Efficacy of a Communication Training Program for Hearing-Impaired Elderly Adults

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The efficacy of a communication training program for elderly adults with hearing impairment was investigated. An experimental group ($N = 13$) received a 4-week communication training program that emphasized the comprehension of the general meaning of spoken messages by using situational and linguistic cues. A control group ($N = 13$) received no training. Results revealed significant reduction in self-perception of hearing handicap, and slight but significant improvement of speech recognition ability for all subjects. The HHIE and speech recognition measures did not reveal a difference in improvement between the experimental and control group. The results highlight the need for continued development of reliable validation measures for documenting the effectiveness of audiologic rehabilitation programs and for the inclusion of a control group.

The major goal of audiologic rehabilitation is to overcome the communication and psychosocial handicaps that often accompany hearing impairment (Weinstein, Spitzer, & Ventry, 1986). Components of a rehabilitation program usually include a hearing aid orientation, speechreading and/or listening training, and

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educational and informational counseling. Although many authors have proposed models of adult audiologic rehabilitation (Alpiner, 1971; Garstecki, 1982; Hardick & Gans, 1982), documentation of the effectiveness of these proposed models in the elderly population is lacking.

Several researchers attempted to document the effectiveness of certain rehabilitation strategies by noting statistically significant changes in speech recognition abilities following treatment. For example, some studies have demonstrated significant improvement in speech recognition following auditory and/or visual training (Rubinstein & Boothroyd, 1987; Walden, Erdman, Montgomery, Schwartz, & Prosek, 1981). Walden et al. (1981) studied 35 first time hearing aid users who had no previous training. After pre-testing, the control group received a 2-week standard hearing aid orientation. The auditory and visual training groups received 7 hours of analytic consonant recognition training beyond the standard hearing aid orientation. Pre- and post-test results using an auditory consonant recognition test suggested that although subjects in all three groups increased their scores, subjects receiving individual consonant recognition training (auditory or visual) improved significantly more than those receiving just the 2-week standard orientation.

Rubinstein and Boothroyd (1987) studied 20 older adults with mild to moderate sensorineural hearing loss. Each subject's speech recognition was tested at the beginning of the study, after 4 weeks of no treatment, after 4 weeks of auditory training, and after a final 4 weeks of no training. The tests included a nonsense syllable test (NST) (Resnick, Dubno, Hoffnung, & Levitt, 1975), the low predictability portion of the Revised Speech Perception in Noise (RSPIN) test, and the high predictability items of the RSPIN test (Bilger, 1984).

The goals of the study were to determine if speech recognition would improve in response to auditory training and whether inclusion of an analytic training component would increase scores more than training with synthetic tasks alone. Also of interest was whether improvements would be retained after treatment ended and whether any improvements would be detected by both analytic and synthetic measures.

Results indicated that auditory training, both synthetic and analytic, resulted in statistically significant improvement in speech recognition performance on the high predictability RSPIN test items (approximately 10% for both the synthetic only and synthetic-analytic groups). Scores for the low predictability portion of the RSPIN, and the NST, were not improved. The gains achieved were not lost in the month following the end of training.

The improvements in speech recognition performance were modest in most cases and significant improvement was noted in only one of their three speech recognition measures. The authors could not determine if ineffective treatment methods or an insensitive measuring tool were responsible. Further, a wide range of improvement among subjects was seen.

Smaldino and Smaldino (1988) examined the effect of audiologic rehabilitation on perception of hearing handicap. Subjects were divided into a control group, which received only a standard hearing aid orientation, and three experimental groups that received various treatments. One experimental group received the same hearing aid orientation as the control group in addition to information about their individual cognitive learning styles. Another experimental group received the hearing aid orientation, cognitive information, and a 4-week audiologic rehabilitation program. The final experimental group received only the hearing aid orientation and the audiologic rehabilitation training. The audiologic rehabilitation program consisted of four sessions, one of which focused on auditory training. Perception of hearing handicap was assessed using the Hearing Performance Inventory (Lamb, Owens, Schubert, & Giolas, 1979).

Results of the study indicated that the groups receiving the audiologic rehabilitation program experienced a significantly greater reduction in self-perceived handicap than the control group and the group receiving only cognitive style information. However, the authors could not establish which treatment procedures, or combination of procedures, were responsible for the change.

The present study was designed to evaluate a communication training program using both speech recognition and self-perceived hearing handicap measures. Although Rubinstein and Boothroyd (1987) documented the improvement of speech recognition following auditory training, we were interested in determining whether the negative psychosocial effects of hearing impairment were reduced following a communication training program. The Hearing Handicap Inventory for the Elderly (HHIE) (Ventry & Weinstein, 1982) was selected as the dependent measure in this regard. It was hypothesized that speech recognition abilities would be improved, and psychosocial handicaps associated with hearing loss would be reduced as a result of a 4-week communication training program, in the experimental group but not in the control group.

METHODS

Subjects were selected from persons who responded to a newspaper article describing the research project and participation criteria, and which offered free audiologic rehabilitation at a state university. Twenty-six hearing aid users with no previous audiologic rehabilitation participated in this research. All subjects had binaural sensorineural hearing loss and corrected distance vision of at least 20/30 as measured using a Titmus OV-7H vision tester. The subjects were randomly assigned to either the control or experimental group, each group consisting of 13 older adults with hearing impairment. The mean age of the subjects was 70.8 years, with a range from 61 to 83 years. Mean age and pure-tone averages for the subject groups are shown in Table 1.

The HHIE (Ventry & Weinstein, 1982) was used to assess self-perceived handicap before and after the listening training program. Each subject was tested individually using a paper/pencil task.

Additionally, a speech recognition test was administered, consisting of a videotaped presentation of the revised Central Institute for the Deaf Everyday Sen-

Table 1

Mean Age and Pure-Tone Averages for the Subject Groups, $n = 13$ in Each Group

Group	Age (yrs)	PTA (500, 1000, & 2000 Hz)	PTA (1000, 2000, & 4000 Hz)
Control			
Mean	72.5	39.4	52.4
SD	5.1	11.0	12.3
Experimental			
Mean	69.0	36.8	50.7
SD	6.4	11.3	12.4

Note. PTA = pure tone average in dB HL.

tence Test Lists (Harris, Haines, Kelsey, & Clack, 1961). The six lists were recorded on ¾-inch video, with an accompanying audiotape of competing voice babble noise. They were then routed through a Grason Stadler 1701 audiometer, to a 19-inch Sony Model 1920 video monitor, placed 4 feet from the subject at a zero degree azimuth inside a double-walled IAC sound-isolated booth.

The subjects listened to monaural presentations of randomized sets of CID sentences at signal to noise ratios of −10, 0, and +10 dB, with speech remaining at a constant 60 dB HL level, through standard TDH-50 headphones. The stimuli were presented in two conditions: audiovisual and audio only. The order of presentations of these conditions was randomized. The subjects wrote down each sentence while the tape was stopped. When they finished, they verbally signaled the clinician, who restarted the tape for presentation of the next sentence. Answers were scored by the percentage of syllables correctly identified.

The control group received no training while the experimental group received communication training on an individual basis for 4 weeks, twice a week, in 1-hour sessions for a total of eight sessions/hours. This training schedule was similar to that employed by Rubinstein and Boothroyd (1987). Training was conducted individually by a male graduate-level audiology student under supervision of the senior authors. It consisted of information presentation and listening activities, in quiet and noise, that were developed to train the individual to recognize the meaning of the message rather than individual sounds or words. The program emphasized coping strategies to enable the elderly person with hearing impairment to comprehend the meaning of a message when only part of the signal is heard. Training to develop good listening habits and conversational strategies was designed to increase the subjects' confidence and help them concentrate on the meaning of the message. The areas covered in training were: (a) attitude, (b) assertiveness, (c) repair strategies, (d) anticipation strategies, (e) relaxation strategies, and (f) practice listening in background noise.

Pre- and post-training assessments were conducted for each group. The control group, upon conclusion of the research, could opt to receive the same communication training course that the experimental group received.

RESULTS

The HHIE yields a total score, and emotional and social subscores, which range from 0 to 100 for the total scale, 0 to 52 for the emotional subscale, and 0 to 48 for the social subscale. Table 2 shows mean HHIE data for all subjects combined ($N = 26$), as well as for the two groups. It can be noted that the mean improvement in handicap rating (total scale) was 8.39 percentage points for all subjects.

Table 2

Means and Ranges of HHIE Data for the Control, Experimental, and Combined Groups

	Emotional		Social		Total	
	Mean	**Range**	**Mean**	**Range**	**Mean**	**Range**
Control $n = 13$						
Pre	19.69	0-52	20.15	4-48	39.85	4-100
Post	15.38	0-52	16.46	4-48	31.85	4-100
Experimental $n = 13$						
Pre	16.00	0-48	18.92	6-44	34.92	10-92
Post	10.14	2-24	13.00	0-44	23.14	2-58
Combined $N = 26$						
Pre	17.85	0-52	19.54	4-48	37.39	4-100
Post	13.15	0-52	15.85	0-48	29.00	2-100

Due to the distribution of the data, an arcsine transformation was performed on all scores prior to analysis. Separate analyses of variance with repeated measures then were conducted using the design of 26 subjects in two groups (experimental and control) by time (pre-, post-treatment) for the HHIE emotional subscale, social subscale, and total score. For all three analyses, the only significant effect was time ($p < .05$), indicating a significant difference in pre- and post-treatment test scores. No other significant main or interaction effects were found ($p > .05$).

In order to examine the effects of listening training on speech recognition performance, a speech recognition test was given in both audiovisual (AV) and auditory only (A) conditions. Table 6 shows speech recognition data for the two groups of subjects. Arcsine transformations were also completed on these data. To determine the relationship between the number of syllables correctly identified and group (experimental, control), time (pre-, post-test), condition

Table 3
Results of the Analysis of Variance With Repeated Measures Using Arcsine Transformed Scores on the HHIE Emotional Subscale

Source	df	Type III SS	Mean Square	F Value	Prob > F
Group	1	0.0017612	0.00176122	0.00	.9506
Error	23	10.7715502	0.44881459		
Time	1	0.4927410	0.49274108	4.28	.0495
Time * Group	1	0.0094505	0.00945055	0.08	.7770
Error	23	2.7634111	0.11514213		

Table 4
Results of the Analysis of Variance With Repeated Measures Using Arcsine Transformed Scores on the HHIE Social Subscale

Source	df	Type III SS	Mean Square	F Value	Prob > F
Group	1	0.1694406	0.16944061	0.45	.5065
Error	23	8.9415242	0.37256351		
Time	1	0.5046818	0.50468182	6.19	.0202
Time * Group	1	0.0053340	0.00533405	0.07	.8003
Error	23	1.9570808	0.08154503		

Table 5
Results of the Analysis of Variance With Repeated Measures Using Arcsine Transformed Scores on the HHIE Total Scale

Source	df	Type III SS	Mean Square	F Value	Prob > F
Group	1	0.0499296	0.04992967	0.05	.7025
Error	23	8.0176707	0.33406961		
Time	1	0.5142864	0.51428647	6.52	.0175
Time * Group	1	0.0078275	0.00782754	0.10	.7555
Error	23	1.8934835	0.07889515		

(auditory, audiovisual), and level (−10, 0, +10 S/N ratio), another repeated measures analysis of variance was completed. Table 7 shows the results of this analysis. No group effect was found ($p > .05$), as the mean score for the experimental group was not significantly different from the mean score for the control group.

Significant results for within subject analysis were the time main effect ($p < .05$) and condition-level interaction ($p < .05$). Although significant, the pre- to post-test improvement (time main effect) was only 2.8% (pre-test grand mean = 41.44%; post-test grand mean = 44.25%). Further analysis of the condition-

Table 6
Mean Pre- and Post-Test Scores (Percent Correct) for the Speech Recognition of the Two Groups of Students

	Control				Experimental			
	AV		A		AV		A	
S/N	Pre	Post	Pre	Post	Pre	Post	Pre	Post
+10 dB								
M	80.5	84.5	67.5	73.7	82.5	78.1	68.2	68.2
SD	22.4	18.4	31.0	22.2	13.6	17.3	23.0	19.7
0 dB								
M	60.5	69.1	31.2	37.2	58.0	58.3	32.7	33.7
SD	27.6	28.5	25.9	31.8	18.5	22.6	21.0	19.0
−10 dB								
M	10.9	13.9	0	3.6	5.2	10.0	0.1	0.8
SD	17.9	22.2	0	11.3	7.7	15.5	0.3	2.5

Note. AV = Audiovisual; A = Auditory only.

level interaction, using Tukey Wholly Significant Difference tests, indicated expected results of significantly better scores for the audiovisual over the auditory only condition for the 0 dB SN level. For the easier +10 dB SN level and the more difficult −10 dB SN, no significant differences were found between conditions.

DISCUSSION

We had predicted that the experimental subjects would show a small but significant improvement in speech recognition. Recall that Rubinstein and Boothroyd (1987) had found a modest but significant improvement in speech recognition using the highly predictable sentences of the RSPIN. We felt that use of the CID Everyday Sentences would yield similar results because of the redundancy within the sentences. Likewise, we had predicted that the experimental subjects would show a significant reduction in perceived hearing handicap, due to training. The training procedures were designed to provide practice in difficult listening situations and advice on coping strategies. Since Rubinstein and Boothroyd (1987) found a significant improvement in speech recognition, we wished to determine whether similar training would also yield a reduction in the psychosocial effects of hearing loss.

Results of this research indicate that elderly persons with hearing impairment in this study show a modest but significant reduction (approximately 8.4 points) in self-perception of hearing handicap over time (from pre- to post-test), as well as a slight but significant improvement in speech recognition. However, none of the between subject effects was found statistically significant. That is, there

Table 7
Results of the Analysis of Variance With Repeated Measures Using Arcsine Transformed Scores on the Speech Recognition Tests

Source	df	Type III SS	Mean Square	F Value	Prob > F
Group	1	0.0950	0.0950	0.07	.7914
Error	23	30.5420	1.3279		
Time	1	1.2564	1.2564	5.64	.0263
Time * Group	1	0.4470	0.4470	2.01	.1701
Error	23	5.1257	0.2228		
Condition	1	13.9813	13.9813	94.72	.0001
Condition * Group	1	0.4447	0.4447	3.01	.0960
Error	23	3.3950	0.1476		
Level	2	158.2166	79.1083	127.23	.0001
Level * Group	2	0.1605	0.0802	0.13	.8792
Error	46	28.6016	0.6218		
Time * Condition	1	0.0082	0.0082	0.06	.8084
Time * Condition * Group	1	0.1973	0.1973	1.45	.2407
Error	23	3.1286	0.1360		
Time * Level	2	0.1050	0.0525	0.45	.6417
Time * Level * Group	2	0.1920	0.0960	0.82	.4469
Error	46	5.3886	0.1171		
Condition * Level	2	2.0913	1.0456	4.32	.0191
Condition * Level * Group	2	0.0263	0.0132	0.05	.9471
Error	46	11.1383	0.2421		
Time * Condition * Level	2	0.0209	0.0104	0.07	.9349
Time *Condition * Level * Group	2	0.5154	0.2577	1.66	.2011
Error	46	7.1357	0.1551		

was no real difference in improvement between the experimental and control groups on the total HHIE score, the emotional or situational subscales, nor the speech recognition measures.

The mean improvement in speech perception ability across subjects was 2.8%. However, there was considerable variation among subjects' scores, suggesting the inadequacy of using mean data alone to describe improvements in performance. When individual data were examined, it was noted that a few subjects showed substantial improvement in speech recognition scores while others actually obtained worse scores on the post-test.

In addition to the large variability noted among subjects for speech recognition measures, there was wide dispersion of self-perceived handicap ratings. The HHIE was chosen for this study based on its high test-retest reliability, its high internal consistency reliability, and because it had been previously validated in terms of psychometric adequacy. Ventry and Weinstein (1982) suggested that pre- and post-intervention HHIE ratings were one of the most promising means of documenting the psychosocial effectiveness of a particular rehabilitation strategy. Yet, except for Smaldino and Smaldino (1988), there are no reports in the literature of hearing handicap inventories being used to document the influence of audiologic rehabilitation programs on psychosocial functioning in the elderly population with hearing impairment.

Several reasons may be offered as to why the HHIE failed to detect a difference in improvement between the experimental and control group. The most obvious is that there was none. That is, participation in the active listening program may have had no effect on reduction of self-perceived handicap. While this hypothesis seems defensible based on group data, the dispersion of individual HHIE scores suggests that some elderly persons with hearing impairment may experience a much greater handicap reduction than others as a result of audiologic rehabilitation beyond that provided by amplification alone. For example, 1 experimental subject showed striking reduction in self-perceived handicap following treatment (from 100% handicap rating to 18%), while another experimental subject gave identical total ratings (44%) before and after treatment. Likewise, a control subject showed a reduction in handicap rating of 30% (from 52% to 22%) with no treatment intervention, while another control subject gave identical (100%) handicap ratings before and after a no treatment period.

It is interesting that 1 subject in the control group contacted the authors several weeks after her post-testing to thank us for helping her learn to deal with her disability. This was surprising because she received no therapy. The administration of the self-assessment itself could have a treatment effect by making the subject more aware of problems, thereby helping them problem solve themselves.

The failure of the HHIE to detect a group difference may lie in the sensitivity of the test instrument rather than the efficacy of treatment. The training program used in this study focused on conversational strategies, empathic skills, and assertiveness training. While conversational ease may have improved as a result of the 4-week training program focusing on conversation strategies, this improvement may not have been sufficient to reduce the perception of the overall handicap. For example, one of the HHIE questions asks if a hearing problem causes feelings of frustration when talking to family members. It is doubtful that a 4-week training program will cause patients to no longer feel frustrated by their hearing impairment, and therefore any benefits of the program may be masked. Perhaps use of the HPI, with its detailed communication situation descriptors and five response options ("nearly always" to "almost never"), would be a more sensitive measure. Recall that Smaldino and Smaldino (1988) successfully used the HPI to document treatment efficacy.

It is also noted that 3 subjects (1 in the experimental and 2 in the control groups) had pre-test HHIE scores below 12%. Use of subjects with greater perceived handicap may have yielded differences between the experimental and control subjects.

Also, Weinstein et al. (1986) recommended use of face-to-face administration of the HHIE. We used the paper-and-pencil format thus possibly decreasing the sensitivity of the HHIE as a measure of treatment effectiveness.

Some of the same concerns regarding the sensitivity of the HHIE are evident for the speech recognition measures used. There was pronounced variability among subjects in CID sentence scores presented both audiovisually and in the auditory-only mode. According to mean group data, both experimental and control subjects showed modest improvement in the ability to identify key words in CID sentences. Examination of data from individuals, however, revealed that pre- and post-test scores were unstable, irrespective of condition or experimental group. Additionally, recall that a goal of the training program was to facilitate ease of conversation. Since live conversation was not used during pre- and post-testing, there was no opportunity for subjects to employ anticipation and repair strategies, or reflective listening skills in the test situation. These types of improvements are difficult to measure using conventional speech recognition measures. Thus, the type of tests used to measure speech perception improvement might not be sensitive to the types of improvements gained by the training. That is, the subjects were trained to take control of communication situations, yet were not allowed to do so in the testing situation.

For future research, a method for measuring ease of conversation should be used to assess gains made from this type of program. Topicon, by Erber (1988), is a method by which conversations may be elicited from subjects on a wide range of topics. The clinician rates overall fluency and related pragmatic factors (e.g., attention, receptive ability, turntaking, etc.). This assessment procedure is conversation-based and may be sensitive to subtle, yet significant benefits of adult audiologic rehabilitation programs. Tye-Murray's (1991) Strategies Usage Test may also be a useful way to quantify benefits from communication therapy.

In agreement with Rubinstein and Boothroyd (1987), we noted a small, but statistically significant, improvement in speech recognition in subjects as a function of time. The Rubinstein and Boothroyd study, however, did not use a separate control group. The subjects served as their own controls. If we had not included a control group, our results might also have supported the inclusion of formal communication training in audiologic rehabilitation programs with adults. Yet, because there was a lack of differentiation of speech recognition and handicap measures between the experimental and control group, this study shows no clear trend toward a significant improvement in speech recognition abilities, or reduction of self-perceived handicap, resulting from intervention. The question of whether training of this type and duration is efficacious for reduction of communication and psychosocial handicap remains unresolved. It is imperative for studies of this nature either to have a control group included in the design, as in the current investigation, or to use a multiple baseline design as in the study by Rubinstein and Boothroyd (1987). It will be beneficial, also, to establish what changes in speech perception or handicap rating are clinically relevant. Research in this area is lacking.

Additionally, studies employing larger numbers of subjects would allow regression analysis to establish correlates of subject gains. When gain scores show high variability, as in the present investigation, regression analysis may be helpful to determine if regression toward the mean has affected the data set (Montgomery & Demorest, 1988). Regression toward the mean may bias the data because the person's initial score may influence subsequent scores. A high initial pretest score tends to be lower on retest, whereas a low initial pretest score tends to be higher on retests regardless of treatment effects.

In sum, the results of this study suggest slight improvements in speech recognition ability and modest reductions in perception of hearing handicap in elderly subjects with hearing impairment over time. However, it cannot be concluded that participation in a communication training program had any influence on these changes. Nor can it be concluded that the intervention was not beneficial to subjects, since the pre- and post-intervention measures might not have been sensitive to the types and amounts of change in subjects. The ambiguities of the findings of this study warrant further research to investigate not only the effectiveness of various components of the rehabilitation program but also the validity of the measures used to document treatment effectiveness. The results of this study highlight the need for continued development and refinement of reliable validation measures for documenting the effectiveness of audiologic rehabilitation programs. Additionally, it was not clear from the present study whether further training would have yielded significant gains in the experimental group. Studies investigating the learning curves associated with various training techniques should be conducted.

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