants exhibited significant improvement on the Sensory Profile, increasing a mean of 71 points. Parents reported improvements in their children's behaviors related to sensory processing. Scores on the VMI visual and ETCH legibility scales also improved more during the therapeutic listening phase. Therapeutic listening combined with a sensory diet appears effective in improving behaviors related to sensory processing in children with SPD and visual-motor impairments.

Other Evidence Resources: Google Scholar and AJOT

Preparing for Search Process

- a. Many times when searching Google scholar the results would be about other auditory interventions and techniques, such as using music as therapy, the listening program, and AIT. Other results included how to listen effectively in order to therapeutically heal individuals and articles that only included the background information of therapeutic listening.
- b. I found a few other potentially relevant articles, however some of them were not available online for free.
- c. Although Google yielded multiple results, typically there were no relevant articles after p. 2-3.
- d. Many of the articles I found relevant include Master's theses and posters. This made me question if they were peer-reviewed, as it did not say.

e. During my search, I looked for the case studies presented as beneficial on the Vital Links website, the founders and providers of therapeutic listening. I was not able to find many of these articles as some were unpublished and some were not accessible online.

Summarizing Strategic Process

| Filters/Years | Keywords | Total Yield / Relevant Hits | Date |
|--|---|---|---------------|
| None (Articles, including patents) Years: Unlimited | “Effects of Therapeutic Listening Intervention” | 144,000/2 Hall & Case-Smith, 2007 Case-Smith & Arbesman, 2008 | Nov. 14, 2016 |
| None (Articles, including patents) Years: Unlimited | “Therapeutic Listening AND Sheila Frick” | 193/7 Bazyk, 2010 Wilson, Munchua, Buccat, Mousley, & Irao, 2016 Haas & Sequeira Boesch, 2014 Abbott, 2011 Ben-Haim, DeBonis, Schwartz, & Smith-Schwartz, 2015 Frick, 2000 Carroll, Lambert, & Brooks, 2011 | Nov. 14, 2016 |
| None (Articles, including patents) Years: Unlimited | “Auditory Intervention AND Frick” | 2,770/11 Hall & Case-Smith, 2007 Bazyk et al., 2010 Haas & Sequeira Boesch, 2014 Wilcox, 2016 Case-Smith & Arbesman, 2008 | Nov. 14, 2016 |

| | | | |
|--|-------------------------------------|---|---------------|
| | | Harris, 2013 Carroll et al., 2011 Frick, 2000 Ben-Haim et al., 2015 Hall, 2005 Abbott, 2011 | |
| None (Articles, including patents) Years: Unlimited | “Therapeutic listening AND Frick” | 3,440/18 Frick, 2009 Hall & Case-Smith, 2007 Bazyk et al., 2010 Frick, 2002 Frick, Huecker, & Young, 2007 Case-Smith & Arbesman, 2008 Shoener, Kinnealey, & Koenig, 2008 Abbott, 2011 Wilson et al., 2016 Haas & Sequeira Boesch, 2014 Boggs & Fliegel, n.d. Luong, Malloy, & Preto, 2016 Ben-Haim et al., 2015 Sheehy & Brasesco, 2016 Wilcox, 2016 Maddox & Bettendorf, 2009 Hall, 2005 Frick, 2000 Carroll et al., 2011 | Nov. 14, 2016 |
| None (Articles, including patents) | “Sensory integration AND listening” | 115,000/ | Nov. 14, 2016 |

| | | | |
|------------------|--|--|--|
| Years: Unlimited | | Hall & Case-Smith, 2007 Polatajko & Cantin, 2010 | |
|------------------|--|--|--|

Summary of 5 BEST Research Articles or Credible Resources

Abbott, 2011: Auditory sensory differences and sensitivities are often mentioned by parents of children with Autism Spectrum Disorder (ASD), and in research involving children with ASD. Addressing these auditory processing differences is the goal of various auditory treatment techniques, but current research does not yield a body of evidence in support of auditory therapy as a treatment for children with ASD. This study is a single-subject study, repeated across two subjects, to investigate the effect of the Therapeutic Listening program on the social engagement and self-care skills of preschool-aged children with ASD. Both social engagement and self-care skills increased with for both subjects in this study. Also, parental stress associated with the mothers' relationship to their child with ASD decreased. These outcomes indicate the Therapeutic Listening program can be a useful modality in the treatment of children with ASD; one that may improve the communication and function of the child and create an environment within the family that decreases maternal stress.

Ben-Haim et al., 2014: This study examined the effects of a 15-minute Therapeutic Listening Quickshift® series intervention on 8-10 year-old typically developing children. A convenience sample was used for 8 participants in Marin County, California. Participants were randomly assigned to either the Therapeutic Listening® intervention or white noise control intervention. All participants participated in a pretest to establish a baseline of bilateral coordination abilities. Participants then listened to 15-minutes of the Therapeutic Listening® or white noise interventions. Following this intervention period, participants then participated in a posttest

identical to the pretest. Movement assessment measures from the bilateral coordination subtest of the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) and the Quick Neurological Screening (Backwards Tandem Walk and Rapid Forearm Rotation) were used for the pretest and posttest measures. Following the 15-minute interventions, one item from the BOT-2, Tapping Feet and Fingers, trended towards improvement in the Therapeutic Listening® group. Results of the Backwards Tandem Walk indicated a significant improvement in bilateral coordination in the Therapeutic Listening® group compared to the white noise control group. Positive findings from this study, though limited, give researchers an indication that the effects of Therapeutic Listening Quickshift® series on bilateral coordination are trending towards significance. This pilot study will be continued into 2015 for researchers to assess a greater amount of subjects, add to this current data, and ultimately increase the statistical power of findings.

Haas & Sequeira Boesch, 2013: The purpose of this research study was to examine the influence of Therapeutic Listening® Quickshift on the bilateral coordination of healthy adults with no history of developmental or motor delays. Additional studies that demonstrate the effectiveness of the Therapeutic Listening® modality using measurable outcomes are necessary as many therapists currently use this program, even though few studies prove its effectiveness. This study recruited 14 freshman and sophomore students aged 18-21 years. Seven participants received Therapeutic Listening® Quickshift intervention one time for 20 minutes and seven received no intervention, but instead listened to white noise for the same duration. The participants received the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) bilateral coordination subsection before and after either the white noise or Therapeutic Listening® Quickshift protocol. Results demonstrated a slightly greater increase in scores for

those who received the Therapeutic Listening® Quickshift intervention, however this difference was not statistically significant. Additionally, many participants received the maximum score on the pre-test and had no room for improvement on the post-test. This study was likely underpowered and the BOT-2 bilateral coordination subsection was not sensitive enough to measure change in a healthy, adult population. More sensitive assessment tools are needed to support future research in order to prove effectiveness of interventions through measurable outcomes that further evidence based practice in occupational therapy.

Hall, 2005: Objective: This study investigated the effects of implementing therapeutic listening in a therapist directed, 8-week home program on children between the ages of 5 and 11 years.

Method: A convenience sample of 10 subjects with sensory processing deficits and delays in visual motor integration participated in this study. Each participant acted as his own control by measuring changes during the first four weeks using traditional sensory diet and comparing those changes to changes made following 8 weeks of therapeutic listening program. The Sensory Profile, Draw a Person test (DAP), Development test of Visual Motor Integration (VMI), and Evaluation Tool for Children's Handwriting (ETCH) were the outcome measures. Visual motor integration and handwriting legibility were measured three times, before and after each treatment. Sensory processing behaviors were measured during the initial visit and the final visit following the 8-week treatment period. The researcher met with the families at 4-week intervals to update and monitor program. Parents responded to a questionnaire at the end of the study.

Results: Over the twelve-week period, all ten subjects showed improvement in their scores on the Sensory Profile, averaging 71 points per child indicating a decrease in behaviors indicative of sensory processing dysfunction. Total score and nine of the 14 subtests showed significant improvements on the Sensory Profile. Scheffe's Compound Contrast analysis determined that

visual subscale of the VMI and overall handwriting legibility significantly improved as a result of therapeutic listening. The DAP, VMI and Motor subscale of the VMI did not demonstrate significant effects. Conclusion: Therapeutic listening when used with a sensory diet is an effective treatment approach for reducing behaviors indicative of sensory processing dysfunction. Therapeutic listening can facilitate the visual aspect of visual motor integration and handwriting legibility. The motor aspect of visual motor integration and overall visual motor performance is not affected by this treatment.

Shoener et al., 2008: This case report describes an intensive approach to treating autism and provides an intersection between a first person narrative paired with intervention and outcomes. In-depth conversations between a person with autism and an occupational therapist provide insight into understanding differences and difficulties in sensory processing and regulation, praxis, and communication. Individuals with autism may be intellectually and emotionally intact but hampered by deficits that interfere with the ability to move the body efficiently. These sensorimotor deficits underlie the ability to communicate with others and to develop relationships. This article illustrates the benefits of an intensive therapeutic program designed to address sensory and motor differences underlying communication, as well as the vital role the occupational therapist plays in addressing these underlying differences to improve functional communication and social participation.

Wilcox, 2016: Two therapies that have been identified to target sensory modulation needs associated with developmental delay are the Wilbarger Deep Pressure Proprioceptive Technique (Wilbarger Protocol) and Therapeutic Listening. This study examined several patients from an outpatient pediatric occupational therapy facility. These patients have some sort of developmental delay and need intervention to help them modulate their sensory input, so that

their lack of appropriate sensory modulation will not interfere with their delay occupations. This study looked at the effects of the Wilbarger Protocol and Therapeutic Listening over multiple sessions to determine how those techniques affected four overall themes to which research has demonstrated a correlation: modulation, calmness, level of communication, and challenging behaviors. Both treatments demonstrated weak correlations, with the Wilbarger Protocol being a negative correlation (-0.26) and Therapeutic Listening being a positive correlation (0.55). Therefore, the hypotheses that the Wilbarger Protocol and Therapeutic Listening would positively affect the four overall themes were rejected. It appears that the effect is more influenced by patient dependent variables than by temporal markers. It is also likely that the limited number of subjects (n=7) and changes in the treatment protocols, over time, led to the results being inconclusive.

Name of Library and Online Databases: St. Catherine University Library- PsycInfo

Preparing for Search Process

- a) Searching for therapeutic listening under the PsycInfo database, I was unsuccessful when trying to find a lot of relevant information.
- b) There were no MeSh headings for therapeutic listening on the PsycInfo database. I used similar words such as therapy, listening, children, learning disabilities, sensory processing, and sound based integration to find articles that pertain to therapeutic listening and provide evidence on the intervention.
- c) I utilized Cynthia Graham, the OT librarian for assistance in finding peer-reviewed, credible articles. She explained that since there is little to no research on therapeutic listening, extracting keywords that are relevant to therapeutic listening would be most beneficial. Instead of using the word ‘therapy’, use more specific keywords such as ‘sensory integration’.
- d) I tried phrases, specific keywords and subject words, however it was most beneficial to use exact keywords and use a few of them to have results come up that is somewhat applicable to therapeutic listening.

Summarizing a Strategic Search Process

| Filters/Years | Keywords | Total Yield/Relevant Hits | Date |
|---------------|--|-----------------------------------|-------------------|
| None | (“Therapeutic Listening”) | 1/150 Susan Bazyk, et al. | November 14, 2016 |
| Peer Reviewed | (“Listening”) AND (“Therapy”) AND (“Children”) | 3/344 Wolfe & Woolsey, 2003 | November 14, 2016 |

| | | | |
|-----------------------------|--|------------------------------------|-------------------|
| Type of Article; Journal | (Sensory Processing”) AND (“Sound based intervention”) | 1/15 Hall & Case-Smith, 2007 | November 14, 2016 |
|-----------------------------|--|------------------------------------|-------------------|

References and Abstracts

Susan Bazyk , Janet Cimino , Kim Hayes , Glenn Goodman & Pamela Farrell (2010) The Use of Therapeutic Listening with Preschoolers with Developmental Disabilities: *A Look at the Outcomes, Journal of Occupational Therapy, Schools, & Early Intervention. 3:2*, 124-138, DOI: 10.1080/19411243.2010.491013

A one-group pretest–posttest design was used to measure developmental outcomes in 15 preschoolers receiving Therapeutic Listening in addition to their typical therapy services. Six assessments measuring fine-motor, visual-motor, social, language, and sensory processing were used. Statistically significant improvements were found in all areas except sensory processing and the behavior subtest of the Social Skills Rating System. Proportional Change Index scores indicated an accelerated rate of development in fine-motor, visual-motor, nonverbal ability, and language. Observations from parents, teachers, and therapists were consistent with these results. Findings suggest that the use of Therapeutic Listening in addition to typical therapy services may have a role in supporting the development for children with developmental disabilities.

Hall, L., & Case-Smith, J. (2007). The effect of sound-based intervention on children with sensory processing disorders and visual-motor delays. *American Journal of Occupational Therapy, 61*(2), 209-215. doi:10.5014/ajot.61.2.209

This study investigated the effects of a sensory diet and therapeutic listening intervention program, directed by an occupational therapist and implemented by parents, on children with sensory processing disorders (SPD) and visual-motor delays. A convenience sample was used of

10 participants, ages 5 to 11 years, with SPD and visual-motor delays. In the first phase, each participant completed a 4-week sensory diet program, then an 8-week therapeutic-listening and sensory diet program. The Sensory Profile was completed by the participants' parents before and after both study phases. The Draw-A-Person test, Developmental Test of Visual Motor Integration (VMI), and Evaluation Tool of Children's Handwriting (ETCH) were administered before and after each phase. Over 12 weeks, the participants exhibited significant improvement on the Sensory Profile, increasing a mean of 71 points. Parents reported improvements in their children's behaviors related to sensory processing. Scores on the VMI visual and ETCH legibility scales also improved more during the therapeutic listening phase. Therapeutic listening combined with a sensory diet appears effective in improving behaviors related to sensory processing in children with SPD and visual-motor impairments. (PsycINFO Database Record (c) 2016 APA, all rights reserved) (journal abstract)

Wolfe, D. E., & Woolsey, W. (2003). Information sharing: Developing a music

listening/relaxation program for parents of children in pediatric care. *Music Therapy*

Perspectives, 21(1), 41-45. Retrieved from

<http://pearl.stkate.edu/login?url=http://search.proquest.com/docview/620151424?accountid=26879>

Discusses the development of a music listening/relaxation program for parents of children in pediatric care. The development of this program took place at a prominent children's hospital located in a major city in Northern California. The primary purpose of this practicum was to help student therapists design and implement music therapy programs for children within a pediatric medical setting. Article explores the benefits of the therapy. Author describes the

model and the factors that led to its development. (PsycINFO Database Record (c) 2016 APA, all rights reserved)

Other Evidence Resources

Library Database: Google Scholar

Preparing for Search Process

- a) Our group has continued to collaborate and share what databases each person is finding the best articles. We have found there isn't one specific database that does a good job pulling up articles relevant to our intervention.
- b) I used Google Scholar as my second database because I thought it would have a large selection of articles to choose from.
 - While that is the case, there were very few that I related specifically to therapeutic listening.
- c) Key words I used to keywords to obtain the research articles I found: "Therapeutic", "Sensory Processing", "Children", "Autism spectrum disorder", "Auditory", "Therapy", "Sound based intervention"
- d) Both articles found on Google Scholar discuss the goal and outcomes of therapeutic listening.
- e) My goal is to find an article that examines the reasons and factors that make therapeutic listening and ineffective intervention.

| Goals | Article | Author | Date |
|--|---|--------------|-------------------|
| -There is no indication that it has been cited in other research studies | <i>A study on the effects of therapeutic listening on the social and functional</i> | Abbott, 2011 | November 14, 2016 |

| | | | |
|--|---|-----------------------------|--------------------------|
| <p>- Published by a licensed occupational therapist -Thesis</p> | <p><i>behavior of preschool children with autism spectrum disorder</i></p> | | |
| <p>-Is this a peer-reviewed article? -Published by a licensed occupational therapist -Recently published</p> | <p>The effect of therapeutic listening on bilateral coordination. Scholarly and Creative Works Conference</p> | <p>Wilson, et al., 2016</p> | <p>November 14, 2016</p> |

References and Abstracts

Abbott, R. (2011). *A study on the effects of therapeutic listening on the social and functional behavior of preschool children with autism spectrum disorder.* (Master’s Thesis).

Retrieved from <http://scholarscompass.vcu.edu/cgi/viewcontent.cgi?article=3619&context=etd>

Auditory sensory differences and sensitivities are often mentioned by parents of children with Autism Spectrum Disorder (ASD), and in research involving children with ASD. Addressing these auditory processing differences is the goal of various auditory treatment techniques, but current research does not yield a body of evidence in support of auditory therapy as a treatment for children with ASD. This study is a single-subject study, repeated across two subjects, to investigate the effect of the Therapeutic Listening program on the social engagement and self-care skills of preschool-aged children with ASD. Both social engagement and self-care skills increased with for both subjects in this study. Also, parental stress associated with the mothers’ relationship to their child with ASD decreased. These outcomes indicate the Therapeutic Listening program can be a useful modality in the treatment of children with ASD; one that may

improve the communication and function of the child and create an environment within the family that decreases maternal stress.

Wilson, A., Munchua, M., Buccat, M., Mousley, M., & Irao, A. (2016). The effect of therapeutic listening on bilateral coordination. Scholarly and Creative Works Conference. Paper 74. Retrieved from <http://scholar.dominican.edu/scw/scw2016/AllConference/74>

Therapeutic Listening® is a sound-based treatment developed by Sheila Frick, OTR, rooted in sensory integration (Frick & Young, 2009). In Therapeutic Listening® programs, clients listen to music that has been electronically altered (Hall & Case-Smith, 2007). Therapeutic Listening® is an intervention increasingly used by occupational therapists despite the lack of supporting evidence in current literature.

A previous thesis study attempted to determine the effectiveness of Therapeutic Listening® through the outcome measure of bilateral movement. In the previous thesis study, three assessments were used to measure bilateral coordination in typically developing children. However, the quantifiable results did not reflect the qualitative observations of the quality of movement (Ben-Haim, Debonis, Schwartz, & Smith-Schwartz, 2015). Because the quantifiable results did not reflect the qualitative results, the effectiveness of the Therapeutic Listening® on quality of movement is not appropriately represented in current research (Ben-Haim et al., 2015). Bilateral coordination development begins in the early stages of a child's life and provides further foundation for more complex motor skills needed to enhance participation and a child's quality of life. The purpose of our research study is to examine the effects of Therapeutic Listening® Quickshift in improving bilateral coordination as measured by the quality of

movement. To examine the effects, a measure with sufficient sensitivity will be created to detect changes in motor behavior in response to Therapeutic Listening® Quickshift.

Name of Library and Online Database: St. Catherine University Library- PubMed

Preparing for Search Process:

- The farthest left dropdown bar on that automatically goes to ‘PubMed’ I changed to ‘MeSH’.
- If search without any keywords in the search bar after changing the ‘MeSH’ brings to a help and tutorial sections for using MeSH along with NLM MeSH homepage as an additional resource.
- Therapeutic Listening is not a MeSH heading.
- Auditory Integration Intervention and Auditory Interventions are not a MeSH heading
- Occupational therapy – Rehabilitation- Therapeutics (narrow to broad)
- Autism Spectrum Disorder – Child Developmental Disorders
- Boolean Logic Terms: I will use ‘AND’ to incorporate all searches
- Searched "Autism Spectrum Disorder"[Mesh] and Occupational therapy and auditory interventions. No items were found, need to be more broad
- MeSH headings did not yield many relevant searches, so I switched to just searching terms

Summarizing a Strategic Search Process

| Filters/Years | Keywords | Total Yield/ Relevant Hits | Date |
|----------------|---|---------------------------------|-------------------|
| None Unlimited | "Occupational Therapy"[Mesh] and therapeutic listening | 29/1 Hall & Case-Smith, 2007 | November 14, 2016 |
| None Unlimited | "Autism Spectrum Disorder"[Mesh] and auditory interventions | 2/0 | November 14, 2016 |

| | | | |
|----------------|--|---------------------------------|-------------------|
| None Unlimited | Therapeutic Listening and Autism Spectrum Disorder | 74/1 Hall & Case-Smith, 2007 | November 14, 2016 |
| None Unlimited | Therapeutic Listening in Occupational Therapy | 78/1 Hall & Case-Smith, 2007 | November 14, 2016 |
| None Unlimited | Sheila Frick and Therapeutic Listening | 0 | November 14, 2016 |

Summary of 5 BEST Research Articles

- This database only had one relevant research articles that I was able to find
- The most relevant searches require using the term “Therapeutic Listening” otherwise the search yields information for other auditory integration techniques.

This study investigated the effects of a sensory diet and therapeutic listening intervention program, directed by an occupational therapist and implemented by parents, on children with sensory processing disorders (SPD) and visual-motor delays. A convenience sample was used of 10 participants, ages 5 to 11 years, with SPD and visual-motor delays. In the first phase, each participant completed a 4-week sensory diet program, then an 8-week therapeutic-listening and sensory diet program. The participants’ parents completed the Sensory Profile before and after both study phases. The Draw-A-Person test, Developmental Test of Visual Motor Integration (VMI), and Evaluation Tool of Children's Handwriting (ETCH) were administered before and after each phase. Over 12 weeks, the participants exhibited significant improvement on the Sensory Profile, increasing a mean of 71 points. Parents reported improvements in their

children's behaviors related to sensory processing. Scores on the VMI visual and ETCH legibility scales also improved more during the therapeutic listening phase. Therapeutic listening combined with a sensory diet appears effective in improving behaviors related to sensory processing in children with SPD and visual-motor impairments.

Hall, L., & Case-Smith, J. (2007). The effect of sound-based intervention on children with sensory processing disorders and visual-motor delays. *The American Journal of Occupational Therapy : Official Publication of the American Occupational Therapy Association*, 61(2), 209-215. doi:10.5014/ajot.61.2.209

Other Evidence Resources: Google Scholar

Preparing for Search Process:

- There are a variety of help options to under 'About Google Scholar' to learn more about the site including 'Search Tips'
- Therapeutic Listening was way too broad of search (77,900 results), so will need to add at least one other search parameter
- I went back to the Vital Links website to see what research they have cited and 2 of the articles are "unpublished" and the other two I have already found.
- Using quotation marks will help narrow down the search
- Did not find hardly any peer reviewed articles
- I also started looking through references on the article by Bazyk, Cimino, Hayes, Goodman, & Farrell, 2010 to see if any of them were directly related to Therapeutic Listening and the ones

that were were case studies from the Vital Links website, which is the main founding site for Therapeutic Listening.

| Filters/Years | Keywords | Total Yield/ Relevant Hits | Date |
|-------------------|--|---|----------------------|
| None Unlimited | Therapeutic Listening and Sheila Frick | 153/6 Bazyk, Cimino, Hayes, Goodman, & Farrell, 2010 Wilson, Munchua, Buccat, Mousley, & Irao, 2016 Abbott, 2011 | November 14, 2016 |
| None 2000-2016 | Therapeutic Listening for ASD | 17,200/1 Case-Smith & Arbesman 2008 | November 14, 2016 |
| None 2010-2016 | "Occupational therapy" and "therapeutic listening" | 130/1 Luong, Malloy, & Preto, 2016 | November 14, 2016 |
| None 2010-2016 | "therapeutic listening" and "ASD" | 47/0 | November 14, 2016 |

Summary of 5 BEST Research Articles

A one-group pretest–posttest design was used to measure developmental outcomes in 15 preschoolers receiving Therapeutic Listening in addition to their typical therapy services. Six assessments measuring fine-motor, visual-motor, social, language, and sensory processing were used. Statistically significant improvements were found in all areas except sensory processing and the behavior subtest of the Social Skills Rating System. Proportional Change Index scores indicated an accelerated rate of development in fine-motor, visual-motor, nonverbal ability, and language. Observations from parents, teachers, and therapists were consistent with these results.

Findings suggest that the use of Therapeutic Listening in addition to typical therapy services may have a role in supporting the development for children with developmental disabilities.

Bazyk, S., Cimino, J., Hayes, K., Goodman, G., & Farrell, P. (2010). The use of therapeutic listening with preschoolers with developmental disabilities: A look at the outcomes. *Journal of Occupational Therapy, Schools, & Early Intervention*, 3(2), 124-138.

doi:10.1080/19411243.2010.491013

Therapeutic Listening® is a sound-based treatment developed by Sheila Frick, OTR, rooted in sensory integration (Frick & Young, 2009). In Therapeutic Listening® programs, clients listen to music that has been electronically altered (Hall & Case-Smith, 2007). Therapeutic Listening® is an intervention increasingly used by occupational therapists despite the lack of supporting evidence in current literature.

A previous thesis study attempted to determine the effectiveness of Therapeutic Listening® through the outcome measure of bilateral movement. In the previous thesis study, three assessments were used to measure bilateral coordination in typically developing children. However, the quantifiable results did not reflect the qualitative observations of the quality of movement (Ben-Haim, Debonis, Schwartz, & Smith-Schwartz, 2015). Because the quantifiable results did not reflect the qualitative results, the effectiveness of the Therapeutic Listening® on quality of movement is not appropriately represented in current research (Ben-Haim et al., 2015). Bilateral coordination development begins in the early stages of a child's life and provides further foundation for more complex motor skills needed to enhance participation and a child's quality of life. The purpose of our research study is to examine the effects of Therapeutic Listening® Quickshift in improving bilateral coordination as measured by the quality of

movement. To examine the effects, a measure with sufficient sensitivity will be created to detect changes in motor behavior in response to Therapeutic Listening® Quickshift.

Wilson, A., Munchua, M., Buccat, M., Mousley, M., & Irao, A. (2016). The effect of therapeutic listening on bilateral coordination. Scholarly and Creative Works Conference. Paper 74.

Retrieved from <http://scholar.dominican.edu/scw/scw2016/AllConference/74>

Auditory sensory differences and sensitivities are often mentioned by parents of children with Autism Spectrum Disorder (ASD), and in research involving children with ASD. Addressing these auditory processing differences is the goal of various auditory treatment techniques, but current research does not yield a body of evidence in support of auditory therapy as a treatment for children with ASD. This study is a single-subject study, repeated across two subjects, to investigate the effect of the Therapeutic Listening program on the social engagement and self-care skills of preschool-aged children with ASD. Both social engagement and self-care skills increased with for both subjects in this study. Also, parental stress associated with the mothers' relationship to their child with ASD decreased. These outcomes indicate the Therapeutic Listening program can be a useful modality in the treatment of children with ASD; one that may improve the communication and function of the child and create an environment within the family that decreases maternal stress.

Abbott, R. C. (2011). *A Study on the Effects of Therapeutic Listening on the Social and Functional Behavior of Preschool Children with Autism Spectrum Disorder* (Doctoral dissertation, Virginia Commonwealth University Richmond, Virginia).

Occupational therapy practitioners are among the professionals who provide services to children and adults with autism spectrum disorder (ASD), embracing both leadership and supportive roles in service delivery. The study's primary aims were as follows: (1) to identify, evaluate, and synthesize the research literature on interventions for ASD of relevance to occupational therapy and (2) to interpret and apply the research literature to occupational therapy. A total of 49 articles met the authors' criteria and were included in the review. Six categories of research topics were identified, the first 3 of which are most closely related to occupational therapy: (1) sensory integration and sensory-based interventions; (2) relationship-based, interactive interventions; (3) developmental skill-based programs; (4) social cognitive skill training; (5) parent-directed or parent-mediated approaches; and (6) intensive behavioral intervention. Under each category, themes supported by research evidence and applicable to occupational therapy were defined. The findings have implications for intervention methods, communication regarding efficacious practices to professionals and consumers, and future occupational therapy research.

Case-Smith, J., Arbesman, M. (2008). Evidence-based review of interventions for autism used in or of relevance to occupational therapy. *American Journal of Occupational Therapy* 62(4). 416-429 Doi: 10.5014/ajot.62.4.416.

Few empirical studies have been conducted to provide evidence for the effectiveness of Therapeutic Listening - Quickshifts (TL-Q). Anecdotally, TL-Q has produced consistent positive results for therapists and clients as a pediatric intervention. Therefore, it is imperative to research TL-Q's efficacy, which may lead to its broader implementation. In this study, the researchers

examined the effectiveness of TL-Q intervention for children with sensory processing difficulties to improve participation and function in 1) school performance, (2) self-regulation and arousal, (3) activities of daily living (ADLs), (4) social/emotional skills, and (5) sensorimotor skills. Over the course of an 8 week prospective study, the researchers conducted a pre-test, post-test case study. During the intervention period, TL-Q expert therapists adjusted the specific musical track depending on the needs of the specific child. Results showed an overall positive increase in quantitative scores and a qualitative feedback. Most notably, in the areas of social emotional skills and sensorimotor skills. This study provided evidence for the support of TL-Q in the clinical setting and developed an effective protocol for future research.

Luong, B., Malloy, A., & Preto, S. (2016). Therapeutic listening - quickshifts support for pediatric intervention *Student Research Posters*. Book 30. Retrieved from <http://scholar.dominican.edu/ug-student-posters/30>

Appraisal of Evidence**Initial appraisal: Primary Research Studies.**

| | |
|-------------------------------------|---|
| Type of article | Overall Type: Primary Research Study Specific Type: A one-group pretest–posttest design |
| APA Reference | Bazyk, S., Cimino, J., Hayes, K., Goodman, G., & Farrell, P. (2010). The use of Therapeutic Listening with preschoolers with developmental disabilities: A look at the outcomes. <i>Journal of Occupational Therapy, Schools, & Early Intervention</i> , 3(2), 124-138. doi: 10.1080/19411243.2010.491013 |
| Abstract | A one-group pretest–posttest design was used to measure developmental outcomes in 15 preschoolers receiving Therapeutic Listening in addition to their typical therapy services. Six assessments measuring fine motor, visual-motor, social, language, and sensory processing were used. Statistically significant improvements were found in all areas except sensory processing and the behavior subtest of the Social Skills Rating System. Proportional Change Index scores indicated an accelerated rate of development in fine motor, visual-motor, nonverbal ability, and language. Observations from parents, teachers, and therapists were consistent with these results. Findings suggest that the use of Therapeutic Listening in addition to typical therapy services may have a role in supporting the development for children with developmental disabilities. |
| Author | Credentials: Ph.D., MHS, B.S., OTR/L Position and Institution: Professor at Cleveland State University Publication History in Peer-Reviewed Journals: Extensive |
| Publication | Type of publication: Peer reviewed journal Publisher: Taylor and Francis Online |
| Date and Citation History | Date of publication: 2010 Cited By: 12 |
| Stated Purpose or Research Question | “The purpose of this study was to further contribute to the available evidence on Therapeutic Listening by systematically measuring outcomes in a group of preschool children with developmental disabilities” (p. 1). |
| Author’s Conclusion | “Results indicate that for this sample of children with disabilities who received Therapeutic Listening in addition to their traditional occupational therapy |

| | |
|----------------------------|--|
| | services, statistically significant developmental gains in a number of performance areas (fine-motor, visual-motor, nonverbal, language, and social) were obtained” (p. 1) |
| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: This study looks at children with developmental disabilities who are receiving Therapeutic Listening. They are measuring social and language, which is related to our PICO question. |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: This study focuses on Therapeutic Listening through the lense of occupational therapists implementing the intervention depending on the specific needs of each child. |

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|-------------------------------------|--|
| Type of article | Overall Type: Primary Research Study Specific Type: Case Report |
| APA Reference | Shoener, R. F., Kinnealey, M., & Koenig, K. P. (2008). You can know me now if you listen: Sensory, motor, and communication issues in a nonverbal person with autism. <i>American Journal of Occupational Therapy</i> , 62, 547–553. doi: 10.5014/ajot.62.5.547 |
| Abstract | This case report describes an intensive approach to treating autism and provides an intersection between a first- person narrative paired with intervention and outcomes. In-depth conversations between a person with autism and an occupational therapist provide insight into understanding differences and difficulties in sensory processing and regulation, praxis, and communication. Individuals with autism may be intellectually and emotionally intact but hampered by deficits that interfere with the ability to move the body efficiently. These sensorimotor deficits underlie the ability to communicate with others and to develop relationships. This article illustrates the benefits of an intensive therapeutic program designed to address sensory and motor differences underlying communication, as well as the vital role the occupational therapist plays in addressing these underlying differences to improve functional communication and social participation. |
| Author | Credentials: BS, OTR/L Position and Institution: Supervisor of Occupational Therapy at the TALK Institute and School Publication History in Peer-Reviewed Journals: None |
| Publication | Type of publication: Scholarly peer reviewed journal Publisher: American Journal of Occupational Therapy (AJOT) Other: Official journal of the AOTA |
| Date and Citation History | Date of publication: 2008 Cited By: 20 |
| Stated Purpose or Research Question | “This article illustrates the benefits of an intensive therapeutic program designed to address sensory and motor differences underlying communication, as well as the vital role the occupational therapist plays in addressing these underlying differences to improve functional communication and social participation” (p. 1). |

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|----------------------------|---|
| Author's Conclusion | “David continues to receive occupational therapy services with the goal of greater self-regulation and freedom of movement, with full participation in relevant occupations and independence as primary goals” (p. 6). |
| Overall Relevance to PICO | Overall Relevance to PICO: Poor Rationale: This study is clearly laid out with relevant information regarding children with ASD, but doesn't focus on Therapeutic Listening. It takes a different approach and relies on personal narratives to “Provide insight into a process that goes beyond what can be measured” (p. 6). |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: This article examines occupational therapists working directly with autistic clients. Therapeutic Listening is touched on, however the study focuses on various interventions that will improve sensory processing, praxis, and communication. |

| | |
|-------------------------------------|--|
| Type of article | Overall Type: Primary research study Specific Type: Case studies |
| APA Reference | Vital Links. (n.d.). <i>Therapeutic Listening case studies: Autism therapy</i> . Retrieved from https://vitallinks.com/therapeutic-listening/case-studies/ |
| Abstract | N/A Studies on Charles, Ned, and Jill |
| Author | Credentials: OTR Position and Institution: unknown facility, in Grand Rapids MI Publication History in Peer-Reviewed Journals: minimal |
| Publication | Type of publication: Trade Literature Publisher: Vital Links Other: No publication date given for any of the three case studies, and only one author given. |
| Date and Citation History | Date of publication: N/A Cited By: 1 |
| Stated Purpose or Research Question | “Charles’ mother was concerned about his poor social and motor skills” (Charles, p. 1). “His mother also hoped the therapy would help Ned with some basic communication” (Ned, p. 1). “Her activity level is high and she is in nearly constant motion that includes running, jumping, climbing and flapping her hands” (Jill, p. 1). |
| Author’s Conclusion | “Furthermore, Charles was now more confident in his ability to communicate with his peers and was able to make new connections” (Charles, p. 1). “Ned’s vocabulary continued to expand to 50-60 words” (Ned, p. 1). “She demonstrates a more optimal level of arousal and is engaging actively in the classroom routine” (Jill, p. 1). |
| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: All three case studies look at the use of Therapeutic Listening with those with Autism Spectrum Disorder. They all had some relation of improving social participation, school performance, and or communication. |
| Overall Quality of Article | Overall Quality of Article: Poor |

| | |
|--|---|
| | <p>Rationale: The case studies come from the Vital Links website, which is the founder of Therapeutic Listening. There is only one author cited for one of the cases studies and none of them have dates.</p> |
|--|---|

| | |
|-----------------|---|
| Type of article | Overall Type: Primary Research Study Specific Type: Double-blind, randomized control, pretest-posttest experimental design |
| APA Reference | Ben-Haim, S., DeBonis, C., Schwartz, J., & Smith-Schwartz, A. (2015). <i>Therapeutic Listening and bilateral coordination in typically developing children</i> . (Master's Thesis). Retrieved from http://scholar.dominican.edu/cgi/viewcontent.cgi?article=1144&context=masters-theses |
| Abstract | This study examined the effects of a 15-minute Therapeutic Listening Quickshift® series intervention on 8-10 year-old typically developing children. A convenience sample was used for 8 participants in Marin County, California. Participants were randomly assigned to either the Therapeutic Listening® intervention or white noise control intervention. All participants participated in a pretest to establish a baseline of bilateral coordination abilities. Participants then listened to 15-minutes of the Therapeutic Listening® or white noise interventions. Following this intervention period, participants then participated in a posttest identical to the pretest. Movement assessment measures from the bilateral coordination subtest of the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) and the Quick Neurological Screening (Backwards Tandem Walk and Rapid Forearm Rotation) were used for the pretest and posttest measures. Following the 15-minute interventions, one item from the BOT-2, Tapping Feet and Fingers, trended towards improvement in the Therapeutic Listening® group. Results of the Backwards Tandem Walk indicated a significant improvement in bilateral coordination in the Therapeutic Listening® group compared to the white noise control group. Positive findings from this study, though limited, give researchers an indication that the effects of Therapeutic Listening Quickshift® series on bilateral coordination are trending towards significance. This pilot study will be continued into 2015 for researchers to assess a greater amount of subjects, add to this current data, and ultimately increase the statistical power of findings. |
| Author | Credentials: None Position and Institution: Master's Occupational Therapy student at Dominican University of California Publication History in Peer-Reviewed Journals: None |
| Publication | Type of publication: Grey Literature |

| | |
|-------------------------------------|---|
| | <p>Publisher: School of Health and Natural Sciences at Dominican University of California</p> <p>Other: Master's Thesis written by Occupational Therapy students</p> |
| Date and Citation History | <p>Date of publication: 2014</p> <p>Cited By: 0</p> |
| Stated Purpose or Research Question | <p>“Does the Therapeutic Listening®’s Quickshift program improve performance in bilateral motor coordination on various motor tasks in typically developing 8-10 year old children?” (p. 17).</p> |
| Author’s Conclusion | <p>“The results of this study demonstrated that a significant change in bilateral coordination did in fact occur in one assessment item, the Backward Tandem Walk, as a result of Therapeutic Listening® Quickshift intervention. One assessment item, Contralateral Finger Tapping, trended towards significance. However, the other assessments did not show significance. Likely conclusions for these results are that this study was underpowered and the tools used to assess items were not sensitive enough to detect change in bilateral coordination” (p. 37-38).</p> |
| Overall Relevance to PICO | <p>Overall Relevance to PICO: Poor</p> <p>Rationale: The literature review provided background information on the many auditory interventions, including AIT and TLP, and sensory integration techniques used in occupational therapy. The study did not use Therapeutic Listening as an occupational therapy intervention as it was used with typically developing children that did not have any cognitive, mental, physical, or sensory deficits. The outcomes did not measure performance or participation, only bilateral coordination.</p> |
| Overall Quality of Article | <p>Overall Quality of Article: Poor</p> <p>Rationale: Article is a master’s thesis written by occupational therapy students. The study is recently published and reviewed by reputable therapists, however the students did not have credentials and the article has not been cited in other articles. The study only involved eight 8-10 year old children within the same school district. The study did not come up with significant, conclusive results.</p> |

| | |
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| Type of article | Overall Type: Primary Research Study Specific Type: Pretest, posttest case study using qualitative and quantitative data |
| APA Reference | Luong, B., Malloy, A., & Preto, S. (2016). <i>Therapeutic Listening - quickshifts support for pediatric intervention</i> . (Student Research Poster). Retrieved from http://scholar.dominican.edu/ug-student-posters/30 |
| Abstract | Few empirical studies have been conducted to provide evidence for the effectiveness of Therapeutic Listening - Quickshifts (TL-Q). Anecdotally, TL-Q has produced consistent positive results for therapists and clients as a pediatric intervention. Therefore, it is imperative to research TL-Q's efficacy, which may lead to its broader implementation. In this study, the researchers examined the effectiveness of TL-Q intervention for children with sensory processing difficulties to improve participation and function in 1) school performance, (2) self-regulation and arousal, (3) activities of daily living (ADLs), (4) social/emotional skills, and (5) sensorimotor skills. Over the course of an 8-week prospective study, the researchers conducted a pre-test, post-test case study. During the intervention period, TL-Q expert therapists adjusted the specific musical track depending on the needs of the specific child. Results showed an overall positive increase in quantitative scores and a qualitative feedback. Most notably, in the areas of social emotional skills and sensorimotor skills. This study provided evidence for the support of TL-Q in the clinical setting and developed an effective protocol for future research. |
| Author | Credentials: None Position and Institution: Master's Occupational Therapy student at Dominican University of California Publication History in Peer-Reviewed Journals: None |
| Publication | Type of publication: Grey Literature Publisher: Dominican University of California |
| Date and Citation History | Date of publication: 2016 Cited By: None |
| Stated Purpose or Research Question | "The researchers intend to show how Therapeutic Listening® Quickshifts can improve function of ADLs, social interaction, school performance, sensorimotor skills, and self-regulation in children with sensory processing difficulties" (p. 1). |

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| Author's Conclusion | “Results of our study indicate changes in all ADLs, social interaction, school performance, sensorimotor skills and self-regulation domains” (p. 1). |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: Researchers looked at social interaction, sensorimotor skills, and school performance in children with sensory processing needs. Researchers implemented Therapeutic Listening to observe improvements or changes in behaviors that were being made. |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: This was a master's thesis that had a small sample size of only five children. This resource clearly states the objective for the study, and concisely states background information, methods, results, and a discussion section. |

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| Type of article | Overall Type: Primary Research Study Specific Type: Single subject AS research design |
| APA Reference | Abbott, R. (2011). <i>A study on the effects of Therapeutic Listening on the social and functional behavior of preschool children with autism spectrum disorder</i> . (Master's Thesis). Retrieved from http://scholarscompass.vcu.edu/cgi/viewcontent.cgi?article=3619&context=etd |
| Abstract | Auditory sensory differences and sensitivities are often mentioned by parents of children with Autism Spectrum Disorder (ASD), and in research involving children with ASD. Addressing these auditory processing differences is the goal of various auditory treatment techniques, but current research does not yield a body of evidence in support of auditory therapy as a treatment for children with ASD. This study is a single-subject study, repeated across two subjects, to investigate the effect of the Therapeutic Listening program on the social engagement and self-care skills of preschool-aged children with ASD. Both social engagement and self-care skills increased with for both subjects in this study. Also, parental stress associated with the mother's relationship to their child with ASD decreased. These outcomes indicate the Therapeutic Listening program can be a useful modality in the treatment of children with ASD; one that may improve the communication and function of the child and create an environment within the family that decreases maternal stress. |
| Author | Credentials: BS Position and Institution: Graduate student at Virginia Commonwealth University Publication History in Peer-Reviewed Journals: None |
| Publication | Type of publication: Grey Literature Publisher: Virginia Commonwealth University |
| Date and Citation History | Date of publication: 2011 Cited By: 0 |
| Stated Purpose or Research Question | "This study is a single-subject study, repeated across two subjects, to investigate the effect of the Therapeutic Listening program on the social engagement and self-care skills of preschool-aged children with ASD" (p. 7). |

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| Author's Conclusion | “While the nature of this study does not allow for a direct causal link between the use of TL and improvements in the children’s function and parental stress, clear improvements were seen in all three subjects. All three subjects exhibited gains in socially-acceptable behaviors and communication” (p. 75). |
| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: This thesis provides ample research and information about effects TL has on children with ASD. |
| Overall Quality of Article | Overall Quality of Article: Poor Rationale: The conclusion states there is not a causal relationship between TL and improvements in children’s function, which is the type of research we are looking for. A lot of sources explain the benefits of TL, but this study is honest with their results. The overall research used poor measurement methods, follow-up, and had multiple biases. |

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| Type of article | Overall Type: Primary Research Study Specific Type: Quasi-experimental design |
| APA Reference | Hall, L. (2005). <i>The effect of sound-based treatment as a home program on 10 children with sensory processing deficits and visual motor delays</i> . (Master's Thesis). Retrieved from http://rave.ohiolink.edu/etdc/view?acc_num=osu1407138678 |
| Abstract | <p>Objective: This study investigated the effects of implementing Therapeutic Listening in a therapist directed, 8-week home program on children between the ages of 5 and 11 years. Method: A convenience sample of 10 subjects with sensory processing deficits and delays in visual motor integration participated in this study. Each participant acted as his own control by measuring changes during the first four weeks using traditional sensory diet and comparing those changes to changes made following 8 weeks of Therapeutic Listening program. The Sensory Profile, Draw a Person test (DAP), Development test of Visual Motor Integration (VMI), and Evaluation Tool for Children's Handwriting (ETCH) were the outcome measures. Visual motor integration and handwriting legibility were measured three times, before and after each treatment. Sensory processing behaviors were measured during the initial visit and the final visit following the 8-week treatment period. The researcher met with the families at 4-week intervals to update and monitor program. Parents responded to a questionnaire at the end of the study. Results: Over the twelve-week period, all ten subjects showed improvement in their scores on the Sensory Profile, averaging 71 points per child indicating a decrease in behaviors indicative of sensory processing dysfunction. Total score and nine of the 14 subtests showed significant improvements on the Sensory Profile. Scheffe's Compound Contrast analysis determined that visual subscale of the VMI and overall handwriting legibility significantly improved as a result of Therapeutic Listening. The DAP, VMI and Motor subscale of the VMI did not demonstrate significant effects. Conclusion: Therapeutic Listening when used with a sensory diet is an effective treatment approach for reducing behaviors indicative of sensory processing dysfunction. Therapeutic Listening can facilitate the visual aspect of visual motor integration and handwriting legibility. The motor aspect of visual motor integration and overall visual motor performance is not affected by this treatment.</p> |
| Author | <p>Credentials: BS, OTR/L Position and Institution: Master's of Science student at Ohio State University</p> |

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| | Publication History in Peer-Reviewed Journals: Limited to one other article |
| Publication | Type of publication: Grey Literature Publisher: Ohio State University Other: Master's Thesis |
| Date and Citation History | Date of publication: 2005 Cited By: None |
| Stated Purpose or Research Question | “The purpose of this study was to investigate the effects of incorporating sound-based intervention strategies in a therapist directed, 8-week home program on children between the ages of 5 and 11 years” (p. 6). |
| Author's Conclusion | “Therapeutic Listening when used with a sensory diet is an effective treatment approach for reducing behaviors indicative of sensory processing dysfunction. Therapeutic Listening can facilitate the visual aspect of visual motor integration and handwriting legibility. The motor aspect of visual motor integration and overall visual motor performance is not affected by this treatment” (p. 58). |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: The literature review provided background on a few of the auditory interventions used in occupational therapy, including the AIT subgroup, as well as sensory integration techniques. The study used Therapeutic Listening as an occupational therapy intervention with individuals with sensory processing deficits and visual motor delays, but did not provide diagnoses. The study measured the effects on visual motor, handwriting, and sensory processing behaviors, which relate to school performance, however the author did not discuss the result of performance or participation in activities. |
| Overall Quality of Article | Overall Quality of Article: Poor Rationale: Article is a master's thesis written by a registered/licensed occupational therapist. The study was reviewed by reputable therapists, however was published over 10 years ago and has not been cited in other articles. The study only involved ten children ages 5-11 years and parents at home administered TL, without direct monitoring from the therapist. |

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| Type of article | Overall Type: Primary Research Study Specific Type: Quantitative, experimental, pre-test-post-test control-group design. Pilot study. |
| APA Reference | Haas, M., & Sequeira Boesch, A. M. (2014). <i>Effect of Therapeutic Listening quickshift on bilateral coordination in healthy adults</i> . (Master's Thesis). Retrieved from http://scholar.dominican.edu/cgi/viewcontent.cgi?article=1008&context=masters-theses |
| Abstract | The purpose of this research study was to examine the influence of Therapeutic Listening® Quickshift on the bilateral coordination of healthy adults with no history of developmental or motor delays. Additional studies that demonstrate the effectiveness of the Therapeutic Listening® modality using measurable outcomes are necessary as many therapists currently use this program, even though few studies prove its effectiveness. This study recruited 14 freshman and sophomore students aged 18-21 years. Seven participants received Therapeutic Listening® Quickshift intervention one time for 20 minutes and seven received no intervention, but instead listened to white noise for the same duration. The participants received the Bruininks-Oseretsky Test of Motor Proficiency, Second Edition (BOT-2) bilateral coordination subsection before and after either the white noise or Therapeutic Listening® Quickshift protocol. Results demonstrated a slightly greater increase in scores for those who received the Therapeutic Listening® Quickshift intervention, however this difference was not statistically significant. Additionally, many participants received the maximum score on the pre-test and had no room for improvement on the post-test. This study was likely underpowered and the BOT-2 bilateral coordination subsection was not sensitive enough to measure change in a healthy, adult population. More sensitive assessment tools are needed to support future research in order to prove effectiveness of interventions through measurable outcomes that further evidence based practice in occupational therapy. |
| Author | Credentials: None Position and Institution: Master's Occupational Therapy student at Dominican University of California Publication History in Peer-Reviewed Journals: None |
| Publication | Type of publication: Grey Literature Publisher: School of Health and Natural Sciences at Dominican University of California |

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| | Other: Master's Thesis written by Occupational Therapy students |
| Date and Citation History | Date of publication: 2014 Cited By: 0 |
| Stated Purpose or Research Question | <p>“Does Therapeutic Listening® Quickshift improve bilateral coordination as measured by scores on the BOT-2 bilateral coordination subsection in healthy young adults?” (p. 29).</p> <p>“Does Therapeutic Listening® Quickshift improve the listening experience and comfort with performing motor tasks in healthy adults?” (p. 30). “Does Therapeutic Listening® Quickshift improve the quality of movement during bilateral coordination tasks?” (p. 31).</p> |
| Author's Conclusion | <p>“The results did not demonstrate a significant change in bilateral coordination as a result of Therapeutic Listening® Quickshift. Likely conclusions for these results are that this study was underpowered and used a tool that was not sensitive enough to measure change in bilateral coordination of healthy adults” (p. 34).</p> |
| Overall Relevance to PICO | <p>Overall Relevance to PICO: Poor</p> <p>Rationale: The literature review provided background information on the many auditory interventions, including AIT and TLP, and sensory integration techniques used in occupational therapy. The study did not use Therapeutic Listening as an occupational therapy intervention as it was used with adults with no history of motor or developmental delays. The outcomes measured comfort when performing motor tasks, bilateral coordination, and quality of movements when completing motor assessments, however did not measure direct effects on participation and performance in school.</p> |
| Overall Quality of Article | <p>Overall Quality of Article: Poor</p> <p>Rationale: Article is a master's thesis written by occupational therapy students. The study is recently published and reviewed by reputable therapists, however the students did not have credentials and the article has not been cited in other articles. The study only involved fourteen 18-21 year old college students that attended the same University. The study did not come up with significant, conclusive results.</p> |

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| Type of article | Overall Type: Primary Research Study Specific Type: Case study |
| APA Reference | Wilcox, M. (2016). <i>Occupational therapy techniques, over time, on children with developmental delays</i> . (Honor's Project). Retrieved from http://www.uncp.edu/academics/library |
| Abstract | Two therapies that have been identified to target sensory modulation needs associated with developmental delay are the Wilbarger Deep Pressure Proprioceptive Technique (Wilbarger Protocol) and Therapeutic Listening. This study examined several patients from an outpatient pediatric occupational therapy facility. These patients have some sort of developmental delay and need intervention to help them modulate their sensory input, so that their lack of appropriate sensory modulation will not interfere with their delay occupations. This study looked at the effects of the Wilbarger Protocol and Therapeutic Listening over multiple sessions to determine how those techniques affected four overall themes to which research has demonstrated a correlation: modulation, calmness, level of communication, and challenging behaviors. Both treatments demonstrated weak correlations, with the Wilbarger Protocol being a negative correlation (-0.26) and Therapeutic Listening being a positive correlation (0.55). Therefore, the hypotheses that the Wilbarger Protocol and Therapeutic Listening would positively affect the four overall themes were rejected. It appears that the effect is more influenced by patient dependent variables than by temporal markers. It is also likely that the limited number of subjects (n=7) and changes in the treatment protocols, over time, led to the results being inconclusive. |
| Author | Credentials: None Position and Institution: Honors college scholar at University of North Carolina at Pembroke Publication History in Peer-Reviewed Journals: None |
| Publication | Type of publication: Grey Literature Publisher: The Esther G. Maynor Honors College at University of North Carolina at Pembroke Other: Senior Honors Project for the Exercise and Sport Science major |
| Date and Citation History | Date of publication: 2016 Cited By: 0 |

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| Stated Purpose or Research Question | “This study looked at the effects of the Wilbarger Protocol and Therapeutic Listening over multiple sessions to determine how those techniques affected four overall themes to which research has demonstrated a correlation: modulation, calmness, level of communication, and challenging behaviors” (p. 1). |
| Author’s Conclusion | “Both treatments demonstrated weak correlations, with the Wilbarger Protocol being a negative correlation (-0.26) and Therapeutic Listening being a positive correlation (0.55). Therefore, the hypotheses that the Wilbarger Protocol and Therapeutic Listening would positively affect the four overall themes were rejected. It appears that the effect is more influenced by patient-dependent variables (e.g. parental involvement, degree of developmental delay, age, etc.) than by temporal markers. It is also likely that the limited number of subjects (n=7) and changes in the treatment protocols, over time, led to the results being inconclusive” (p. 14-15). |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: The literature review provided background on Therapeutic Listening and sensory integration techniques. The study used Therapeutic Listening as an occupational therapy intervention with individuals with some sort of developmental delay and sensory modulation deficit. The study measured the effects on sensory modulation, calmness, level of communication, and challenging behaviors. Although the author addressed communication effects, she did not specify behaviors seen/not seen related to any of these areas or the overall result of performance and participation in activities and/or academics. |
| Overall Quality of Article | Overall Quality of Article: Poor Rationale: Article is a senior honors project by an exercise science student who does not have any credentials. This study was published this year, but has not been cited in other articles. The study only involved seven children (ages not stated) and information was taken from daily OT progress notes. |

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| Type of article | Overall Type: Primary research study Specific Type: Pretest and posttest case study |
| APA Reference | Hall, L., & Case-Smith, J. (2007). The effect of sound-based intervention on children with sensory processing disorders and visual-motor delays. <i>American Journal of Occupational Therapy</i> , 61, 209-215. doi: 10.5014/ajot.61.2.209 |
| Abstract | Music has long been known to have therapeutic value (Ferguson & Voll, 2004; Sacks, 2006). In recent years, occupational therapists, speech-language pathologists, and psychologists have adopted the use of music and sounds as therapy, and a variety of auditory intervention techniques have become available. Occupational therapists use music as preparation for therapeutic activities on the basis of the belief that sensory input through the auditory and vestibular systems can be calming and organizing to children (Ayres, 1979; Frick & Hacker, 2001). The purpose of this study was to investigate the effectiveness of a Therapeutic Listening home program in combination with a sensory diet on children with sensory processing disorders (SPDs) and visual-motor delays. |
| Author | Credentials: MS, OTR/L Position and Institution: Clinical Occupational Therapist at Children's Hospital in Columbus, OH Publication History in Peer-Reviewed Journals: None |
| Publication | Type of publication: Scholarly peer reviewed journal Publisher: American Journal of Occupational Therapy (AJOT) Other: Official journal of the AOTA |
| Date and Citation History | Date of publication: 2007 Cited By: 65 |
| Stated Purpose or Research Question | "The purpose of this study was to investigate the effectiveness of a therapeutic-listening home program in combination with a sensory diet on children with sensory processing disorders (SPDs) and visual-motor delays" (p. 209). |
| Author's Conclusion | "The present study produced encouraging findings to support the use of Therapeutic Listening as part of an overall sensory integrative approach to occupational therapy in elementary school-age children. Therapeutic |

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| | Listening, along with sensory diet strategies, can be effective in reducing many behaviors associated with sensory integration disorder” (p. 215). |
| Overall Relevance to PICO | Overall Relevance to PICO: Moderate Rationale: The article doesn't specifically look at children with ASD, but it looks at Sensory Processing Disorder (SPD). |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: The article is from the American Journal of Occupational Therapy, so is a reputable source and relates directly to OT. |

Initial Appraisal: Reviews of Research Studies.

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| Type of article | Overall Type: Review of research study Specific Type: Treatment intervention advisory committee review and determination |
| APA Reference | Wisconsin Department of Health Services. (2014). <i>Determination of listening therapy/Therapeutic Listening as a proven and effective treatment for individuals with autism spectrum disorder and/or other developmental disabilities</i> . Retrieved from https://www.dhs.wisconsin.gov/tiac/listeningtherapy.pdf |
| Abstract | Please find below a statement of our determination as to whether or not the committee views Listening Therapy/Therapeutic Listening as a proven and effective treatment for children with autism spectrum disorder and/or other developmental disabilities. In subsequent sections you will find documentation of our review process including a description of the proposed treatment, a synopsis of review findings, the treatment review evidence checklist, and a listing of the literature considered. In reviewing treatments presented to us by DHS/DLTC, we implement a review process that carefully and fully considers all available information regarding a proposed treatment. Our determination is limited to a statement regarding how established a practice is in regard to quality research. We do not make funding decisions. |
| Author | Credentials: Ph.D. (chairperson) Position and Institution: Government appointed position Publication History in Peer-Reviewed Journals: extensive |
| Publication | Type of publication: Government publication Publisher: Wisconsin department of health services |
| Date and Citation History | Date of publication: 2015 Cited By: 0 |
| Stated Purpose or Research Question | “Please find below a statement of our determination as to whether or not the committee views Listening Therapy/Therapeutic Listening as a proven and effective treatment for children with autism spectrum disorder and/or other developmental disabilities” (p. 1). |

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| Author's Conclusion | “In sum, it is the decision of the committee that Listening Therapy/Therapeutic Listening remain a Level 5 treatment (Untested, Experimental & Potentially Harmful)” (p. 3). |
| Overall Relevance to PICO | Overall Relevance to PICO: Strong Rationale: The review specifically looks at the effectiveness of Therapeutic Listening for individuals with Autism Spectrum Disorder. |
| Overall Quality of Article | Overall Quality of Article: Good Rationale: This is a review done by the Wisconsin Department of Health Services. It was a review done in 2015 from the initial review in 2014. |

Critical Appraisal Papers

- Hall, L., & Case-Smith, J. (2007). The effect of sound-based intervention on children with sensory processing disorders and visual-motor delays. *American Journal of Occupational Therapy*, *61*, 209-215. doi: 10.5014/ajot.61.2.209
- Susan Bazyk , Janet Cimino , Kim Hayes , Glenn Goodman & Pamela Farrell. (2010). The Use of Therapeutic Listening with Preschoolers with Developmental Disabilities: A Look at the Outcomes, *Journal of Occupational Therapy, Schools, & Early Intervention*, *3:2*, 124-138, DOI: 10.1080/19411243.2010.491013
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- Case-Smith, J., & Arbesman, M. (2008). Evidence-based review of interventions for autism used in or of relevance to occupational therapy. *American Journal of Occupational Therapy*, 62, 416-429. doi: 10.5014/ajot.62.4.416
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- Hall, L., & Case-Smith, J. (2007). The effect of sound-based intervention on children with sensory processing disorders and visual-motor delays. *American Journal of Occupational Therapy*, 61, 209-215. doi: 10.5014/ajot.61.2.209
- Luong, B., Malloy, A., & Preto, S. (2016). *Therapeutic Listening - quickshifts support for pediatric intervention*. (Student Research Posters). Retrieved from <http://scholar.dominican.edu/ug-student-posters/30>
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Washington Hospital. (2016). *Children's therapy center*. Retrieved from

http://www.washingtonhospital.org/services/childtherapy/occupational_therapy_dept.php

Wilcox, M. (2016). *Occupational therapy techniques, over time, on children with developmental*

delays. (Honor's Project). Retrieved from <http://www.uncp.edu/academics/library>

Wisconsin Department of Health Services. (2014). *Determination of listening*

therapy/Therapeutic Listening as a proven and effective treatment for individuals with

autism spectrum disorder and/or other developmental disabilities. Retrieved from

<https://www.dhs.wisconsin.gov/tiac/listeningtherapy.pdf>

EBP Summary

After extensive review of select auditory integration interventions including Auditory Integration Therapy (AIT), The Listening Program (TLP), and Therapeutic Listening (TL), we can conclude that many of these interventions have not been examined for use with children and adolescents with autism spectrum disorder (ASD). Although some the research we found showed slight improvements in our investigated outcomes, many of them did not analyze the primary long-term outcomes of interest for occupational therapy including performance, participation, and engagement. Specialized training is required for therapists to facilitate AIT, TLP, and TL with their clients. Courses are costly ranging from \$365-\$2400, which further detracts the practicality of these interventions. All three of our auditory interventions were either not reviewed by the expert review groups or were investigated but not recommended. Additionally, some insurance companies and the United States Federal Drug Administration do not approve of some of the interventions and equipment required due to safety concerns and lack of evidence (UnitedHealthcare, 2016). Our preliminary recommendations are that these interventions are a Level 5. A Level 5 means that the treatment is designated as an untested/experimental treatment and/or is potentially harmful (WI Department of Health Services, 2014). Additionally, the results may not be a direct outcome of AIT, TLP, and TL due to a variety of limitations and gaps in research. Because of these gaps and limitations we can conclude that the existing research is of poor quality. Given the chosen study design in a majority of these articles, we cannot make definite conclusions that these interventions caused the differences in the outcomes. Also, due to case study designs and small sample sizes, the results cannot be generalized to the larger population. Conflicting recommendations exist for further on these auditory integration

interventions. Therefore, individuals interested in conducting research should be aware of these cautions.