AV Outcome Research Studies

Class 1 studies	represent the first level of evidence consisting of well-designed, experimentally controlled research studies that include a good, thorough review of all related studies
Communication Outcomes of pre-schoolers with hearing loss enrolled in AVT programs in Ontario Alice Eriks-Brophy, Andree Durieux-Smith, Janet Olds, Elizabeth Fitzpatrick, Robin Gaines , Linda Moran , David Schramm, and JoAnne Whittingham	This prospective, longitudinal research study examined the question of how children with permanent bilateral hearing loss (PBHL) enrolled in AVT programs in Ontario compared to their hearing peers on standardized measures of speech, language and global development. Two groups of children participated in the study; a group of 65 children with hearing loss enrolled in recognized AVT centers in Toronto and Ottawa, and a control group of 48 children with normal hearing. The participating children in both groups ranged in age from 12 to 60 months and had no additional severe handicapping conditions that might have impacted on their speech and language development. In addition to being enrolled in AVT, inclusion criteria for children with hearing loss were the presence of a bilateral sensorineural or conductive hearing loss with congenital or early onset (< 6 months), consistent use of hearing technology, and English as language of intervention. Of the participating children with permanent bilateral hearing loss (PBHL), 68% had severe to profound hearing losses. Thirty two of the children with PBHL wore CIs and 33 wore bilateral hearing aids. Mean age of diagnosis was 13. 9 months (range 0.8-42.9 months) and mean length of enrollment in AVT was 29.5 months (range 9.3-53.7 months). Both groups of children were administered the Preschool Language Scale-Fourth Edition (PLS-4) (Zimmerman, Steiner, & Pond, 2002), the Peabody Picture Vocabulary Test-Third Edition (PPVT-III) (Dunn & Dunn, 1997), the Goldman Fristoe Test of Articulation, Second Edition (GFTA-2) (Goldman & Fristoe, 2000), and the Child Development Inventory (CDI) (Ireton, 1995). The

	number of children who were tested with each measure varied depending on their age at the time of their last assessment. These standardized measures are commonly-used assessment tools that have sound psychometric properties and have been normed on hearing children. Analyses indicated that over 65% of participants with permanent bilateral hearing loss (PBHL) scored in or above the normal range on the speech and language measures used in the study. More specifically, for the PLS-4, 86.8% with scores for this test fell into the normal range for receptive language and 74.6% for expressive language. For the PPVT-III, 67.9% of children with scores for this test performed at or above the normal range. For the GFTA-2, 66.0% of children with scores for this test performed at or above the normal range. Results from the CDI, a parent report instrument, showed no significant differences in performance between the children with hearing loss with scores for this measure and their hearing peers on the scales of gross motor, fine motor, self-help, and social development. Significant differences in expressive and receptive language were found between the two groups of children, however the findings are highly variable for the group of children with hearing loss. Findings from the CDI indicate that parents appear to be reliable reporters of their children's development across all domains. Degree of hearing loss was found to be correlated with several of the standardized outcome measures, however no single variable consistently discriminated between the higher and lower performing groups of children with permanent bilateral hearing loss (PBHL). No consistent correlations with any of the outcome measures and hearing age or age of diagnosis were found, nor were the differences between the higher and lower performing children consistently attributable to age at assessment or type of hearing technology. The results of the study suggest that a large percentage of the children enrolled in AVT fell within normal limits in their performance on the individual

	measures used in the study. Results also suggested differences in development between the two groups of children are apparent in the areas of speech and language, but not consistently in other areas.

Class II Studies	**involve quasi-experimental designs often in the form of cohort studies or program evaluations**
Wu and Brown (2004	examined eight A-V therapists' and 12 parents' expectations of AVT's influence on children at three A-V centers. This study employed a checklist adapted from a norm-referenced standardized language instrument for preselected parents and A-V therapists. The children, mostly preschoolers, received A-V intervention from one to 80 months at the time the questionnaire was completed, and they used either hearing aids and/or cochlear implants. Parents tended to be well educated. The primary outcome of this study is that all adult participants maintained high expectations of the child's progress during A-V intervention. Based on a widely recognized and norm-referenced standardized language assessment tool, the child's language development was predicted by a factor relating to age of diagnosis, device fitting, age at time of A-V initiation, and professional expectation of the child. This Class II study, the first to involve a multi-center collaborative effort, strongly suggests existence of the self-fulfilling prophecy at work among those embracing the Auditory-Verbal model of intervention, that is, high expectation levels related to rate of language growth.
Rhoades and Morrison (2006)	With 20 children from the preceding study, examined their morpho-syntactic and lexical-semantic rates of growth over a one to four year period of A-V intervention that stressed function word learning and comprehension of morpho-syntax rather than speech or lexical-semantic learning. Although the language assessment instruments employed for this study were different, they were also widely used norm-referenced standardized tools. Findings indicate that the children's chronological age upon initiation of A-V intervention was a significant predictor in rates of language progress. The rates of morpho-syntactic language growth exceeded the rates of lexical-semantic growth demonstrated by the children, although both rates were considered equivalent to the rates of language growth of normally hearing children.
(Rhoades & Chisolm, 2001; Rhoades, 2001),	In another longitudinal investigation the language progress of 40 children from one A-V center was examined over one to four years of A-V intervention. These children had varying degrees of hearing loss, with most being severe-profound. Their average age was 40 months at the time of commencing A-V intervention, and their parents tended to be well educated. Only widely recognized normreferenced and standardized global language assessment instruments were employed to ascertain children's rates of language progress. Twenty-five percent of the children started and ended the study as hearing aid users, another 25% started and ended the study as cochlear implant users; the remaining 50% started as hearing aid users but ended as cochlear implant users. During the course of A-V intervention, 78% of the children were

	diagnosed by occupational therapists as having sensory integration issues, and half were identified as having oral-motor dysfunctions by speech pathologists. Outcomes show that these children typically made 100% rates of language growth, that is, the same rate of growth as normally hearing children. While 30% of these children did not continue with the program at the A-V center for a variety of reasons, ranging from insufficient home follow-up to family relocation, most still demonstrated language progress. For most children in this study, their receptive language growth was more rapid during the first two years of A-V intervention, but their expressive language growth rates quickly increased in the third and fourth intervention years. It was also noted that the gap between chronological age and language age was closed so that linguistic competency commensurate with normally hearing peers was A-V research outcomes 17 attained. This investigation showed that 100% rate of language growth for each A-V intervention year can and should be an accurate benchmark for effective delivery of services.
Eriks-Brophy et al., 2006	Incorporating the aforementioned parents, their children and itinerant teachers were included in a later study that involved participation in one of 10 focus groups. Nearly 30% of these parents' children received some sort of special education services at some point in their educational history. The purpose of this investigation was to identify facilitators and barriers to school inclusion. Findings emphasized the importance of examining factors external to individual children with hearing loss in preparing for mainstreaming. Findings from this study strongly suggest that successful mainstreaming requires commitment from all stakeholders: parents, administrators, and itinerant teachers. In particular, the itinerant teacher was identified as being the most frequent and important facilitator. Normally hearing peers were recognized as having potentially important facilitative roles. The majority of identified barriers to successful mainstreaming were lack of knowledge, negative attitudes, and insensitivity of other key players in the mainstream process. As recognized by the investigators, findings of this study are limited in their generalizability.
Duquette, Durieux-Smith, Olds, Fitzpatrick, Eriks-Brophy, and Whittingham (2002)	collected data from parents through questionnaires and focus groups. Parents in this study had children with hearing loss, ranging from mild to profound, with half of the children participating in this study diagnosed as having severe profound deafness. At the time of data collection, the children were between 14-30 years old, with most still in high school. Most of these children were fitted with hearing aids at an average age of 2 years 6 months, having received A-V intervention from one particular program for a mean of two years. Moreover, most children were raised in well educated dual parent households. The purpose of this study was to determine 41 parents' perceptions of their children throughout the mainstream process, subsequent to A-V preschool intervention. Through questionnaires and focus groups, findings show that parents perceived themselves as having four critical roles in the process of facilitating academic and social integration within the

	mainstream. These four roles were (1) to act as a teacher from the time their children were initially mainstreamed until high school graduation; (2) to serve as advocate for their children; (3) to become involved in a support group; (4) to actively and accurately facilitate the social integration of their children with normally hearing peers. A resultant recommendation of this investigation is that schools should recognize parents of children with hearing loss as active, collaborative partners of the mainstream process
Duncan & Rochecouste, 1999	examined the length and complexity of utterances of 13 normally hearing and 13 children receiving A-Vintervention, all in preschool settings. A standardized assessment tool was used to analyze each child's production of free and bound morphemes, MLU-m representing the mean length of utterance measured in morphemes, and MSL representing the mean syntactic length or measurement of utterance length in words. Again, data were collected in both naturalistic and structured dyadic settings, the latter with the inclusion of high specificity toys. This study showed that four-year-old normally hearing children had average 3.8 MLU-m and 3.5 MSL, compared to scores of 2.6 MLU-m and 2.5 MSL for peers receiving A-V intervention, the latter using fewer bound morphemes and less frequently. At this age level, most A-V children's bound morphemes were present progressive /-ing/, plural /s/, and contracted third person copula /'s/, e.g., that one's bigger. The five-year-old normally hearing children had average 4.9 MLU-m and 4.4 MSL, compared to scores of 3.3 MLU-m and 3.1 MSL for peers receiving A-V intervention. The former used a range of 12 grammatical bound morphemes, while the latter used a range of 11 bound morphemes but less frequently. While this study shows a language delay for children receiving A-V intervention, it is noted that although they had severe-profound deafness, they were all hearing aid users. The authors did not statistically consider the significance of any factors, other than to note that the children
An evaluation of Auditory Verbal therapy using the rate of early language development as an outcome measure Sarah Hogan [1 *], Jacqueline Stokes [1], Catherine White [1], Elizabeth Tyszkiewicz [2], Alexandra Woolgar [3] 2008	Providing unbiased data concerning the outcomes of particular intervention methods is imperative if professionals and parents are to assimilate information which could contribute to an 'informed choice'. An evaluation of Auditory Verbal Therapy (AVT) was conducted using a formal assessment of spoken language as an outcome measure. Spoken language scores were obtained on entry to the study and re-administered at intervals of at least 6 months. Predicted language scores in the absence of Auditory Verbal (AV) intervention were calculated according to a model. Predicted and actual rates of language development (RLD) were compared. The heterogeneity of this group of children derived from their degree of hearing loss, the aetiology of each child's loss, the type of hearing technology used and the age at which they started therapy. For all age groups and for each of the different hearing technologies, AVT was found to be a highly effective programme for accelerating spoken language development when using RLD as an outcome measure. Copyright © 2008 John Wiley & Sons, Ltd.

Rhoades, EA; Chisholm, TH. (2001). Global language progress with an auditory-verbal approach for children who are deaf or hard of hearing. Volta Review, Volume 102(1), Pgs. 5-25.	Abstract: Study examining the global language growth rate of 40 children with hearing loss (hearing aid and cochlear implant users) who received intensive auditory-verbal intervention for a period of 1-4 years. Three global language assessment instruments were administered to the children at least annually after auditory-verbal services were initiated. Results show that there was significant growth in both receptive and expressive language abilities, and that the gap between chronological age and language age was closed. This study focused on the language growth of 40 heterogeneous children with significant hearing loss (no other pre-selection criteria were used), both hearing aid and cochlear implant users, who received intensive auditory verbal intervention (auditory comprehension-based model of a functional language 'road map') over a period of one to four years. Their average CA upon initiation of AV intervention was 44 mos. At the outset of this study, 2/3 of children were hearing aid users and about half of these became CI users. The mean unaided better ear PTA of Hearing Aid-only group was 75 dB. Of all 27 CI users, 1/3 were Clarion users and remainder used either N-22 or N-24 device. Although fifteen percent of the children were diagnosed as cognitively delayed, only one was in a special education class. Over the course of this study, 78% were referred for Sensory Integration evaluations and 2/3 of them were found to have moderate or severe SI dysfunctions, with at least 60% of all 40 children receiving SI therapy. About half of all children were referred for oral-motor therapy. Five percent required medication for both ADHD and psychologically diagnosed bipolar disorder. Three global language assessment instruments (SICD-R, PLS-3, OWLS) were administered to the children at semi-annual intervals following initiation of auditory verbal services. Mean equivalent receptive language ages were higher than mean equivalent expressive language ages. Group performances in receptive and expressive language for each year indicate that a reasonable overall minimally expected rate of growth should be 100% for each year of AV intervention, even for older preschool children. Furthermore, performance of the 'graduates' show that the gap between chronological age and language age was closed, i.e., these children essentially attained syntactical competency at levels commensurate with normally hearing peers. These "graduates" attained from 100-240% language growth rates during each year of AV intervention.
Robertson, L., & Flexer, C. (1993). Reading development: A parent survey of children with hearing impairment who developed	

speech and language through the auditory-verbal method. The Volta Review, 95 (3), 253-261.	
Sharma, Anu; Dorman, Michael F.; Spahr, Anthony J (2002). A sensitive period for the development of the central auditory system in children with cochlear implants: implications for age of implantation. Ear & Hearing. 23(6):532-539, December 2002.	OBJECTIVE: The aim of the present experiment was to assess the consequences of cochlear implantation at different ages on the development of the human central auditory system. DESIGN: Our measure of the maturity of central auditory pathways was the latency of the P1 cortical auditory evoked potential. Because P1 latencies vary as a function of chronological age, they can be used to infer the maturational status of auditory pathways in congenitally deafened children who regain hearing after being fit with a cochlear implant. We examined the development of P1 response latencies in 104 congenitally deaf children who had been fit with cochlear implants at ages ranging from 1.3 yr to 17.5 yr and three congenitally deaf adults. The independent variable was the duration of deafness before cochlear implantation. The dependent variable was the latency of the P1 cortical auditory evoked potential. RESULTS: A comparison of P1 latencies in implanted children with those of age-matched normal-hearing peers revealed that implanted children with the longest period of auditory deprivation before implantation-7 or more yr-had abnormal cortical response latencies to speech. Implanted children with the shortest period of auditory deprivation-approximately 3.5 yr or less-evidenced age-appropriate latency responses within 6 mo after the onset of electrical stimulation. CONCLUSIONS: Our data suggest that in the absence of normal stimulation there is a sensitive period of about 3.5 yr during which the human central auditory system remains maximally plastic. Plasticity remains in some, but not all children until approximately age 7. After age 7, plasticity is greatly reduced. These data may be relevant to the issue of when best to place a cochlear implant in a congenitally deaf child.

Class III Studies	**these studies are considered non-experimental research designs that are often retrospective in nature**
(McCaffrey, Davis, MacNeilage, & von Hapsburg, 2000; Warner-Czyz, Davis, & Morrison, 2005	Carefully designed case study of a typical child with profound congenital bilateral deafness whose family received A-V **intervention**
(Easterbrook, O'Rourke, & Todd, 2000)	retrospective study examined ten years of data from an A-V center and then surveyed those identified children. They found that most of those children continued to be fully mainstreamed, had less than a one-year language gap subsequent to AVT, and were from affluent White families
Wray, D., Flexer, C. and Vaccaro, V. (1997). Classroom performance of children who are deaf or hard of hearing and who learned spoken language through the auditory-verbal approach: an evaluation of treatment efficacy. The Volta Review, 99(2):107-119.	study assessed the classroom performance of 19 grade school children who received A-V **intervention**; the Screening Instrument for Targeting Educational Risk (Anderson, 1989), a screening questionnaire completed by their teachers, was the assessment instrument employed by the investigators. Findings show that teachers felt these hearing aid users performed well, both socio-emotionally and academically within the mainstreamed setting. Unfortunately, the screening instrument used has no associated normative data
Outcome Study of Auditory Verbal Graduates: Study of Clinical Efficiency By Donald M. Goldberg and Carol Flexer	The purpose of this investigation was to document the status of graduates of one aural habilitation option; auditory-verbal. A consumer survey was completed by graduates from auditory-verbal programs in the United States and Canada. Graduates were queried regarding degree and etiology of hearing loss, age of onset, amplification, and educational and employment history, among other topics. Results indicated that the majority of the respondents were integrated into regular learning and living **RESULTS** **Hearing Loss** • Ninety-three - severe to profound severity range • over 95 percent reported a prelingual loss (defined as 3 years of age or younger • unknown etiology (53.4%). **Identification and Amplification History** The average age of identification of the hearing loss was 23 months, with the average age of initial amplification 27 months, **Educational History** Perhaps the most telling data relate to the educational history of the auditory-verbal graduates. The degree of mainstreaming (defined as fully integrated in "normal" schools) was impressively high.

	Furthermore, 152 respondents stated that they had completed high school and one reported receiving a GED degree. Approximately 70 percent of the respondents reported their age at graduation from high school to be between 16 through 18 years. Not surprisingly, over 95 percent of the students continued with some form of post-secondary education. Of the 139 respondents reportedly continuing education after high school, 124 attended or were enrolled in college or university settings. Of the individuals attending colleges or universities, only 12.1 percent (N = 15) stated that they attended or were enrolled at National Technical Institute for the Deaf or Gallaudet University. The rest attended postsecondary programs that were not dedicated to working specifically with persons with hearing impairment. **Auditory-Verbal Therapy** The average number of years of enrollment in auditory-verbal therapy was 11. Respondents noted the range of therapy time from 3 to 23 years (for several, their entire lifespan equaled years of therapy), suggesting that auditory-verbal intervention is a long-range commitment. **Familial Involvement** all (N = 152) stated that their mothers were actively involved. Over 80 percent reported involvement of their fathers with approximately two-thirds (66.9%) of their siblings also participating **Societal Integration** More than half of the respondents (56.1%) reported early and continuing involvement in community activities. **Additional Disabilities** Approximately one-third (36.7%) of the graduates reported having disabilities **Perceptions** The respondents were queried as to their perceptions of their current participation in the "hearing," "deaf" or both worlds (Fig. 4). Approximately three-quarters (72.7%) stated that they were part of the "hearing" world. Within this group, 13.3 percent specifically described being offered the opportunity to be part of the hearing world due to the choices afforded them.Only

	one respondent stated being in the "deaf" world; this person did not elaborate. Approximately one-quarter (26.7%) of the respondents reported being part of both the "hearing and deaf worlds."
Goldberg DM, Flexer C (2001). Auditory-verbal graduates: outcome survey of clinical efficacy. J Am Acad Audiol. 2001 Sep;12(8):406-14. Department of Communication, The College of Wooster, Ohio 44691, USA.	This project is an update of an earlier study on American and Canadian graduates of auditory-verbal programs. Survey research was conducted to obtain information on a variety of topics. Overall, the current results again indicated that the majority of respondents were integrated into "regular" or "typical" learning and living environments. In view of the earlier identification of hearing loss and the early fitting of sensory aids and availability of cochlear implant technology, coupled with intervention that emphasizes auditory learning, it is suggested that today's infants have the potential to become independent, participating, and contributing citizens in mainstream society