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VALIDATION OF A NEW APPROACH FOR SCREENING OLDER ADULTS FOR HANDICAPPING HEARING IMPAIRMENT

by

DORON MILSTEIN

A dissertation submitted to the Graduate Faculty in Speech and Hearing Sciences in partial fulfillment of the requirements for the degree of Doctor of Philosophy, the City University of New York

2001

This manuscript has been read and accepted for the Graduate Faculty in Speech and Hearing Sciences in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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Abstract

VALIDATION OF A NEW APPROACH FOR SCREENING OLDER ADULTS FOR HANDICAPPING HEARING IMPAIRMENT

by

DORON MILSTEIN

Advisor: Professor Barbara E. Weinstein

Despite the high prevalence of hearing loss among older adults, relatively few elderly people undergo audiological evaluations and obtain hearing aids, although hearing aids can be beneficial. Hearing impairment negatively effects the elderly person's daily functioning, justifying the need for an efficient hearing screening protocol. Traditional hearing screening protocols are associated with low compliance with follow-up/rehabilitation recommendations. Research suggests that counseling and understanding of the medical condition and its consequences can improve compliance with recommendations.

This research was designed to compare the feasibility and effectiveness of the traditional approach (screening with no counseling) with that of a new informative approach (screening plus counseling), in order to examine the following main research question: Will the new informative screening approach be associated with a statistically

higher compliance with follow-up recommendations than the traditional approach? A total of 147 elderly subjects were randomly assigned to either the control (traditional) or experimental (informative) group, and compliance with follow-up recommendations was compared.

Results revealed that the experimental condition did not lead to greater compliance. In fact, subjects in the control condition were more likely to comply than those in the experimental condition. However, the difference between experimental and control conditions was, at best, marginal. Based on HHIE-S scores and follow-up audiograms, the population of the present sample, from senior centers, seems to be less in need of audiological rehabilitation, so the compliance rate might not be due to the screening protocol. It is possible that the same protocol, including the experimental condition/counseling videotape, would yield a higher compliance rate if tested with a different population/setting (e.g., a geriatric clinic) that is more in need of audiological rehabilitation.

Thus, in spite of the present study results, future research should continue to study the effectiveness of counseling. Furthermore, explanatory programs regarding hearing loss should be viewed as an integral part of the screening process. It is possible that increasing public knowledge regarding hearing loss may result in increased readiness of individuals to accept treatment and consequently in better compliance once they arrive at the hearing screening. That in turn might improve the overall effectiveness of screening programs.

Acknowledgments

To my dearest family and close friends for their constant support throughout my academic studies, go my deepest and most heartfelt gratitude. For without them, this task could never have been accomplished. Words simply cannot express my thankfulness.

My deepest gratefulness and many thanks to the chairperson of my doctorate committee, Dr. Barbara Weinstein, for her remarkable and distinguished professional and personal contribution, support and dedication.

In addition, my deepest appreciation goes to the members of my doctorate committee, Dr. Judith Gravel, Dr. Mark Ross, and the late Dr. Irving Hochberg, for their significant input and support.

Last, but not least, I would like to express my gratitude to Ms. Loretta Walker, the faculty and staff of the department for all their help throughout my doctoral studies.

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CHAPTER 1

INTRODUCTION

The fastest growing segment in the U.S. population is, and will continue to be, the elderly. Hearing impairment increases with age, such that its prevalence can be as high as 70% among older adults (Ventry and Weinstein, 1983). Hearing loss has a negative effect on the elderly person's daily functioning and quality of life, justifying the need for an efficient hearing screening protocol (Bess et al., 1989; Herbst and Humphrey, 1980; Mulrow et al., 1990). At present, traditional hearing screening protocols are associated with low compliance with follow-up rehabilitation recommendations (Weinstein, 1992). However, researchers have noted that counseling and understanding of the medical condition and its consequences can improve compliance with recommendations (Gemson et al., 1990; Israel et al., 1996; Mazzuca, 1982; and Sackett and Haynes, 1976). This is in accordance with Weinstein's (1998) application of the Health Belief Model (Jenz & Becker, 1984) and the six stages of change (Prochaska, DiClemente, and Norcross, 1992) to hearing screening. The present study will investigate the feasibility and effectiveness of a traditional screening approach consisting of audiological/hearing screening with no counseling versus a new informative approach consisting of audiological/hearing screening plus counseling. The goal is to determine if any of these approaches will result in greater compliance with follow-up recommendations. The longer term goal of the study is to identify hearing disorder early in order to prevent disability and thus provide the elderly individual with an improved quality of life.

REVIEW OF THE LITERATURE

An important topic in the public health arena is the issue of screening for disease in populations at risk for conditions that are life threatening or potentially debilitating. Major emphasis is placed on screening for diseases or disorders that, when identified, can be ameliorated effectively. Hearing loss across the age span is a condition that can diminish the quality of life and impede the acquisition and maintenance of fundamental communication skills. Because the elderly rely on auditory input to maintain social contact and awareness of their environment, hearing loss in this age group can lead to isolation and withdrawal from the community. Hence, the ability to hear is critical to quality of life (ASHA, 1997; Healthy People 2000, 1992; Morrison, 1992; U.S. Preventive Services Task Force, 1996; U.S. Public Health Service, 1994).

Demographics: Prevalence of Hearing Loss and Hearing Aid Use in the Elderly

Hearing impairment increases with age, and its prevalence among the elderly population can be as high as 70% (Ventry & Weinstein, 1983). It is estimated that about 60% of persons over the age of 65, and up to 90% of persons 80 years and older have some degree of hearing impairment (Weinstein, 1989). The National Center for Health Statistics (NCHS, 1999) noted that in 1995 one-third of persons 70 years of age and over were hearing impaired and that the prevalence of hearing impairment increased with age, from one-fourth of persons 70 to 74 years of age to one-half of persons 85 years of age and older. Wiley et al. (2000) noted that the prevalence of hearing loss in older adults varies depending on the definition of hearing loss and the selection of test frequencies. However, they stated that regardless of the definition of hearing loss, hearing impairment

is a common problem for many older adults. They noted that a recent epidemiologic study (Cruickshanks et al., 1998) placed the prevalence of hearing loss at approximated 46% among adults from 48 through 92 years of age, and the prevalence increased with age. The hearing-impaired population in the United States is expected to grow at a faster rate than the overall population, and the proportion of hearing-impaired individuals over the age of 65 is projected to increase as well, due to the aging of the U.S. population (Bridges and Bentler, 1998). Nonetheless, despite the high prevalence of hearing loss among older adults, they represent a relatively small proportion of the caseload of audiologists (Ventry and Weinstein, 1983; Weinstein, 1989 and 1992). In general, relatively few elderly people go through an audiological evaluation and obtain hearing aids. In fact, the percentage of older adults with hearing impairment who own hearing aids is estimated to be between 18% (Weinstein,1989) and less than 23% (Kochkin, 1993). Yet hearing aids are beneficial for elderly individuals. Furthermore, although hearing loss is a disorder amenable to early intervention and rehabilitation, the elderly tend to wait about 10 years from its onset before seeking audiologic assistance (Weinstein, 1989).

Hearing Loss Characteristics

Hearing loss among the elderly typically results from degenerative changes in the structure of the inner ear. The inner ear undergoes major changes with age, which have corresponding effects on pure-tone thresholds and word recognition. The substantial loss of outer hair cells in the basal turn of the cochlea affects cochlear mechanics and accounts for normal descent in pure-tone hearing with age. Older adults suffer significant

hearing loss in both the low and high frequencies, but the loss is generally greater in the high frequencies. The hearing loss that is associated with aging is called *presbycusis,* and it is gradual in its onset, bilateral, symmetric, and sensorineural (Schuknecht, 1989; Weinstein, 1989 and 2000; Willott in Weinstein, 2000). The hearing loss among the geriatric population is usually (in 60%) mild to moderate in degree. Nonetheless, 10% to 15% may have a moderate, severe, or profound hearing loss, and only about 25% may have normal hearing (Weinstein, 1989). In addition to presbycusis, sensorineural hearing loss in the elderly can be related to a variety of medical conditions such as vascular and metabolic diseases, idiopathic disorders, infections, ototoxicity, and vestibular dysfunction (Weinstein, 1989). Moscicki et al. (1985) noted that age, sex, illness, family history of hearing loss, Meniere's disease, and noise exposure are significant risk factors for hearing loss, but age is by far the most critical risk factor. Willott (1996) stated that since hearing is accomplished by the brain, using neural input from the cochlea, presbycusis can ultimately be accounted for by changes in the brain that accompany aging.

Schuknecht (1964, 1974, and 1989) classified the following four distinct types of underlying pathologic changes in the aging ear:

1. Sensory presbycusis is caused by degeneration of the organ of Corti and is manifested clinically by abrupt high-frequency sensorineural hearing loss, with word discrimination directly related to the frequency range involved.
2. Neural presbycusis is caused by a loss of cochlear neurons and is characterized by a severe loss of word discrimination.
3. Strial presbycusis results from a loss of stria vascularis and is manifested by a flat

threshold pattern with excellent preservation of word discrimination.

4. Inner ear/cochlear conductive (mechanical) presbycusis is a diagnosis derived by histologic exclusion of any consistent pathologic range and is manifested by gradually sloping high-tone hearing losses and word discrimination that is directly related to the steepness of the slope.

A combination of the four principal types of presbycusis can produce complex patterns of hearing loss. Overall, as noted above, presbycusis hearing losses are symmetrical in both ears and slowly progressive (Arnst in Katz, 1985; Schuknecht, 1964, 1974, and 1989).

Consequences of Hearing Loss in the Elderly

Hearing loss may have a negative effect on the individual's functioning and quality of life. Herbst and Humphrey (1980) studied hearing impairment and mental state of the elderly living at home and found a significant relationship between deafness and depression that was independent of age and socioeconomic status. They noted that the social and psychological effects of hearing loss, such as withdrawal, depression, and frustration, might be minimized by using hearing aids. Although hearing loss is not the only major cause of depression in old age, it is a contributing factor that can often be rehabilitated more than other factors. Bess et al. (1989) studied the effect of hearing impairment on functioning in the elderly using the Sickness Impact Profile (SIP). The SIP is a standardized measure for assessing sickness-related physical and psychosocial dysfunction. In their study, pure-tone audiometry was used to detect hearing loss. Results revealed that poor hearing was associated with higher SIP scores (increased

dysfunctioning). These researchers suggested that since hearing impairment has an important effect on the functioning in the elderly, efforts should be made to improve their hearing status in order to improve their quality of life. Mulrow et al. (1990) also studied the association between hearing impairment and quality of life in elderly individuals and found that hearing loss was associated with significant emotional, social, and communication dysfunction. They noted that subjects perceived these effects as severe handicaps even when their degree of hearing loss was only mild to moderate. They concluded that hearing loss is associated with important adverse effects on the quality of life of elderly individuals.

Weinstein (1989, 2000), in her review of the impact of hearing loss on the elderly, suggested that persistent difficulties in understanding what is being said can lead to frustration and discouragement. Thus, hearing difficulties can severely limit previously enjoyed activities and strain family relations. For example, difficulties understanding one's spouse or caregiver can interfere with ongoing relations. Difficulties interacting with family and friends can lead to reduced involvement in leisure time activities and socialization. Difficulties with solitary activities, such as problems hearing television or radio, can jeopardize psychological well-being. Difficulties in interaction with service providers, such as building superintendents and postmen, can interfere with the ability to live safely and independently. Difficulties using the telephone may jeopardize the elderly person's security.

Undetected hearing loss can also affect medical and psychosocial management. For example, hearing loss can interfere with a physician's obtaining a valid medical, psychiatric, and social history, which increases the potential for a misdiagnosis. Elderly

persons with hearing loss may misunderstand important instructions relating to medication, hence interfering with their medical treatment. Hearing loss might also be misinterpreted as a cognitive, affective, or personality disorder. As such, it could interfere with therapeutic interventions across all disciplines (e.g., social work) and could exacerbate medical conditions such as Alzheimer's disease or depression (Weinstein, 1989, 2000).

In a recent major study, the National Council on the Aging (NCOA, 1999) stated that untreated hearing loss has serious emotional and social consequences for older persons. Their survey of 2,300 hearing-impaired adults age 50 and older revealed that individuals with untreated hearing loss were more likely to report depression, anxiety, and paranoia and less likely to participate in organized social activities than individuals who wear hearing aids (NCOA, 1999; Reinemer and Hood, 1999).

Kochkin and Rogin (2000) reviewed the above NCOA study and noted that the restricted lifestyle of the hearing-impaired individuals would negatively impact their psychosocial well-being. Indeed, research revealed that hearing loss is associated with a number of negative consequences, including embarrassment, tension and stress, withdrawal from social situations, depression, negativism, danger to personal safety, rejection by others, social isolation, less alertness to the environment, impaired memory, less adaptability to learning new tasks, paranoia, lessened ability to cope, and reduced overall psychological health. Gates et al. (1993) noted a small but statistically significant association of cardiovascular disease and hearing loss in the elderly. Gates et al. (1996) noted that hearing loss lowers performances on mental state examination. Overall, Kochkin and Rogin suggested that hearing loss per se should be seen as a serious issue.

Efficacy of Hearing Aids

Amplification is the treatment of choice for presbycusis. Hearing aid use is beneficial in minimizing the negative consequences of hearing loss in the daily functioning of the elderly.

Weinstein (2000) noted that data are beginning to accumulate documenting a link between hearing loss and cognitive status in people diagnosed with senile dementia. Research studies revealed that hearing loss is more prevalent in older adults with dementia; individuals with dementia are likely to have more severe hearing loss than those without dementia; the risk of dementia increases as a function of increasing hearing loss; untreated hearing loss lowers performances on diagnostic tests used to quantify the severity of senile dementia; and hearing aids decrease scores on tests of cognitive function suggesting improved mental status with hearing aid use. Weinstein (2000) suggested that due to the high prevalence of senile dementia among adults, especially those residing in institutions, and the high prevalence of hearing loss, it is likely that the two disorders will co-occur in a large proportion of elderly individuals. Therefore, unless rehabilitated/aided, untreated hearing loss can confound the diagnosis of dementia and frequently exacerbate the behavioral manifestations of individuals with senile dementia.

Tannahill (1979) studied 24 new hearing aid users (mean age 74 years) with bilateral sensorineural hearing loss. To quantify their subjective reports of their listening difficulties the researcher examined changes in speech reception threshold, word identification, and hearing handicap as measured by the Hearing Handicap Scale (High, Fairbanks, and Glorig, 1964). Tannahill compared data obtained prior to hearing aid fitting and four weeks later. Results revealed a significant improvement on all three

measurements, indicating the important role of amplification in minimizing the negative consequences of hearing loss. Newman and Weinstein (1988) studied 18 elderly hearing-impaired males and their spouses' responses to the Hearing Handicap Inventory for the Elderly (HHIE), prior to and one-year after hearing aid fitting. The HHIE is a 25-item self-assessment inventory composed of a 13-item emotional subscale and a 12-item social/situational subscale, which was also modified for use with spouses. Results indicated a significant reduction in the perceived emotional and social effects of hearing impairment following one year of hearing aid use by both the hearing aid users and their spouses. Malinoff and Weinstein (1989) also studied the benefits of hearing aids among the elderly. In their study, 45 new hearing aid users completed the HHIE prior to and three weeks after hearing aid fitting. Results showed a significant reduction in handicap following three weeks of hearing aid use.

Kochkin and Rogin (2000), in their review of the NCOA study, stated that since modern hearing instruments improve speech intelligibility, the instruments should also improve the social, emotional, psychological, and physical functioning of individuals with hearing loss. Indeed, the NCOA study revealed that hearing instruments were clearly associated with impressive improvement in all these areas for people in all hearing loss categories. Specifically, along with improving hearing, rehabilitation with hearing aids was related to a number of positive effects, including improved interpersonal relationships, reduction in depression, reduction in anger and frustration, improved emotional stability, reduced paranoid feeling, and enhanced group activity. The subjects' family members also noted significant improvement as a result of hearing aid use in most areas measured. Kochkin and Rogin noted that since the NCOA research was an

observational study, they could not say that hearing aid usage "caused" all the above quality-of-life improvements. However, short of stating definite causality, the evidence is quite compelling and perhaps suggestive of causality for the following reasons: the large size of the sample, which was nationally representative of hearing loss subjects; the consistency of many of the findings across all hearing loss categories; the corroboration of specific findings within the study; and the consistency of the findings with other correctional and randomized control studies, pre-post hearing aid fitting studies, and the literature on factors impacting hearing loss. Therefore, the NCOA findings provide strong evidence for the importance of hearing aids in improving the quality of life of people with hearing loss (Kirkwood, 1999; Kochkin and Rogin, 2000; NCOA, 1999).

Bridges and Bentler (1998) studied the relationship between hearing aid use and overall well-being among 251 older adults. These authors examined (a) subjects who reported having hearing losses, (b) subjects who did not wear hearing aids, (c) subjects who had worn hearing aids but had not reported successful use, and (d) subjects who wore hearing aids and reported success. The subjects completed a personal data form, the Geriatric Depression Scale (GDS) (a self-report measure of depression), and the Satisfaction With Life Scale (SWLS) (a self-report measure of life satisfaction). Slightly more than half of the subjects reported having a hearing loss, but only 29.5% stated that they had worn a hearing aid. Approximately 73% of those who had worn hearing aids reported successful use. Results revealed several important relationships between well-being (assessed and defined by the scores on either the GDS or the SWLS) and hearing aid use. First, subjects who reported having no hearing loss reported significantly less depression than did those who reported a hearing loss. Second, subjects who had

previously worn a hearing aid but no longer use it reported less life satisfaction and significantly higher depression than did successful hearing aid users. Third, subjects who reported successful current hearing aid use reported significantly greater life satisfaction than did those who were wearing hearing aids but reported no success. The study was limited, however, in that subjects' hearing status was based only on individual reports, and no audiological assessment was conducted. In addition, only a small sample of hearing aid users was studied. Therefore, future research should assess these relationships with a larger sample size. Nonetheless, the above results suggest that hearing aids can improve the general well-being and communication function of the elderly. Hence the researchers concluded that amplification should be viewed as a necessary, rather than elective, component of health care.

Dye and Peak (1983) studied the influence of amplification on the psychological functioning of 58 older adults with sensorineural hearing loss. The subjects, male veterans with a mean age of about 61 years, were divided into two groups of "more" and "less" severe sensorineural hearing loss, issued hearing aids, and given a battery of psychological tests. Before amplification, subjects with more severe hearing loss were less alert to information from the environment, less capable of memory tasks and learning new material, more depressed, more paranoid, and perceived themselves to be experiencing more problems in coping with the environment than subjects with less severe hearing loss. After amplification, both groups revealed improvement in psychological functioning, and there were no significant differences between the groups on any of the psychological tests. Although only male veterans were included in the study, this research was valuable in addressing issues regarding the effects of hearing loss

and amplification on psychological functioning. The results support the need for efficient hearing screening protocols, so that assessment and management of disability may take place.

Dempsey (1986) studied 10 hearing-impaired adults (5 male; 5 female), pre- and post-amplification. The subjects completed the Hearing Performance Inventory (HPI), a 90-item inventory that effectively measures degree of hearing handicap (the individual's difficulty in everyday communicative situations), pre- and post-amplification. Results demonstrated a significant decrease in hearing handicap for the understanding speech and intensity sections of the HPI and no statistically significant change in the sections concerning response to auditory failure and personal feelings. Dempsey suggested that specific counseling strategies might be needed to improve individuals' feelings about their hearing loss. Despite the small sample, this study lends support to the role of amplification in decreasing hearing handicap, as all subjects reported general satisfaction with their hearing aids.

Alberti et al. (1984) measured the degree of hearing handicap, pre- and post-rehabilitation/amplification, among 33 hearing-impaired older adults. Two standardized questionnaires were used to measure handicap: the McCarthy-Alpiner Scale, which measures the subject's psychological, personal, and social handicap, and the Hearing Performance Inventory (HPI) discussed previously. Results revealed significant improvement on the total score for 78% of the subjects on the McCarthy-Alpiner Scale and for 90% of the subjects on the HPI, following hearing aid fitting. These results suggest that hearing aid use improves the general well-being and communication function of older individuals.

In a study of 188 elderly veterans with hearing loss, Mulrow et al. (1990) assessed whether hearing aids improved quality of life. The subjects were randomly assigned to either receive a hearing aid or join a waiting list for amplification. A comprehensive battery of disease-specific and generic quality-of-life measures was administered at baseline, six weeks, and four months after study enrollment. Subjects assigned to the two groups were similar in age, ethnicity, education, marital status, occupation, and comorbid diseases. At baseline, 82% of the subjects noted adverse effects on quality of life due to hearing loss, and 24% were depressed. At follow-up, significant improvements in communication and social, emotional, and cognitive function, as well as a decrease in feelings of depression, were found in subjects who received hearing aids as compared with subjects assigned to the waiting list. However, limitations of this study should be considered. First, the study population consisted almost exclusively of male veterans. Therefore, results may not be readily generalizable to women or to elderly who vary markedly in cultural, socioeconomic, and clinical characteristics from the subjects. Second, hearing aids were provided free of charge. This variable may prevent generalization of the results to the real world. Despite these design limitations, the results from Mulrow et al. are valuable in demonstrating that hearing loss is associated with adverse effects on the quality of life of elderly individuals; and importantly, that these adverse effects are lessened by hearing aid use.

Nevertheless, as Kochkin (1993) noted, hearing loss is an emotional issue to many people, and the stigma of hearing loss, as represented by the hearing aid, is rejected by many individuals who can benefit from amplification. Research has revealed that subjects reject hearing aids because of a feeling that they signify aging, incompetence, weakness,

or imperfection. Kochkin points out that only after individuals learn to accept their hearing loss will they comply with audiological rehabilitation.

Screening

Screening, as discussed by Fletcher et al. (1988), Morrison (1992), and Weinstein (2000), is a process by which asymptomatic people are examined and classified as either likely or unlikely to have a target disease (condition). Subsequently, further examination is required to confirm the existence of the targeted disorder. Treatment is then provided to those diagnosed as having the disorder. The long-term goal of screening is to prevent disability by providing early assessment and intervention. Ideally, the screening process leads to identification and treatment of the disorder prior to the appearance of symptoms. A clear and measurable definition of the target disorder is essential for a successful screening program.

The roots of screening originate in pathology, clinical medicine, statistics, and public health (Morrison, 1992). Epidemiology, the study of the distribution and determinants of pathology frequency in humans, is an essential part of screening (Fletcher et al., 1988). A screening program in which a set of procedures is being followed to achieve early detection and treatment of a disease can be divided into two components: (a) the diagnostic portion, which includes the screening test and the procedures for diagnostic evaluation of those who test positive; and (b) the therapeutic portion, in which the positive cases are treated (Morrison, 1992). Clearly the characteristics of the screening procedures and the effectiveness of the methods of treatment strongly influence the overall success of the screening program (Fletcher et al.,

1988; Morrison, 1992).

A report on audiologic screening for early detection and treatment of communication disorders by the American Speech-Language-Hearing Association's Ad Hoc Committee on Screening for Hearing Impairment, Handicap, and Middle Ear Disorders (ASHA, 1995) stated that the following are essential elements of any screening program: The screening purpose should be to separate healthy individuals from those who are at greater risk for having the disorder. The importance of the disease should be evaluated in terms of its prevalence, morbidity, duration, cost of screening, diagnosis, and treatment. The diagnostic criteria must be clearly defined. Treatment should be available and effective. The program should reach individuals who can benefit from early identification. Resources for diagnosis and treatment should be available prior to operating the screening program, and compliance with follow-up should be emphasized. The screening test should be simple, easy to administer, comfortable, short, inexpensive, sensitive, specific, and should result in a minimum number of over-referrals. Finally, the screening program must be evaluated prior to its official use via randomized controlled clinical trials (ASHA, 1995; Weinstein, 2000).

Classification of Impairment, Disability, and Handicap

A clear distinction should be made when discussing hearing impairment and hearing handicap. Hearing impairment can be defined as a negative change in either structure or function, due to anatomic or functional abnormality, which causes hearing loss. Audiological testing is used to quantify hearing impairment. Hearing handicap can be defined as the disadvantage caused by the impairment, which can negatively affect the

individual's daily functioning. Ventry and Weinstein noted that hearing handicap seems to involve more than simply hearing impairment, that there is an imperfect relationship between hearing impairment and hearing handicap, and therefore that audiometry alone will not necessarily quantify hearing handicap (Ventry and Weinstein, 1983).

The World Health Organization's revised International Classification of Impairment, Disability, and Handicap (ICIDH-2), also referred to as the International Classification of Functioning and Disability, is a classification of human functioning and disability that stresses how context interacts with the health condition (in this case, hearing impairment) to influence the individual's level of function. There are three levels of functioning and contextual factors in the ICIDH-2. The three levels of functioning (at the body, person, and social levels) in interaction with contextual factors yield as outcomes either positive or negative levels of functioning, and both can be classified by the ICIDH-2. The negative levels of functioning are three kinds of disablement: impairment, activity limitation, and participation restriction. Essentially, impairment represents function at the level of the body, such as hearing loss; activity limitation replaces the term *disability* and represents function at the level of the individual person, such as difficulties communicating in certain situations due to hearing loss/impairment; and participation restriction replaces the term *handicap* and represents function at the level of society, such as restricted socialization.

Epidemiology and Hearing Screening

Based on the literature reviewed earlier, it appears that hearing loss in the elderly is an appropriate target disorder for screening efforts since it meets several criteria for

epidemiological efficacy. First, the burden of suffering posed by handicapping hearing impairments warrants screening efforts. Evidence suggests that unremediated hearing loss does interfere with an elderly person's quality of life. Second, screening programs can reach those who could benefit from audiological services. Third, good screening tests are available. Fourth, effective treatments are available for elderly individuals with hearing impairment. Finally, the current hearing health-care system can cope with an increased caseload of elderly individuals with handicapping hearing impairments, since the elderly currently comprise only about 30% of the audiologist's caseload (Mulrow and Lichtenstein, 1991; Weinstein, 1992, 2000).

However, Nondahl et al. (1998) noted that there is a need for large epidemiological studies of hearing loss in older adults to measure clearly the extent of this public health problem and to identify appropriate interventions. Large-scale survey studies of hearing status can be used to track temporal trends in hearing loss prevalence and to reveal geographic areas and population subgroups at high risk for hearing loss. These studies can provide an essentially rapid and inexpensive means of estimating the prevalence of hearing loss in large populations, where cost and time constraints may otherwise be prohibitive.

Overall, although hearing loss in the elderly appears to be an appropriate target disorder for screening efforts, hearing screening programs are not without controversy. Questions concerning issues such as which frequency and intensity characteristics of the signal should be used as Pass/Fail criteria remain unresolved, and debate over the effectiveness of screening programs continues.

Handicap Inventories

Audiologists focus mostly on methods of directly identifying hearing loss, via pure-tone and speech audiometric measurement, and less on detecting communication disabilities of the individual (Weinstein, 2000). In the mid-1940s, however, attempts began to be made by researchers to assess communication ability. A Social Adequacy Index was proposed (Silverman et al. and Davis in Schow & Nerbonne, 1982), which combined measured sensitivity and speech discrimination scores to obtain an index of communication adequacy. Since the tool was based solely on audiometric data, however, it was found to have major limitations and was not widely used. About twenty years later, in the early 1960s, a new approach was developed in which communication efficiency was assessed via self-reports (High, Fairbanks, and Glorig, 1964). The instrument was called the Hearing Handicap Scale, and it addressed the need for an objective and quantifiable means for evaluating the individual's communication performance in activities of daily life, not simply via hearing-impairment assessment. The Hearing Handicap Scale was based on a self-evaluation questionnaire in which subjects rated the auditory problems that were the result of their hearing loss. The questionnaire included items directed toward everyday hearing experiences, used simple language appropriate for a wide range of users, and had a sufficiently high internal consistency to permit reliable determination of handicap for individual subjects. The scale's main contribution was its formalization and standardization of both the questions and the subjects' possible responses, which allowed quantification of the responses and then determination of the individual's position on a scale of handicap with a high degree of accuracy. However, the scale possessed no internal means for detecting the validity of the respondent's answer,

was designed to focus only on speech communication difficulties, and did not evaluate other areas, such as psychological or vocational domains, that may be affected by hearing loss. Later on, other self-evaluation instruments were developed. For example, the Hearing Measurement Scale (Noble and Atherley, 1970) assessed subjective hearing handicap by questioning individuals about speech and nonspeech difficulties, localization problems, and emotional reaction. The Hearing Performance Inventory (Giolas et al., 1979) assessed problems experienced in everyday listening, by asking questions regarding understanding of speech, intensity, and responses to auditory failure, as well as social, personal, and occupational aspects of hearing difficulty. The Self-Assessment of Communication (Schow & Nerbonne, 1982) assessed communication difficulties in various situations and individuals' general feelings about their handicap and perceptions of how their hearing ability was perceived by others.

All these scales provide a personal perspective on communication difficulty/hearing handicap. Schow and Nerbonne (1982) noted that in order to be useful as screening tools, handicap inventories should be short in time and easy to administer and score. Their aims should be validity and reliability, including minimal but appropriate equipment, providing scores in a quantifiable manner, and being oriented toward the adult (mostly the elderly) population.

In 1982, Ventry and Weinstein developed the Hearing Handicap Inventory for the Elderly (HHIE), a 25-item self-assessment instrument. In 1983, they reduced the HHIE to a 10-item screening tool, the Hearing Handicap Inventory for the Elderly-Screening (HHIE-S), to identify elderly individuals with hearing loss that resulted in handicap. The HHIE-S includes 5 questions to evaluate the emotional aspect of the hearing handicap

and 5 questions to evaluate the social/situational difficulties caused by the hearing loss (Weinstein, 1986).

Among the self-assessment instruments designed for adults, only the HHIE and the HHIE-S were designed exclusively for use with older adults. The HHIE-S meets basic psychometric requirements of good construct validity and internal consistency, reliability, and adequate test sensitivity and specificity. It is one of the self-assessment measures recommended by the American Speech-Language-Hearing Association (ASHA, 1997) to screen for hearing disability in adults and is the instrument used by the largest number of audiologists (Wiley et al., 2000).

Weinstein (1986) noted that the questions raised by the hearing handicap tool often increase individuals' awareness of their hearing impairments. Furthermore, a number of reports suggested that self-perceived handicap rather than hearing sensitivity is a better predictor of follow-up with recommendation for rehabilitation (Fino et al., 1990; Garstecki in Weinstein, 1986; Kapetyn in Weinstein, 1986).

Compliance and Compliance-Improving Strategies

One of the most important epidemiological criteria for evaluating a screening program is whether or not persons with positive screening results comply with advice for follow-up. A number of investigators have evaluated various hearing screening protocols for the elderly in this respect. In general, the protocols tended to combine pure-tone screening with a self-assessment questionnaire. Overall, regardless of the protocol, there was poor compliance with recommendations for follow-up audiological evaluation.

Koike and Johnston (1989) screened 177 adults, using priorities referral criteria

proposed by Ventry and Weinstein (1983) that combined pure-tone screening and the HHIE-S. They reported a 52% rate of compliance with follow-up recommendations. However, they only referred subjects with the most serious problems (priorities 1, 2, and 3 but not priorities 4 and 5 in the Ventry and Weinstein referral scheme). In addition, they were only able to contact 25 (66%) of the 38 referred for follow-up, and compliance was found among 13 of the 25 reached by phone. Therefore the true percentage of follow-up could be as low as 34% (13/38). Jupiter (1989) screened 843 older adults using a pure-tone screen alone and a combination of the HHIE-S and a pure-tone screen as proposed by Ventry and Weinstein (1983). Although 66% of the subjects from both groups failed the screening, only about 13% (from both groups) of the 239 subjects who failed the screening and were contacted by the researcher sought a follow-up hearing test.

Schow (1991) reviewed several studies that examined follow-up subsequent to referral after failure of a hearing screening and found compliance rates ranging from 5% to 59% (Table 1). Schow noted that although factors such as vanity may work against following professional advice for a complete audiological evaluation, follow-up compliance data are important sources of validation for any screening protocol.

Table 1

Follow-Up Percentages Subsequent to Referral After Failure of Hearing Screening (modified from Schow, 1991)

Study	Total Number Referred	% Complied
Reese (1987)	123	5
	21	14
Brockett (1987)	108	7
	25	24
	14	36
Doyle and Healey (1981)	108	35
Koike and Johnston (1989)	38	34
Lichtenstein et al. (1988)	304	59
Schwartz and Matsko (1988)	36	19
Jupiter (1989)	239	13

The 1997 American Speech-Language-Hearing Association's Guidelines for Audiologic Screening recommended including an educational/informative component regarding hearing disorder and follow-up procedures in the screening program for the elderly. Healthy People 2000 (1992), the government report designed to improve the health of U.S. citizens, recognized the profound effect of hearing impairment on quality of life and encouraged appropriate screening and counseling of the elderly in order to prevent further disability. In addition, the U.S. Preventive Services Task Force (1996)

encouraged hearing screening (via questionnaire) and counseling of the elderly. The Task Force graded the strength of this recommendation as B. Recommendations' strength ranged from A, the strongest, to E, the weakest. A B grade suggests that hearing screening in the elderly is a fairly high priority, and indicates that the Task Force concluded that there was a fair amount of evidence to support the recommendation that the condition be specifically considered in a periodic health examination.

Ross (Carmen and Ross, 2000) noted that the impact of a hearing loss is very much underestimated in our society. Hildesheimer and Muchnik (1992) noted that elderly people often believe that their hearing loss is their own "secret" and that attention would be drawn to their handicap if they wore a hearing aid. Hence Hildesheimer and Muchnik suggested that an intensive explanatory program—which improved the awareness that hearing rehabilitation may actually reduce evidence of hearing handicap and improve communication functioning—should be an integral part of the screening process.

Evidence suggests that lack of knowledge can interfere with a person's intentions to engage in health-seeking behavior. Van den Brink et al. (1996) noted that individuals with hearing loss that did not discussed their hearing problem with a physician perceived their impairment as relatively inconsequential, most frequently demonstrated a passive acceptance of hearing problems with increasing age, and saw least benefits of hearing aid use. Kochkin (1993) reported that given two individuals of the same age and with equal hearing loss, the individual to whom rehabilitation was recommended was eight times more likely to pursue rehabilitation/amplification than the person who received no recommendation for rehabilitation. Kochkin also suggested that recommendations from an audiologist or a physician might be the single most powerful predictors of whether

hearing-impaired individuals will pursue rehabilitation. Nonetheless, current preventive care/screening protocols do not include counseling and therefore do not provide the individual with potentially beneficial information leading to follow-up. Weinstein (1992, 1998) suggests that incorporating compliance-improving strategies into all screening programs might positively influence rates of return for follow-up.

At present, hearing screening with the elderly is done by using traditional procedures of pure-tone screening and/or a self-assessment questionnaire. However, as is evident from Table 1, relatively few individuals who fail the screening process do follow recommendations and receive further evaluation and rehabilitation. Therefore the effectiveness of the traditional hearing screening protocols should be reexamined, and the use of a new informative approach should be further studied.

The Health Belief Model and Stages of Change

Several proposed models of health belief and change are relevant to the potential benefit of counseling after screening. The Health Belief Model (Jenz & Becker, 1984) was developed to predict participation in health prevention programs. Derived from psychological and behavioral theory, the model suggests that behavior depends mainly upon the value individuals place on a particular goal and their estimate of the likelihood that a given action will achieve that goal. In the context of health-related behavior, the correspondences are the desire to avoid illness and the belief that a specific health action can prevent or ameliorate illness. The model further suggests that health-related behaviors depend upon (a) the perceived threat of susceptibility to and severity of the disease; (b) the perceived benefits of and barriers to the health behavior (such as pursuing

audiological rehabilitative services); and (c) perceptions of control or self-efficacy and the ability to perform a behavior. Overall, an individual's perceptions of susceptibility and the severity of the consequences provide the individual with the strength to act. The perceived benefit of preventive action minus the perceived barriers to preventive action is an index of the likelihood that the individual will take the recommended preventive health action (i.e., comply with recommendations). Thus, in relation to hearing screening, the model suggests that individuals' perception of their susceptibility to hearing loss and the seriousness of the consequences associated with hearing loss will affect their willingness to comply with recommended rehabilitation services (Weinstein, 1998). Therefore, an informative screening approach, which incorporated counseling regarding the nature of hearing loss, its consequences, and the advantages of hearing aid/rehabilitation, might positively affect the elderly individual's decision regarding follow-up. If the individual perceived that the reduction in handicap (benefits) outweighed the inconveniences (barriers) associated with hearing aids, then the outcome would be a higher likelihood of compliance with the rehabilitation recommendation.

Prochaska et al. (1992) identified the following six stages of change in relation to individuals' readiness to comply with recommendations regarding their health status:

1. precontemplation
2. contemplation
3. preparation
4. action
5. maintenance
6. termination

Relative to the development of an effective hearing screening protocol for the elderly, the provision of counseling might be helpful in moving individuals from one stage to another and consequently modifying their behaviors and activities (Kochkin, 1993; Noa et al., 1994; Weinstein, 1992, 1998).

Counseling

Gemson et al. (1990) studied the impact of cholesterol screening that included a brief (three- to five-minute) counseling session on cardiovascular risk factors. Baseline values were obtained from 886 subjects. Results examined at a six-month follow-up revealed significant declines in total cholesterol levels, weight, blood pressure, and number of people reporting smoking, among subjects with higher baseline cholesterol values. Gemson et al. concluded that these results support the feasibility and efficacy of screening utilizing brief counseling. Gemson et al., however, did not use a control group (screening with no counseling) for comparison with the experimental group (screening with counseling). This design variable might have added value to the statistical and empirical findings of their study. Nonetheless, this study provides support for the benefit gained when counseling is added to a screening protocol.

Israel et al. (1996) studied the effectiveness of brief cognitive behavioral counseling versus simple advice, following screening for alcohol abuse. The 105 subjects who met the criteria of alcohol abuse or alcohol dependence were randomly assigned to either the experimental or control group. Those in the control group were only advised to reduce their consumption and were handed a pamphlet with guidelines for achieving abstinence or acceptable drinking. Those in the experimental group received the same pamphlet but

were also counseled on cognitive behavioral ways to reduce drinking, receiving a total of three hours of counseling over a period of one year. Results obtained after one year revealed that counseling was significantly better than simple advice in reducing alcohol consumption, objective indicators of alcohol-related morbidity, and frequency of physician visits.

Haynes (1976) reviewed studies that reported on the effect of individual patient counseling on compliance with follow-up recommendations. Two studies reported statistically and clinically significant effects of counseling on compliance, two reported partially successful results, and one reported no significant improvement in therapeutic outcomes. However, the content and format of the counseling were inadequately described, limiting the studies' validity (Haynes in Sackett and Haynes, 1976).

Mazzuca (1982) examined whether patient education about chronic disease has therapeutic value, by reviewing 30 articles addressing the use of patient education and measured compliance with a therapeutic regimen. The articles related to various medical problems, such as obesity and hypertension. The magnitude of the experimental effects of patient education was calculated using an empirical form of integrating research findings known as meta-analysis. Results revealed that patient education had a significant effect ($P < 0.05$) on compliance. Mazzuca suggested that subjects who received education regarding the disease and its treatment might be in a better position to participate in their own health care. Mazzuca also noted that since chronic conditions usually cannot be treated as easily and quickly as acute conditions, the need for education to improve compliance might be greater with chronic conditions. Since hearing impairment is

considered a chronic condition (Healthy People 2000, 1992), the above suggestions appear applicable to the issue of counseling accompanying a hearing screening.

Weinstein (1992) noted that people may comply with recommendations if they:

1. perceive themselves to be susceptible to the condition (Therefore the fact that age is the primary risk factor for hearing loss, yet not all aged adults suffer from hearing loss, should be addressed during the screening.)
2. think that the condition may have serious consequences (Therefore the consequences of unremediated hearing loss should be addressed during the screening.)
3. realize that the daily hearing difficulties can be minimized via aural rehabilitation
4. believe that the cost of the treatment will be compensated by the benefit of the intervention

Weinstein stated that compliance with recommended treatment is vital and that therefore compliance-improving strategies are crucial in order to justify screening efforts from a manpower as well as an economic point of view. Weinstein also suggested that the incorporation of a hearing health-care videotape in the screening program may motivate the individual to seek audiological assistance and thus is a potentially effective component of the screening program. The critical issue may not be simply the nature of the screening protocol but the incorporation of compliance-improving strategies into every screening program, so that elderly persons who are in need will receive the appropriate intervention (Rubenstein et al., 1986; Weinstein, 1992; Weinstein et al., 1995).

Although several studies suggest that counseling can affect compliance positively,

there is a lack of research in this area in general, and in hearing sciences specifically. Winograd et al. (1990) noted that counseling might be even more effective in helping to manage nonmedical/nonsurgical rehabilitation. This would apply to the use of counseling with hearing screening, since the nature of audiologic rehabilitation for presbycusis is mostly nonmedical. Nonetheless, as noted by Falvo (1994), more research is needed to enhance and strengthen the quality of patient education/counseling. Such research might provide conclusions regarding the effectiveness of counseling in improving compliance with rehabilitation recommendations.

Designing Effective Counseling

Counseling should use terms that the individuals can understand and avoid jargon. Research has shown that three factors are important in planning an effective counseling session:

1. Length should be no longer than three to five minutes.
2. Information should include no more than five to seven points.
3. Counseling should be specific.

Counseling for hearing loss should provide information regarding the nature of hearing loss, the effects of the hearing loss on communication/daily functioning, and the remedial procedures (hearing aids) that are feasible to minimize the problem. It should address misperceptions regarding hearing loss and hearing aids and emphasize advances in the technology of hearing aids. Counseling should also address emotions and attitudes in order to facilitate acceptance and objectivity regarding hearing loss and hearing aids. Together, these aspects of counseling may lead to better understanding of the hearing

problem and the advantages of amplification and consequently overcome obstacles to rehabilitation (such as vanity, denial, and cost of amplification), and create willingness to make a change (Falvo, 1994; Gemson et al., 1990; Jupiter, 1989; Katz, 1985; Kochkin, 1993; Lesner, 1992; Van den Brink et al. 1996; Vogt and Kupp, 1987; Weinstein, 1989).

SUMMARY

Rationale and Purpose

The fastest growing segment in the U.S. population is the elderly. Hearing impairment is the third most prevalent chronic condition affecting older adults. The negative effect of hearing loss on the elderly person's daily functioning and the efficacy of hearing aids in rehabilitation justify the need for developing a more efficient screening protocol that will improve compliance with rehabilitation recommendations over currently existing traditional protocols. Counseling and understanding of the medical condition, its consequences, and the benefits of amplification might improve compliance with follow-up recommendations.

The present study will attempt to investigate and compare the feasibility and effectiveness of the traditional hearing screening with no counseling versus a new informative hearing screening approach that includes counseling. The purpose of the investigation is to determine whether the new informative approach will result in higher compliance with follow-up recommendations than a traditional screening protocol. Findings from this study could lead to improved hearing screening protocols for use with the elderly. The ultimate goal of this research is to increase the number of older adults seeking audiological rehabilitation services, thereby preventing disability and providing the elderly individual with a better quality of life.

Research Questions

The specific research questions to be addressed in the proposed research are:

1. Will the new informative hearing screening approach, which includes short counseling as part of the screening process, be associated with a statistically higher compliance with follow-up recommendations than the traditional approach?
2. Will the yield from the informative approach be statistically high enough (sufficient) to justify revising the protocol traditionally used in screening for handicapping hearing impairment in the elderly?
3. What variables will be significantly related to compliance with follow-up recommendation (e.g., socioeconomic status, type of health insurance, readiness for change, audiometric characteristics)?
4. What are the subjects' reported reasons for compliance/noncompliance with the follow-up recommendation for a complete hearing test (e.g., vanity, cost of amplification)?

Hypothesis

A hearing screening approach that includes counseling will improve understanding of the hearing problem and increase the willingness of elderly persons with a hearing loss to participate in rehabilitation (as measured by compliance with follow-up recommendations) over a traditional hearing screening approach.

CHAPTER 2

METHOD/RESEARCH DESIGN

Subjects

Subjects were 147 community-based, English-speaking-and-reading individuals age 65 and above recruited from Aging in America's senior center and its satellites, in the Bronx, New York. Hearing aid users were excluded from participation. Every elderly individual meeting the above criteria was eligible to participate in the study. A notice was placed in the senior citizen centers requesting individuals to participate voluntarily in a hearing screening study. Subjects represented a varied demographic base (see the Results section for details).

Overall Design

The performance (compliance with follow-up recommendations) of two hearing screening groups of elderly subjects (control/traditional hearing screening with no counseling versus experimental/traditional hearing screening plus counseling) was measured using a between-subjects design.

Subjects were randomly assigned to the control or experimental group. All subjects were given hearing screening in the senior citizen center. However, only the experimental group subjects received short counseling (via videotape) regarding hearing loss and hearing aids, as part of the screening. All the subjects who did not pass the hearing screening received a recommendation for a complete hearing test/follow-up in a nearby hospital (Jacobi or Montefiore Medical Centers) (see Appendix F). The proposed study was designed to examine which if either of the two approaches would result in higher

compliance with the follow-up recommendation for a comprehensive hearing test. Therefore, two weeks after the hearing screening, the researcher telephoned the subjects who did not pass the hearing screening, to determine whether he/she had made an appointment for a follow-up hearing test, and if so, where (facility), and when (date). Two months after the hearing screening, the researcher sent a short questionnaire to all the subjects who did not pass the hearing screening, inquiring whether they had completed a follow-up hearing test and about their rationale for compliance or noncompliance with the follow-up recommendation (see Appendix G). Later on, the researcher obtained the results of the hearing tests (audiograms) from the above hospitals. If by two months after the hearing screening, no follow-up hearing test had been completed in the above facilities or reported completed in a different facility (by returning the questionnaire), the subject was considered noncompliant with the follow-up recommendation. If completed, the subject was considered compliant.

Procedures

Pure-Tone Screening

A portable audiometer was used for pure-tone screening. The subjects were asked to indicate when they heard a tone by raising a hand. A 25 dB HL screening level at 1000 Hz, 2000 Hz, and 4000 Hz was used (ASHA, 1997). When responses to all pure-tone stimuli at the specified intensity level were obtained in both ears, the result was considered a Pass. When no response was obtained at the 25 dB HL criterion at one or more frequencies in one or both ears, the result was considered a Fail. The pure-tone screening took approximately two minutes to complete. Weinstein (1986) noted a

sensitivity and specificity of about 70% and 80% respectively for pure-tone screening when used with adult subjects (see Appendix A).

Screening was conducted in a quiet room meeting standards recommended by the ASHA Screening Guidelines (1997). The room noise level was checked using a Realistic Sound Level Meter. The Maico MA 41 portable audiometer with TDH-39 earphones was used. Electroacoustic calibration was in accordance with ANSI–1989 standards, and biological listening checks were conducted on all testing days.

Questionnaires

The Hearing Handicap Inventory for the Elderly - Screening (HHIE-S). The HHIE-S was used to screen for hearing handicap. Ventry and Weinstein (1982, 1983) devised this screening questionnaire to identify elderly individuals with a hearing loss that results in handicap. The HHIE-S, a self-perceived hearing handicap instrument, includes five questions to evaluate the emotional aspect of the hearing handicap and five questions to evaluate the social/situational difficulties caused by the hearing loss. An answer of no scores 0, sometimes scores 2, and yes scores 4. Total scores range from 0 to 40. Scores of 0 to 8 suggest no hearing handicap; scores of 10 to 24 suggest mild-moderate hearing handicap; and scores of 26 to 40 suggest severe hearing handicap. A referral for follow-up was made for scores greater than or equal to 10. The HHIE-S has a sensitivity and specificity of about 70% and 80% respectively and high test-retest reliability ($r = 0.84$). The test can be completed in a little more than two minutes and is recommended for use by the 1997 ASHA Guidelines for Audiologic Screening (see Appendix A) (ASHA, 1997; Ventry and Weinstein, 1983; Weinstein, 1986, 1989).

The Short Form (SF-12) Health Survey. The SF-12 is the shorter version of the original Short Form-36 Health Survey devised by Ware and Sherbourne (1992). The original SF-36 is a 36-question standardized form designed to be used in research as well as in clinical practice, health evaluation, and general population surveys. The SF-36 includes one multi-item scale that assesses eight health concepts:

1. limitations in physical activities due to health problems
2. limitations in social activities due to physical or emotional problems
3. limitations in usual role activities due to physical health problems
4. bodily pain
5. general mental health (psychological distress and well-being)
6. limitations in usual role activities due to emotional problems
7. vitality (energy and fatigue)
8. general health perceptions

The lower the score, the greater the functional impairment. The survey was constructed for self-administration by older individuals and was found to be a valid and reliable measure of health status. The need for a shorter survey resulted in the development of the SF-36 subset shorter version, the SF-12 (1995). The SF-12 (12 questions) came from the SF-36 and includes one or two items from each of the SF-36 eight health concepts. The SF-12 provides a Physical Component Score (PCS) and a Mental Component Score (MCS). The mean score on each component for the general U.S. population of older adults is 50, and the standard deviation is 10. The SF-12 survey has been shown to yield health outcome scores that are virtually identical to those obtained with the SF-36. Therefore the SF-12, which is shorter (taking approximately two minutes to complete),

yet valid and reliable, has been recommended for use in examining overall health status (Crandell, 1998; Jenkinson et al., 1997; Ware and Sherbourne, 1992; Ware et al., 1996 and 1998). (See Appendix C.) In the present study, the SF-12 was not being used for clinical diagnostic purposes but simply for control of several variables that might affect the dependent variable (compliant/noncompliant). Consequently, the correlation between these extraneous variables and the dependent variable will also be examined.

Demographic Questionnaire. A short demographic questionnaire was completed by the subjects in order to obtain the following basic demographic information: gender, ethnicity, marital status, living arrangement, education, household income, and health insurance (see Appendix D.)

Readiness for Change Questionnaire (Hearing Status Questionnaire). As discussed previously, Prochaska et al. (1992) identified six stages of change in relation to individuals' readiness to comply with recommendations regarding their health status. To investigate the relationship between those stages and compliance with recommendations and to examine the possible correlation between counseling and compliance, a short questionnaire was presented to the subjects before and after the hearing screening. The subjects were asked to select the statement that best described their view of their hearing status (see Appendix E). Only the first four stages, which are relevant to the screening process, were utilized.

All questionnaires were presented using large print. Subjects completed each questionnaire independently. However, if a subject was not able to complete the forms

independently (e.g., due to vision difficulties), the forms were read to the subject and subject responses recorded by the researcher.

Counseling

A short (about three-minute) counseling session was presented to subjects in the experimental group via videotape. The videotape (a) provided information regarding the nature of hearing loss and its effects on communication/daily functioning; (b) discussed the remedial procedures (hearing aids) that are available to minimize the problem; (c) addressed misconceptions regarding hearing loss and hearing aids; (d) emphasized the advanced technology of present hearing aids; and (e) presented several hearing instruments to aid conceptualization of style. In addition, the videotape addressed emotions and attitudes by dispelling notions regarding hearing loss and hearing aids and emphasizing the positive aspects of hearing aids, including reduction of handicap and improved communication. A complete handout script of the videotape was provided to the subjects in the experimental group (see Appendix B).

A Preliminary Pilot of the Counseling Videotape

Prior to the research, a pilot study was designed to evaluate the adequacy of the counseling videotape in terms of quality and clarity. The videotape was presented to six older adults (three males and three females) with an average age of about 70 years. Subjects were asked to answer five questions about the quality, clarity, and educational value of the videotape. As seen in Table 2, the subjects found the videotape to be good in overall quality and clarity; the written material to be clear; the information to be provided

in a clear/simple manner; the length of the videotape to be appropriate; and the information provided to be helpful/educational. In addition, one subject added a note saying, "I found the tape to be very clear and informative," and a second subject wrote, "I found it to be very informative and very precise." Therefore the videotape was considered to be adequate for the purpose of the proposed study.

Table 2

Evaluation of the Counseling Videotape by the Pilot Subjects (N=6)

Please answer the following questions relating to the short "hearing loss and hearing aids" videotape you viewed.	Yes	No	Other
1) Did you find the overall quality/clarity of the screen/picture to be good?	100%		
2) Did you find the written material to be clear?	100%		
3) Was the information provided in a clear/simple manner?	100%		
4) Was the length of the videotape appropriate?	100%		
5) Was the information provided in the videotape helpful/educational for you?	100%		

Research Protocol

Following a notice placed on the bulletin board of the senior citizen centers regarding the hearing screening study, volunteer subjects were scheduled for a free hearing screening session in Aging in America's senior citizen centers. Prior to the screening session, written informed consent was obtained from each potential subject.

The screening session conducted with only the researcher and the subject present in the room. Prior to the screening, all subjects were asked to complete each of the questionnaires. Subjects were randomly assigned to one of two groups: control or experimental.

The screening procedure for each group was as follows:

Group 1: Control. Subjects were screened via the HHIE-S questionnaire and pure-tone hearing (the traditional approach). A Fail on the pure tone or HHIE-S or both constituted a Fail and subsequent referral. At the end of the hearing screening, every subject received a written statement of the test results. If the subject received a screening Pass, no further recommendations were suggested. For a Fail/Refer, a complete hearing/audiological evaluation (follow-up) was recommended (see Appendix F).

Group 2: Experimental. In addition to the traditional hearing screening (HHIE-S questionnaire and pure tone) which was provided to the control group, the counseling videotape was presented to the subjects in the experimental group. Again, at the end of the hearing screening, every subject received a written statement of the test results. If the results revealed a Pass, no further recommendations were suggested. If the results revealed a Fail/Refer, a complete hearing/audiological evaluation (follow-up) was recommended (see Appendix F).

A Preliminary Pilot of the Study Protocol

A preliminary pilot study was designed to examine randomization, procedures, timing, and other technical issues related to the study protocol. There were 10 subjects, with an average age of 75 years. Subjects were randomly assigned to either control or experimental group. All the protocol components discussed earlier in this chapter were carefully followed. No difficulties or obstacles were noted while conducting the protocol. The average time to complete the protocol was about 25 minutes (including all the research questionnaires and the consent form). As shown in Table 3, subjects in the control and experimental groups were well matched with regard to gender, age, ethnicity, and other demographic variables.

Table 4 shows results of the hearing screening in the control and experimental groups. The Pass/Refer rates were comparable on the HHIE-S (60% Pass). On the pure-tone screen, 80% of the subjects in the control group scored Fail/Refer versus 100% of the subjects in the experimental group. On the Hearing Status Questionnaire, similar results were obtained from subjects in both groups.

Therefore, overall, the pilot study indicated that the protocol was acceptable to subjects, feasible with regard to time, and could be used for the entire study.

Table 3

Demographic Comparison Between the Control (N=5) and Experimental (N=5) Pilot Groups

	Control Group	Experimental Group
Gender	40% Females 60% Males	40% Females 60% Males
Average Age	78	75
Ethnicity	80% Caucasians 20% African-American	100% Caucasians
Marital Status	20% Widowers 60% Married 20% Other	40% Widowers 60% Married
Living Arrangement	40% Living Alone 60% With Spouse	40% Living Alone 40% With Spouse 20% With Others
Education	60% High School 20% Some College 20% Graduate School Or Above	80% High School 20% Some College
Household Income	40% <$10,000 40% $20-29,000 20% $30-39,000	60% $10-19,000 40% $20-29,000
Health Insurance	All Medicare	All Medicare

Table 4

Comparison of Hearing Screening Results Between the Control and Experimental Groups (N=10)

	Control Group	Experimental Group
Prescreening Hearing Status Questionnaire	40% Stage 1 40% Stage 2 20% Stage 3	40% Stage 1 60% Stage 2
Pass/Refer HHIE-S	60% Pass 40% Refer	60% Pass 40% Refer
Pass/Refer Pure-Tone	20% Pass 80% Refer	100% Refer

CHAPTER 3

RESULTS

Introduction/Analysis of Data

The proposed study used a between-subjects design. Compliance with follow-up recommendations was compared for control and experimental groups. The first analytic objective was to examine what effect the counseling (the independent variable) had on the compliance with follow-up recommendation (the dependent variable). The second analytic objective was to examine this effect while controlling for potential confounding variables, such as health status.

The following demographic variables were examined: health insurance, health status, socioeconomic status, gender, mental status, ethnicity, living arrangement, and readiness for change. Statistical analyses investigated the potential relationship between the above factors and compliance with follow-up recommendations.

The proposed between-subjects design was a complete random design with two groups. Subjects were randomly assigned to either the control or the experimental group. Thus, variables that could affect the subjects' performance on the dependent variable should be equally controlled, and no systematic bias should exist. Consequently, threats to internal validity should be minimized. Logistic regression was used for multivariate analysis of the study's manipulation, since the dependent variable has only two values: compliant and noncompliant (Christensen, 1994; Doehring, 1988; Norman and Streiner, 1986; Ventry and Schiavetti, 1986).

In order to ascertain the end point for the data collection phase. a statistician was consulted and a power analysis to determine the appropriate sample size was performed. The following assumptions were made in order to predict power: a low proportion of compliance (.20), a medium (.10) or large (.15) effect size, and an .05 level of probability. Table 5 shows the estimated power (β) for sample sizes (within each condition) of 75, 100, 125, and 150.

Table 5

Estimate of Statistical Power

Sample size in each condition	Medium Effect (.20 vs. .30)	Large Effect (.20 vs. .35)
75	.29	.46
100	.39	.66
125	.43	.76
150	.52	.83

A sample size of 150 in each condition (a total of 300) was initially established for the study. Once 75 subjects had been run (150 total), the data were analyzed to determine trends and the need for additional collection of data. After consultation with the statistician, a decision was made to stop data collection for the following reasons. Analysis indicated that, contrary to predictions, compliance was no greater in the treatment condition than in the control. Moreover, there was a marginally significant trend for compliance to be higher in the control group; the difference in proportions was .15, equivalent to a large effect.

Demographic Characteristics of the Sample

The subjects were 147 community-based, English-speaking-and-reading individuals age 65 and above, recruited from senior citizen centers to participate in the hearing screening. The mean age of the sample was 75 years (SD = 5.8) with ages ranging from 65 to 92 years. With regard to gender, 110 subjects (75%) were female, and 37 (25%) were male.

Subjects represented a varied demographic base. The demographics of the sample were as follows:

Ethnicity: 59% Caucasian, 32% African American, 6% Hispanic, and 3% other

Marital Status: 49% widowed, 31% married, and 20% other (never married, separated, or divorced)

Living Arrangements: 57% living alone, 29% living with spouse, 14% living with others

Education Level: 4% less than elementary degree, 11% elementary degree, 16% high school (some), 43% high school degree, 20% college (some), 1% college degree, 5% graduate school or above

Annual Household Income: 26% less than $10,000; 32% between $10,000 and 19,000; 29% between $20,000 and 29,000; 9% between $30,000 and 39,000; 2% between $40,000 and 49,000; 1% between $50,000 and 59,000; 1% $60,000 and above

Health Insurance: 29% Medicare only; 1% Medicaid only; 6% Medicare and Medicaid; 59% Medicare and other; 1% Medicare, Medicaid, and other; 3% other; and 1% no insurance

SF-12 Scores

The mean Physical Component Score (PCS) on the SF-12 was 44 (SD = 10.7). The mean Mental Component Score (MCS) was 49 (SD = 9.3). Both scores are within the standard deviation of the mean score for the general U.S. population of older adults.

Prescreening Hearing Status Questionnaire (Stages of Readiness)

Prior to the screening, subjects were asked to select the statement that best described their view/awareness of their hearing status. The purpose of these statements was to determine whether stages of readiness for treatment influenced compliance. The majority of the subjects (44%) selected the following statement: "I do not think I have a hearing problem, and therefore nothing should be done about it." Table 6 presents a summary of the sample responses.

Table 6

Responses to Prescreening Hearing Status Questionnaire for the Total Sample (N=147)

Statement	% responding
"I do not think I have a hearing problem, and therefore nothing should be done about it."	44
"I think I have a hearing problem. However, I am not yet ready to take any action to solve the problem, but I might do so in the future."	32
"I know I have a hearing problem, and I intend to take action to solve it soon."	14
"I know I have a hearing problem, and I am here to take action to solve it now."	10

Screening Outcomes and Compliance Rate of the Sample

Tables 7, 8, and 9 present the summary statistics of the sample on the screening tests.

Overall Outcomes

As shown in Table 7, of the 147 subjects undergoing the hearing screening, 12 (8%) passed the overall screening and 135 (92%) failed the screening and were referred for a complete hearing test. The remainder of the results section will focus on the 135 subjects who failed the hearing screening, as this study was designed to focus on the subjects who failed the screen. Specifically, the reminder of the chapter focuses on those who failed either the pure-tone screen, the HHIE-S, or both.

As shown in Table 8, of the 135 subjects who failed, 85 (63%) failed only pure-tone screening, 1 (1%) failed only the HHIE-S, and 49 (36%) failed both HHIE-S and pure-tone screening. Hence 98% of the subjects who failed the HHIE-S also failed pure-tone screening, but only 37% of those who failed pure-tone screening also failed the HHIE-S. This is shown in Table 9.

HHIE-S Screening Scores

As seen in Table 7, 97 subjects (66%) passed the HHIE-S and 50 (34%) failed. The overall mean score on the HHIE-S was 8 (SD = 8.9) with scores ranging from 0 to 38 points. The mean score of the 50 subjects who failed the HHIE-S was 18 (SD = 7.8) and the mean HHIE-S of the 97 subjects who passed was 3 (SD = 2.7). Of the 50 subjects who failed the HHIE-S, 13 (26%) complied with recommendation to pursue audiological testing. The mean score of those who failed and complied was 16 (SD = 5.7).

Pure-Tone Screening Scores

As seen in Table 7, 13 subjects (9%) passed, and 134 subjects (91%) failed.

Table 7

Pass/Fail Rate on HHIE-S, Pure-Tone, and Overall Screening Test for the Total Sample (N=147)

Screening Test	Pass		Fail	
	N	%	N	%
Overall screening	12	8	135	92
HHIE-S	97	66	50	34
Pure tone	13	9	134	91

Table 8

Failure Rate on Pure-Tone Screening Only, HHIE-S Only, and Both HHIE-S and Pure-Tone Screening Among Subjects Who Failed the Screen and Were Referred for Audiological Testing (N=135)

Screening test	Failure rate	
	N	%
Failed pure-tone screening only	85	63
Failed HHIE-S only	1	1
Failed both HHIE-S and pure-tone screening	49	36

As evident from Tables 7 and 8, statistical analyses using descriptive statistics revealed a much higher failure rate on pure-tone screening than on the HHIE-S.

Table 9

Failure Rate on HHIE-S within Pure-Tone Screening Failure and on Pure-Tone Screening within HHIE-S Failure for the Total Sample (N=147)

Screening test	Failure rate	
	N	%
HHIE-S within pure-tone screening failure	49	37
Pure-tone screening within HHIE-S failure	49	98

$p < .05$

Statistical analyses using chi-square tests on the data in Table 9 revealed a significantly higher failure rate on the pure-tone screening than on the HHIE-S screen (chi-square [df = 1] = 4.40, $p < .05$).

Pure-Tone Screening Results by Frequency

Table 10 presents a summary of the outcome on the pure-tone screening by frequency (1000Hz, 2000Hz, and 4000Hz). As shown in Table 10, failure rate increased as a function of frequency, with the highest failure rate at 4000Hz (75% in the right ear and 84% in the left ear).

Table 10

Pass/Fail Rate on Pure-Tone Screening by Frequency and Ear for the Total Sample (N=147)

Frequency	Ear	Pass		Fail	
		N	%	N	%
1000Hz	Right ear	74	50	73	50
	Left ear	70	48	77	52
2000Hz	Right ear	63	43	84	57
	Left ear	58	40	89	60
4000Hz	Right ear	37	25	110	75
	Left ear	24	16	123	84

A comparison of the screening failure rate between 4000 Hz to 1000 Hz and 2000 Hz was conducted using a test of difference in proportion. Statistical analyses revealed that the percentage that failed at 1000 Hz (in both ears) and at 2000 Hz (in at least one ear)

was significantly lower than the percentage that failed at 4000 Hz; that is, a higher percentage of persons undergoing the pure-tone screening failed at 4000 Hz using a 25 dB HL screening level in either ear.

Compliance with Follow-up Recommendations of the total Sample

Of the 135 subjects who failed the screen and were referred for an audiological evaluation, 28 (21%) complied with the recommendation for an audiologic follow-up and 107 (79%) did not comply.

Control versus Experimental Groups

The study included 73 subjects in the control group and 74 subjects in the experimental group.

Demographic Information

The following demographic variables were examined to assess general randomization between groups: health insurance, age, gender, health status, annual household income, education, mental status, ethnicity, living arrangements, and prescreening hearing status questionnaire. A series of cross-tabulations were run to determine if differences emerged between the two experimental conditions, and chi-square tests revealed no significant differences between control and experimental groups on any of the demographic variables. Thus randomization yielded groups that were well matched with regard to gender, age, ethnicity, and other demographic variables.

Screening Scores

Table 11 presents the summary statistics (pass/fail rates) for the control and experimental groups on the HHIE-S, pure-tone screening, and overall screening outcomes.

Overall Screening Scores (HHIE-S and Pure Tone). As shown in Table 11, among those who passed the overall screening test, 7% (N=5) were from the control group and 10% (N=7) from the experimental group. Therefore an approximately equal number of subjects in each group passed the overall screen. Among those who failed,

93% (N=68) were from the control group and 91% (N=67) from the experimental group. Hence an approximately equal number of individuals from each group failed the overall screen. Chi-square analysis revealed no significant differences in overall screening scores between control and experimental groups.

HHIE-S Screening Scores. As shown in Table 11, 45 subjects (62%) from the control group and 52 subjects (70%) from the experimental group passed the HHIE-S, while 28 subjects (38%) from the control group and 22 subjects (30%) from the experimental group failed. Chi-square analysis revealed no significant differences in HHIE-S screening scores between control and experimental groups.

Pure-Tone Screening Scores. As shown in Table 11, 5 subjects (7%) from the control group and 8 subjects (11%) from the experimental group passed the pure-tone screening, while. 68 subjects (93%) from the control group and 66 subjects (91%) from the experimental group failed. Chi-square analysis revealed no significant differences in pure-tone screening scores between control and experimental groups.

In sum, as shown in Table 11, chi-square tests revealed no significant differences between control and experimental groups. Thus randomization yielded groups that were well matched with regard to screening scores.

Table 11

Screening Outcomes for Control (N=73) and Experimental (N=74) Groups

Screening test	Outcome	Control		Experimental	
		N	%	N	%
Overall screening	Pass	5	7	7	10
	Fail	68	93	67	91
HHIE-S	Pass	45	62	52	70
	Fail	28	38	22	30
Pure tone	Pass	5	7	8	11
	Fail	68	93	66	91

Compliance with Follow-up Recommendations

The first two research questions of the study were:

1. Will the new informative hearing screening approach, which includes short counseling as part of the screening process, be associated with a statistically higher compliance with follow-up recommendations than the traditional approach?
2. Will the yield from the informative approach be statistically high enough (sufficient) to justify revising the protocol traditionally used in screening for handicapping hearing impairment in the elderly?

To answer the above research questions, the control and experimental groups were compared to determine if differences emerged in terms of compliance with recommendations. Table 12 presents a comparison of compliance rates between control and experimental groups. As shown in Table 12, 19 subjects (28%) from the control group and 9 subjects (13%) from the experimental group complied with recommendations for follow-up. Thus, contrary to expectation, the experimental condition did not lead to greater compliance. In fact, of all subjects who failed the screen (N=135), subjects in the control condition were more likely to comply than those in the experimental condition. A chi-square test performed to examine the statistical significance of this finding revealed that subjects in the control condition were significantly more likely to comply with screening recommendations than those in the experimental condition (chi-square [df = 1] = 4.32, $p < .05$).

Table 12

Comparison of Control and Experimental Groups in Compliance with Recommendations for Follow-Up (N=135)

Compliance Status	Control group		Experimental group	
	N	%	N	%
Compliant	19	28	9	13
Noncompliant	49	72	58	87

$p < .05$.

Hence, based on the present sample, the yield from the informative approach was not statistically high enough to justify revising the protocol traditionally used to screen for handicapping hearing impairment in the elderly.

Statistical Analysis of the Subjects Who Complied with Follow-up Recommendations

The third research questions of the study was:

What variables will be significantly related to compliance with follow-up recommendation (e.g., socioeconomic status, type of health insurance, readiness for change, audiometric characteristics)?

To answer the above research question, subjects who did or did not comply (regardless of experimental condition) were compared across each of the study's independent variables to determine if any variable was significantly related to compliance with follow-up recommendations. The findings were as follows.

Demographic Information

All the independent variables (demographic data, HHIE-S, pure-tone screening, SF-12, and prescreening hearing status) were compared according to compliance status. No differences were found in the above variables between subjects who did or did not comply.

When statistical analyses using chi-square tests were applied to the above findings, results revealed no significant differences on any of the variables between subjects who did or did not comply; that is, compliers and noncompliers did not differ in age, health status, education level, etc.

Screening Outcomes

The screening outcome of the 28 subjects who did comply (regardless of experimental condition) was assessed and compared with that of the entire subset of subjects who did not comply (N=107). This analysis was done to determine if screening outcome was significantly related to compliance with follow-up recommendations. The assessment included Pass/Fail screening outcome on the HHIE-S, pure-tone screening (overall Pass/Fail and frequency-specific Pass/Fail at 1000 Hz, 2000 Hz, and 4000 Hz), and overall screening (HHIE-S and pure tone). The total numerical score on the HHIE-S and the answers to each of the 10 HHIE-S questions were assessed as well.

Pass/Fail Screening Scores. Results revealed no differences in outcome on the HHIE-S, pure-tone screening (overall Pass/Fail and frequency-specific Pass/Fail), and overall screening (HHIE-S and pure tone) between subjects who did or did not comply. Hence compliers and noncompliers did not differ in their screening scores.

When statistical analyses using chi-square tests were applied to the above findings, results revealed no significant differences between subjects who did or did not comply. Thus no significant differences in compliance were found between subjects who failed only pure-tone screening and subjects who failed both HHIE-S and pure-tone screening. Furthermore, no significant differences in compliance were found between subjects who passed or failed a specific frequency or between subjects who failed one frequency or more.

Total Numeric Score on the HHIE-S. The mean score on the HHIE-S was 9.3 (SD = 1.5) for the subset of subjects who complied and 8.1 (SD = 0.9) for the subset of subjects who did not comply. Therefore the subjects who complied obtained higher/poorer scores on the HHIE-S, albeit statistically and clinically insignificant (no significant differences on the above variable were obtained between subjects who did or did not comply).

Answers to Each of the 10 HHIE-S Questions. Results revealed no differences between subjects who did or did not comply in the pattern of responses to each of the 10 HHIE-S questions. Question 3 ("Do you have difficulty hearing when someone speaks to you in a whisper?") and question 8 ("Does a hearing problem cause you difficulty when listening to TV or radio?") yielded the highest percentage of yes or sometimes answers from all subjects (question 3: 85% yes/sometimes and question 8: 54% yes/sometimes from subjects who did comply; question 3: 65% yes/sometimes and question 8: 49% yes/sometimes from subjects who did not comply).

Statistical analyses of the above findings using chi-square tests revealed no significant differences between subjects who did or did not comply.

In summary, the extraneous variables (e.g., health status, age) were examined to determine if they influence the tendency to comply with recommendations. Statistical analyses examined the above extraneous variables and revealed no significant differences between subjects who did or did not comply. The fact that compliers and noncompliers were comparable on each variable suggests that these extraneous variables did not

influence compliance levels. The only variable that appeared to differentiate between subjects who did or did not comply was the experimental condition.

In the next chapter, the discussion focuses on the influence of the experimental condition on the outcome and the interaction between the experimental condition and sampling.

Audiological Evaluation

As discussed earlier, the audiology departments of Montefiore and Jacobi Medical Centers participated in the present study and were recommended to subjects who did not pass the hearing screening as agencies for a comprehensive audiological follow-up evaluation. Two weeks after the hearing screening, the researcher telephoned the subjects who did not pass the screening to determine if they had made an appointment for a follow-up hearing test, and if so, where and when. Two months after the hearing screening, a short questionnaire was sent to all the subjects who did not pass the screening, inquiring whether they had completed a follow-up hearing test, and if so, where and when. The above audiology departments kept a list of the subjects who scheduled a follow-up hearing test, and their hearing test results (audiograms) were used for data analysis. If two months after the hearing screening, no follow-up hearing test had been completed in the above facilities or reported completed in a different facility (by returning the questionnaire), subject was considered noncompliant with the follow-up recommendation. If completed, the subject was considered compliant. It is important to note, however, that follow-up hearing test results (audiograms) were only available for

subjects who followed up at one of the audiology departments that participated in the study.

Of the 28 subjects who complied, 17 followed up at one of the above audiology departments, and their audiograms were obtained. Statistical analyses using descriptive statistics examined the complete audiogram (pure-tone thresholds and speech discrimination scores) of the 17 subjects for whom test results were available to determine the nature of their hearing status and whether any variable was significantly related to compliance with follow-up recommendations.

Table 13 presents ear-specific rate of hearing loss severity by averaging pure-tone thresholds (PTA) at 500 Hz, 1000 Hz, and 2000 Hz for the 17 subjects for whom audiological test results were available. As shown in Table 13, a majority of subjects (53% in the right ear and 59% in the left ear) had normal hearing. Of the above 17 subjects, 10 had mild hearing loss or poorer in at least one ear (using PTA). The mean hearing thresholds at each frequency, from 250 Hz to 8000 Hz, of these 10 subjects was 50.1 dB HL (51.6 dB HL in the right ear, and 48.2 dB HL in the left ear).

Table 13

Hearing Loss Severity by Pure-Tone Average of Subjects for Whom Follow-up Audiological Test Results Were Available (N= 17)

Hearing Loss Severity	Left Ear		Right Ear	
	N	%	N	%
Within normal limits (0 dB-25 dB)	10	59	9	53
Mild SNHL (30 dB-35 dB)	1	06	5	29
Moderate SNHL (40 dB-50 dB)	4	23	I	6
Moderate-severe SNHL (55 dB-65 dB)	1	06	-	-
Severe SNHL (70 dB-85 dB)	1	06	-	-
Severe mixed hearing loss (70 dB-85 dB)	-	-	1	6
Profound SNHL (90 dB-110 dB)	-	-	1	6

Table 14 presents ear-specific mean hearing thresholds at each frequency, from 250 Hz to 8000 Hz, of the 17 subjects for whom audiological test results were available. As shown in Table 14, The mean thresholds were essentially 27 dB HL at 250 Hz sloping to 66 dB at 8000 Hz bilaterally. Hence, when evaluating the hearing thresholds at each frequency, the mean hearing loss was mild in both ears (39.9 dB HL in the right ear, and 39.2 dB HL in the left ear). The mean PTA was 34 dB HL in the right ear and 32 dB HL

in the left ear. The average speech discrimination score was 93% in the right ear and 89% in the left ear.

Table 14

Mean Hearing Threshold at Each Frequency in Each Ear, 250 Hz to 8,000 Hz (N= 17)

Frequency	Left Ear Mean Hearing Thresholds	Right Ear Mean Hearing Thresholds
250 Hz	26 dB HL	29 dB HL
500 Hz	30 dB HL	32 dB HL
1000 Hz	32 dB HL	35 dB HL
2000 Hz	34 dB HL	35 dB HL
4000 Hz	46 dB HL	44 dB HL
8000 Hz	68 dB HL	65 dB HL

For the above 17 subjects, the correlation was computed between HHIE-S score (mean score = 8) and PTA at 500 Hz, 1000 Hz, and 2000 Hz. The correlation was positive (left ear: $r = .497$, $p < .05$; right ear: $r = .459$, $p < .10$) yet imperfect.

Of the above 17 subjects who complied, 7 had moderate hearing loss or above in at least one ear and 10 had either mild hearing loss or hearing within normal limits (using PTA at 500 Hz, 1000 Hz, and 2000 Hz).

Of the 7 subjects with at least moderate hearing loss, 6 (86%) failed the HHIE-S, and their mean score was 15 (SD = 7.4). Of the 10 subjects with either mild hearing loss or hearing within normal limits, only 2 (20%) failed the HHIE-S and their mean score

was 7 (SD = 5.9).

In order to further address the value of the ASHA recommended 25 dB HL screening levels versus 40 dB HL screening level recommended in the reviewed literature, two possible Pass/Fail pure-tone screening criteria were applied to the above 17 subjects. If a 40 dB HL screening level at 1000 Hz, 2000 Hz, and 4000 Hz had been used as a Pass/Fail criterion, only 3 (30%) of the 10 subjects with either mild hearing loss or hearing within normal limits would have failed the pure-tone screening. Furthermore, if a 40 dB HL screening level only at 1000 Hz and 2000 Hz (without 4000 Hz) had been used as a Pass/Fail criterion, none of the 10 subjects would have failed the pure-tone screening. However, using the above two criteria, all 7 subjects with at least moderate hearing loss would still have failed the pure-tone screening and been referred for a complete audiological follow-up. The validity of a 25 dB HL screening level at 1000 Hz, 2000 Hz, and 4000 Hz will be addressed in the discussion section.

The demographic variables of the total sample were compared with those of the subsets of subjects who complied (both the 17 for whom audiograms were available and the total 28 who complied) to determine if these subsets represented the overall sample demographically. Statistical analyses using chi-square tests revealed no significant differences in demographic variables between the above subsets and the total sample. Hence these subsets did not differ from the total sample in education, age, etc.

Reasons for Compliance/Noncompliance with the Follow-up Recommendation

The fourth research question of the study was:

What are the subjects' reported reasons for compliance/noncompliance with the follow-up recommendation for a complete hearing test (e.g., vanity, cost of amplification)?

To answer the question, responses to the follow-up questionnaire were analyzed to determine why subjects comply or did not comply with the recommendation. Since several subjects gave more than one reason for compliance/noncompliance, the percentages do not add to 100 in the next two Tables. An objective limitation of the present study that should be noted is that the reasons for compliance/noncompliance are unknown for the large number of subjects who did not return the questionnaire. Nevertheless, the findings were as follows.

Among the subjects who did not comply, 71% did not return the questionnaire, and therefore their reasons for noncompliance are unknown. Table 15 presents the frequency of reasons given for noncompliance among respondents. Among the 31 subjects (29%) who returned the questionnaire, the main reason for noncompliance was "other health problems" (39%), following by "had no time" (19%), "noted no hearing difficulties" (19%), "no follow-up at this time" (13%), "financial" (6.5%), "can still cope"(6.5%), "is away"(3%), "the weather" (3%), and "only contacted her ear, nose, and throat (ENT) medical doctor (M.D), but no follow-up hearing test" (3%).

Table 15

Reasons Given for Noncompliance with Follow-up Recommendation (N=31)

Reasons for Noncompliance	N	%
Other health problems	12	39.0
Had no time	6	19.0
Noted no hearing difficulties	6	19.0
No follow-up at this time	4	13.0
Financial	2	6.5
Can still cope	2	6.5
Is away	1	3.0
The weather	1	3.0
Only contacted E.N.T M.D (no follow-up hearing test)	1	3.0

It is evident that the main reason for noncompliance was "other health problems" (39%). This is interesting since statistical analysis revealed no significant differences in SF-12 scores (either physical or mental health) between subjects who did or did not comply.

Among the subjects who complied, 21.5% did not return the questionnaire, and therefore their reasons for compliance are unknown. Table 16 presents the frequency of reasons given for compliance. Among the 22 subjects (78.5%) who returned the questionnaire, the main reason for compliance was " to improve life quality/to get help" (32%), followed by "to find out hearing status" (27%), "was aware of hearing difficulties, and thought it is time to test further" (27%), "recommended at the screening" (23%), and "a complete hearing test is necessary due to age" (5%).

Table 16

Reasons Given for Compliance with Follow-Up Recommendation (N=22)

Reason for Compliance	N	%
To improve life quality	7	32
To find out hearing status	6	27
Was aware of hearing difficulties and thought it is time to test further	6	27
Recommended at the screening	5	23
A complete hearing test is necessary due to age	1	5

Summary of Results

Of the 147 subjects who participated in the study, 12 (8%) passed the hearing screening and 135 (92%) failed. Control and experimental groups were compatible on all demographic variables. Furthermore, the groups were compatible on audiological variables (HHIE-S and pure-tone screening scores). Therefore randomization yielded groups that were well matched with regard to all variables.

Compliance with follow-up recommendations was examined to assess whether the informative hearing screening approach was associated with a statistically higher compliance with follow-up recommendations than the traditional approach (research questions 1 and 2). Contrary to expectations, the experimental condition did not lead to greater compliance. Thus the counseling videotape did not increase compliance. On the contrary, subjects in the control condition were significantly more likely to comply (19 subjects or 28%) than those in the experimental condition (9 subjects or 13%). It should be noted that statistical analyses using chi-square tests suggested that one more compliance case from the experimental group would have eliminated the significant difference between the groups. Therefore the difference between experimental and control conditions is at best marginal. These findings suggest that although the counseling videotape might not discourage compliance, it did not increase compliance.

Statistical analyses of all the variables (demographic, HHIE-S, pure-tone screening, SF-12, and prescreening hearing status) for the subset of subjects who complied revealed no significant differences between subjects who did or did not comply (research question 3). Hence the only variable that appeared to differentiate between subjects who did or did not comply was the experimental condition.

Item analysis of the 10 HHIE-S questions answered by the 28 subjects who complied revealed that the highest percentage of yes or sometimes answers were to question 3 ("Do you have difficulty hearing when someone speaks to you in a whisper?") and question 8 ("Does a hearing problem cause you difficulty when listening to TV or radio?"). Item analysis for the total sample revealed the same results.

Audiograms were obtained for 17 of the subjects who complied. The mean pure-tone average (PTA) was 34 dB HL in the right ear and 32 dB HL in the left ear. The average speech discrimination score was 91%. Thus subjects who complied had relatively mild hearing loss and good word recognition ability. Furthermore, for the above 17 subjects, the correlation between PTA and HHIE-S scores was positive yet imperfect.

The frequency of reasons given for compliance and noncompliance was assessed (research question 4). Among the subjects who complied, the main reason for compliance was "to improve life quality." Among the subjects who did not comply, the main reason for noncompliance was "other health problems." Nonetheless, although "other health problems" was the main reason for noncompliance, no significant differences in SF-12 scores (either physical or mental health) were noted between subjects who did or did not comply.

In regard to the overall pattern of screening results, 66% passed the HHIE-S and 34% failed. With regard to pure-tone screening, only 9% passed and 91% failed, with the highest failure rate at 4000 Hz (75% in the right ear and 84% in the left ear). Statistical analyses revealed that the percentage that failed at 1000 Hz (in both ears) and at 2000 Hz (in at least one ear) was significantly lower than the percentage that failed at 4000 Hz.

Furthermore, of the 135 subjects who failed, 85 (63%) failed only pure-tone screening, 1 (1%) failed only the HHIE-S, and 49 (36%) failed both the HHIE-S and pure-tone screening. Therefore, 98% of the subjects who failed the HHIE-S also failed pure-tone screening, but only 37% of the subjects who failed pure-tone screening also failed the HHIE-S.

CHAPTER 4

DISCUSSION

Introduction

The present study was designed to investigate and compare the feasibility and effectiveness of the traditional approach to hearing screening (with no counseling) versus a new informative approach (hearing screening plus counseling). The purpose of the investigation was to determine if the new informative approach would result in higher compliance with follow-up recommendations than a traditional screening protocol. The ultimate goal of the research was to increase the number of older adults seeking audiological rehabilitation services, thereby preventing disability and providing the elderly individual with an improved quality of life.

The Study's Findings

Characteristics of the Sample

The subjects were 147 community-based individuals age 65 and above recruited from senior citizen centers to participate in the hearing screening. The mean age of the sample was 75 years. Subjects represented a varied demographic base in terms of ethnicity, marital status, living arrangements, education level, annual household income, and health insurance. The sample mean scores on the Physical and Mental Component scales of the SF-12 were within the standard deviation of the mean score for the general U.S population of older adults. Hence the sample represented a wide demographic base of the elderly and thus supported generalization of the present study's findings.

Overall Screening Results

Of the 147 subjects undergoing the hearing screening, 12 (8%) passed the screening and 135 (92%) failed the screening and were referred for a complete hearing test. Of the 135 subjects who failed, 85 (63%) failed only pure-tone screening, 1 (1%) failed only the HHIE-S, and 49 (36%) failed both the HHIE-S and pure-tone screening. In terms of HHIE-S screening outcomes, 97 subjects (66%) passed and 50 subjects (34%) failed. In terms of pure-tone screening outcomes, only 13 subjects (9%) passed and 134 subjects (91%) failed. Thus a significantly higher failure rate was found on pure-tone screening than on HHIE-S screening.

When assessing pure-tone screening outcomes by frequency, the failure rate increased as a function of frequency, with the highest failure rate at 4000 Hz. Ventry and Weinstein (1983) noted that including 4000 Hz produces a dramatic increase in pure-tone

fail rate. Furthermore, they noted that including 4000 Hz would fail nearly 60% of subjects who report no handicap. In the present study, 63% of the subjects failed only pure-tone screening and passed the HHIE-S. Although Ventry and Weinstein used a 40 dB HL screening level, both findings found a higher failure rate at 4000 Hz and essentially the same percentage of subjects who failed only pure-tone screening and reported no handicap. Hence the above findings, which are comparable to those of other studies, support generalizability of the results.

Schow (1991) reviewed failure rates on the HHIE-S and pure-tone screening for thousands of adults screened from 1985 to 1988 in a series of health fairs. For the HHIE-S, Schow reported a failure rate of 41.4% for adults age 60 to 69 and 43.9% for adults age 70 or above. This is comparable to the result of the present study (34%). For pure-tone screening, using a 25 dB HL screening level at 1000 Hz and 2000 Hz and a 30 dB HL screening level at 4000 Hz, Schow reported a failure rate of 77% for adults age 60 and above. The present study revealed a slightly higher failure rate on pure-tone screening (91%). However, our study used a lower fence of 25 dB HL screening level at 4000 Hz. As noted earlier, results revealed that a significantly higher percentage of subjects undergoing the pure-tone screening failed 4000 Hz using a 25 dB HL screening level. Furthermore, the subjects in our study were slightly older (age 65 and above). Hence, considering those two variables, the present study's pure-tone screening findings are essentially comparable to Schow's findings. In addition, a higher failure rate on pure-tone screening than on the HHIE-S was noted in both Schow's and our study's findings. Thus the above comparable findings support generalization of the results.

Weinstein (1991) noted that individuals with hearing disability that seek rehabilitation/obtain amplification have mean scores of about 18 on the HHIE-S. A study by Newman et al. (1991) revealed that irrespective of hearing loss severity and word recognition scores, the mean HHIE-S score of individuals pursuing amplification was 18. In the present study, the mean score of subjects who failed the HHIE-S and complied was 16.3 (SD = 5.7). Thus the above comparable findings support generalization of the present study's results.

Control versus Experimental Groups

Control and experimental groups were compatible on all demographic variables. Further, groups were compatible on audiological variables (HHIE-S and pure-tone screening outcomes). Hence randomization yielded groups that were well matched with regard to all variables, therefore supporting the external validity of the study.

Review of the Research Questions

The present study was designed to answer the following four research questions introduced in chapter 1:

1. Will the new informative hearing screening approach, which includes short counseling as part of the screening process, be associated with a statistically higher compliance with follow-up recommendations than the traditional approach?
2. Will the yield from the informative approach be statistically high enough (sufficient) to justify revising the protocol traditionally used in screening for handicapping hearing impairment in the elderly?
3. What variables will be significantly related to compliance with follow-up recommendation?
4. What are the subjects' reported reasons for compliance/noncompliance with the follow-up recommendation for a complete hearing test?

Compliance with Follow-up Recommendations

Compliance was examined to assess whether the informative hearing screening approach was associated with a statistically higher compliance with follow-up recommendations than the traditional approach. Contrary to expectations, the experimental condition did not lead to greater compliance. Thus the counseling videotape did not increase compliance. On the contrary, subjects in the control condition were more likely to comply than those in the experimental condition. Nonetheless, the significant difference between experimental and control conditions was at best marginal. These findings suggest that although the counseling videotape might not discourage compliance, it did not increase compliance among the current study's sample **(research question 1)**. Therefore the yield from the informative approach was not statistically high enough to justify revising the protocol traditionally used to screen for handicapping hearing impairment in the elderly **(research question 2).**

Subjects who did or did not comply (regardless of experimental condition) were compared across each of the study's independent variables to determine if any variable was significantly related to compliance with follow-up recommendation. As discussed in the Results section, no differences were found for any of the independent variables between subjects who did or did not comply **(research question 3)**.

Fino et al. (1990) examined why the elderly choose not to seek rehabilitation and attempted to identify factors that distinguish them from hearing aid users. Similar to the present study, Fino et al., as well as Humphrey et al. (1981), found that demographic factors such as sex, ethnicity, age, education, and mental status did not differentiate

elderly who choose to seek or not to seek rehabilitation. The above findings, which are comparable to those of our study, support generalizability of the present results.

Compliance Rates

Of the 135 subjects who failed the screen and were referred for an audiological evaluation, 28 (21%) complied and 107 (79%) did not comply.

As discussed in the Introduction, Schow (1991) reviewed several studies that examined rates of follow-up subsequent to referral, following failure of hearing screening. Schow reported compliance rates ranging from 5% to 59%. The average compliance rate was 37%. However, some of the studies reviewed by Schow provided a free follow-up, and as noted by Schow, the most relevant findings when assessing compliance come from studies where follow-up is handled in a fashion that leaves subjects on their own and that require ordinary payment, if needed, for follow-up services. When studies that provided a free follow-up are excluded, the compliance rates ranged from 7% to 52%, with an average of 30%. However, the follow-up rates in several of Schow's reported studies were based on questionnaires returned rather than on total number of referred subjects. When the studies for which follow-up rate was not based on total number of referred subjects are excluded, the compliance rates ranged from 7% to 36%, with an average of only 25% compliance.

Assessing compliance rate based on questionnaires returned rather than on total number of referred subjects may affect the validity of the findings. Furthermore, providing a free follow–up may pose a threat to the external validity of a study and consequently prevent generalization of the results to the real world. The present study

handled follow-up in an ordinary fashion; compliance rate was based on total number of referred subjects; and the 21% compliance rate obtained by the present study is close to the 25% compliance rate found in the studies Schow reviewed. Thus the above issues support the comparability and generalizability of the study findings.

The Study's Hypothesis and the Findings

The study's hypothesis was that the informative hearing screening approach that included counseling would improve understanding of the hearing problem and increase the willingness of subjects to participate in rehabilitation when compared with a traditional hearing screening approach. As noted, however, subjects in the control/traditional condition were more likely to comply than those in the experimental/informative condition. However, the significant difference between experimental and control conditions was at best marginal. Nevertheless, the study's hypothesis was not supported by the findings.

Reasons for Compliance/Noncompliance with Follow-up Recommendation

The subjects' main reasons for compliance **(research question 4)** were (a) "to improve life quality" (32%), (b) "to find out hearing status" (27%), (c) "aware of hearing difficulties" (27%), (d) recommended at the screening (23%), and (e) "hearing test necessary due to age" (5%).

The subjects' main reasons for noncompliance **(research question 4)** were (a) "other health problems" (39%), (b) "had no time" (19%), (c) "noted no hearing difficulties" (19%), (d) "no follow-up at this time" (13%), (e) "financial" (6.5%), (f) "can still cope" (6.5%), (g) "is away"(3%), (h) "the weather" (3%), and (i) "only contacted her ear, nose, and throat (ENT) medical doctor, but no follow-up hearing test" (3%).

Thus the main reason for noncompliance was "other health problems." Nonetheless, statistical analyses revealed no significant differences in SF-12 scores (either physical or mental health) between subjects who did or did not comply. Hence given two individuals with the same health status, one might comply with recommendations and the other might not. Therefore, although health status is a factor that might contribute to compliance, additional variables might affect the decision regarding compliance.

Possible Explanations for No Compliance (Regardless of Experimental Condition)

As will be discussed thoroughly below, one subject of debate when designing hearing screening programs for adults concerns which frequency and intensity characteristics of the signal should be used as Pass/Fail criteria. As noted by Fletcher et

al. (1988) and Morrison (1992), the characteristics of the screening procedures will strongly affect the overall feasibility of the screening program. A criterion of positivity should be defined for interpretation of the screening test. A low criterion may lead to a high degree of false-positives and consequently may cause over-referrals. Ventry and Weinstein (1983) reported that significant hearing handicap among the elderly begins mostly when the pure-tone average (at 500 Hz, 1000 Hz, and 2000 Hz) exceeds 40 dB HL. Furthermore, they noted that including 4000 Hz produces a dramatic increase in pure-tone fail rate and will fail nearly 60% of subjects who report no handicap. Schow (1991) noted that from an epidemiological viewpoint, the biggest objection to the use of 25 dB HL as an intensity level is that it will refer too many individuals. The results of the present study revealed a significantly higher failure rate at 4000 Hz using a 25 dB HL and a significantly higher failure rate using pure-tone screening than the HHIE-S. Whereas 63% of the subjects failed pure-tone screening and passed the HHIE-S, only 1% failed the HHIE-S and passed pure-tone screening. Thus using a different criterion of Pass/Refer might decrease the number of referrals and consequently increase the rate of compliance. That is, the Pass/Fail criterion was too low (25 dB HL) and increased pure-tone fail rate, referred subjects who reported no handicap, and maximized false-positive cases. Hence a possible explanation for no compliance is that subjects of the present sample had minimal handicap, were less in need of audiological rehabilitation, and the compliance rate was low because of the high over-referrals.

The fact that the majority of the present study's sample passed the HHIE-S suggests that the sample had a minimal handicap. Weinstein (1991) noted that individuals with hearing disability who have obtained amplification score much higher/poorer on the

HHIE-S (mean score of about 18) than those without amplification. Fino et al. (1990, 1992) studied why the elderly chose not to seek rehabilitation and attempted to identify factors that distinguish them from hearing aid users. Fino et al. revealed that the factor that most differentiated elderly hearing aid users from nonusers was HHIE-S score. The hearing-impaired elderly who had obtained amplification generally had high HHIE-S scores, while elderly nonusers had low scores and did not perceive themselves as handicapped. Hence, since the majority of the present study's sample passed the HHIE-S, it is possible that they were less in need of audiological rehabilitation and therefore did not comply. It is possible that the same protocol, including the experimental condition, might yield a higher compliance rate if tested on a different population that is more in need of audiological rehabilitation (e.g., a geriatric medical clinic).

For the 28 subjects who complied, 17 audiograms of the complete follow-up hearing test were obtained. The complete audiological evaluations of those 17 subjects were analyzed statistically to determine the nature of their hearing status. As discussed in the Results section, using PTA at 500 Hz, 1000 Hz, and 2000 Hz, a majority of the 17 subjects had normal hearing in both ears. When the hearing thresholds at each frequency from 250 Hz to 8000 Hz were evaluated, the mean hearing loss was found to be mild in both ears. The average speech discrimination was 93% in the right ear and 89% in the left ear. Thus subjects who complied had relatively mild hearing loss and good word recognition ability. Furthermore, the demographic variables of the total sample were compared with those of the subsets of subjects who complied (both the 17 for whom audiograms were available and the total 28 who complied) to determine if these subsets represented the overall sample demographically. Statistical analyses revealed no

significant differences in demographic variables between the subsets of subjects who complied and the total sample. Thus it is possible that the majority of the total sample had relatively normal hearing or mild hearing loss, like the 17 subjects for whom audiograms were available. Fino et al. (1990, 1992) noted that elderly individuals who preferred not to seek rehabilitation had no more than a mild degree of hearing impairment through the speech range. Humphrey et al. (1981) noted that mainly elderly persons with greater levels of mild hearing loss were likely to seek rehabilitation/hearing aids. Hence, again, it is possible that the population of the present sample was less in need of audiological rehabilitation and therefore did not comply.

Wiley et al. (2000) studied self-reported hearing handicap in older adults and found that the probability of reporting a hearing disability/handicap decreased with age, suggesting that older adults may be less bothered by a given disability and/or cope with it better than younger adults. Since chronic illnesses and disorders are more prevalent among the elderly, the impact of these problems may be less disruptive to older adults, and they may have developed better coping skills for the management of their disabilities. In addition, the elderly may have experienced greater hardships in life than younger adults and therefore developed lower expectations in life, stronger survival skills, and greater tolerance for the health problems and disabilities that accompany aging. Wiley et al. also noted that although it might be suggested that the elderly report having less handicap as a result of hearing loss since their lifestyles placed less demand on hearing, their study did not support that suggestion. Nonetheless, Wiley et al. suggested that the above findings may partially explain the decreased prevalence of self-reported hearing handicap with advancing age, and the lower use of amplification. However, it should be

noted that a major part of the sample in the study by Wiley et al. had relatively good hearing (by averaging 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz). Thus it is possible that subjects reported less handicap for that reason. Therefore, although these research findings might suggest an additional possible explanation for no compliance with a recommendation for audiological follow-up, the relatively good hearing of their sample should be taken into consideration.

Kochkin (1993) noted that hearing loss is an emotional issue to many people, and the stigma of hearing loss, as represented by the hearing aid, is rejected by many individuals who can benefit from amplification. Research has revealed that among the reasons subjects reject hearing aids is that they feel hearing aids signify aging, incompetence, weakness, or imperfection. Furthermore, individuals who have hearing difficulties but have not yet obtained amplification often explain it by saying, "I hear well enough in most situations," "My loss is not severe enough," "My hearing loss is not disruptive to my life," or "I don't need fine hearing." Hence these individuals may be denying their hearing loss and its effects on their lives. As noted by Kochkin, only after individuals learn to accept their hearing loss will they comply with audiological rehabilitation.

In the present study, the subjects were asked prior to screening to select the statement that best described their view of their hearing status, to determine their stage of readiness. As noted in the Results section, the majority of the subjects (76%) selected stage 1 or 2 ("I do not think I have a hearing problem, and therefore nothing should be done about it"; "I think I have a hearing problem. However, I am not yet ready to take any action to solve the problem, but I might do so in the future"). As noted earlier, the

fact that the majority of the total sample passed the HHIE-S suggests that the present study's sample had minimal handicap and were in fact not ready to seek assistance. Weinstein (1991) and Fino et al. (1990, 1992) noted that hearing-impaired elderly individuals who obtained amplification generally had high HHIE-S scores, while elderly nonusers had low scores and did not perceive themselves as handicapped. Integrating the HHIE-S and stages of readiness findings within the present study with the conclusions of Weinstein and Fino et al. suggests that the population of the present sample was less in need of audiological rehabilitation. Furthermore, even assuming that some of the subjects did have a hearing impairment that required intervention, the stages of readiness findings revealed no acceptance of the problem, and, as noted by Kochkin (1993), only after individuals learn to accept their hearing loss will they comply with audiological rehabilitation.

In general, it was of interest to explore research literature that examined the yield of other health screening tests among senior citizens and attempted to identify factors associated with subjects' compliance with referral recommendations. Rubenstein et al. (1986) studied health screening program compliance in a community senior center. The mean age of the subjects was 71 years, and 142 subjects were referred to a physician for a follow-up. One month after their examination, subjects were contacted and asked to complete a follow-up questionnaire. Some of the questions were adapted from the Health Belief Model in order to assess and predict compliance. Results revealed that subjects were more likely to comply (about 89% complied) with referrals for conditions that are commonly known to pose a serious threat to health: abnormalities such as breast, cardiac, anemia, and respiratory findings. However, subjects were less likely to comply (about

47%) with referrals on neurological, psychological, musculoskeletal, and skin findings, all of which might be considered by subjects as less serious or even inevitable consequences of aging. Factors that were positively associated with compliance included the specific type of referred problem, the perceived seriousness of the problem, and the absence of financial barriers to medical care. Hence subjects who felt that their positive screening findings were serious were more likely to follow up. Note that hearing screening was included in the program but was not one of the conditions for which subjects were more likely to comply with referrals. Rubinstein et al. noted that among older adults, even a seemingly minor condition, such as a hearing problem, could have serious effects on well-being and ability to live independently. Nonetheless, although the true seriousness of the findings was not determined at the time of the screening, lack of compliance is consistent with the findings that the subject's perception of the seriousness of a condition is positively related to the decision to follow up. Therefore the above research findings suggest a possible additional explanation for no compliance with a recommendation for audiological follow-up following hearing screening.

Schow (1991) noted that research revealed a higher compliance rate when subjects were advised to see a physician rather than an audiologist for follow-up (46% and 11% respectively). In our study subjects were referred to an audiologist for a follow-up, and the compliance rate was 21%. Rubenstein et al. (1986) referred their subjects to a physician for a follow-up, and their findings revealed a much higher compliance rate. Rubenstein et al. conducted a comprehensive health screening, and the nature of their screening tests required a physician follow-up. Nonetheless, referral to a physician for a

follow-up might be a possible additional explanation for a higher compliance rate and should be further examined.

Effect of the Counseling Videotape

Components of the Counseling Videotape

As discussed in chapter 1, three main elements go into the design of an effective counseling session:

1. length (no more than three to five minutes)
2. information (no more than five to seven points)
3. specificity (counseling should be specific)

Counseling for hearing loss should provide information regarding the nature of hearing loss, the effects of the hearing loss on communication/daily functioning, and the remedial procedure/hearing aids that are feasible to minimize the problem. Together, these aspects of counseling may lead to better understanding of the hearing problem and the advantages of amplification, consequently overcoming obstacles to rehabilitation and improving willingness to make a change (Falvo, 1994; Gemson et al., 1990; Jupiter, 1989; Katz, 1985; Kochkin, 1993; Lesner, 1992; Vogt and Kupp, 1987; Weinstein, 1989).

By carefully following the guidelines of the above research literature, a short counseling videotape was produced for the present study. Nevertheless, results revealed that the experimental condition/counseling videotape did not lead to greater compliance. On the contrary, subjects in the control condition were more likely to comply than those in the experimental condition. However, it should be emphasized that, based on statistical analyses, one more compliance case from the experimental group would have eliminated the significant difference between the groups. Thus the difference was at best marginal. Hence it would not be appropriate to conclude that the counseling videotape discouraged

compliance. Nonetheless, findings do suggest that the counseling videotape did not increase compliance.

Possible Solutions for Future Counseling/Videotape/Health Care Marketing

Hildesheimer and Muchnik (1992) studied the cooperation of the hearing-impaired elderly in a hearing screening program and noted that the need for rehabilitation was high, but willingness to participate in the screening program was low, although rehabilitation treatment was provided free of charge. They concluded that elderly people often believe that their hearing loss is their own "secret" and that attention would be drawn to their handicap if they wore a hearing aid.

When attempts are made to hide the hearing aid from society, it follows that this is a psychological phenomenon that relates not only to the elderly but also to society, social norms, and acceptance of individuals with hearing loss. Ross (Carmen and Ross, 2000) noted that the impact of a hearing loss is very much underestimated in our society. Once society as a whole better understands and relates to the individual with hearing loss, that individual will have a better chance of overcoming the psychological barriers associated with wearing hearing aids. Hence, as suggested by Hildesheimer and Muchnik (1992), an intensive explanatory program—one that increases the awareness that hearing rehabilitation may actually reduce evidence of hearing handicap and allow better functioning—should be an integral part of the screening process and should precede administration of the screening test itself. The explanatory program should be directed toward the elderly as well as society as a whole. Furthermore, the advantages of current available audiological rehabilitation services should be communicated by hearing

sciences professionals to the relevant authorities and medical/social services that deal with the elderly.

Hearing Loss Explanatory Programs Via Media Publicity

The process of providing the elderly and society as a whole with information regarding hearing loss, its consequences, and possible remedial procedures such as hearing aids can be done by means of media publicity.

As discussed earlier, hearing aids are rejected by many individuals who could benefit from amplification. Kochkin (in Strom, 2000) noted that although it would be unrealistic to expect to erase the stigma of the hearing aid, we should nonetheless try to minimize it as much as possible. An efficient way to minimize that stigma would be a media campaign with vibrant personalities as spokespersons for hearing aids; that is, familiar personalities with hearing loss and hearing aids who would share their personal experiences with the public. The spokespersons could explain that they have a hearing loss, did something about it (obtained a hearing aid), and feel good about themselves/improved the quality of their lives. Kochkin noted that the positive publicity about President Clinton's hearing loss and hearing aid increased the number of Baby Boomers who admitted to a hearing loss by one million people, and that President Reagan's similar experience increased purchasing of hearing aids by about 40% in one quarter. Sweetow (in Strom, 2000) also stated that the stigma of hearing aids has to be addressed through media publicity and suggested actors to wear hearing aids on television shows, in order to present a positive image of hearing aids.

Kochkin (in Strom, 2000) raised an interesting point regarding the size of hearing aids, noting that the stigma of hearing aids might be reduced by not implying that they are something that should be hidden, since underneath this message is that individuals should be ashamed of wearing them. Thus we should be careful when discussing the visibility of hearing aids. Research has revealed that the smaller hearing aids become, the greater the awareness of the stigma attached to individuals wearing the larger ITE (in-the-ear) and BTE (behind-the-ear) models. As noted by Kochkin (1993), hearing loss is an emotional issue to many people, and hearing aids often signify aging, incompetence, weakness, or imperfection. Therefore, size/cosmetics is a major factor that can also explain the success of the CIC (completely-in-the-canal) model. When conducting explanatory programs, it is necessary to weigh carefully the balance between the visibility and the stigma of hearing aids.

Ross (Carmen and Ross, 2000), in reviewing his personal experience with hearing loss/aids, noted that individuals should see hearing aids as necessary and desirable devices. Ross stated that he became "rehabilitated" once he learned to accept his hearing loss and did not feel that it diminished him as a human being. Furthermore, addressing the issue of negative judgments aimed at people wearing visible hearing aids, Ross stated that if hearing aid users accept themselves, such judgments cannot undermine self-confidence. Thus providing the elderly, as well society as a whole, with better information regarding hearing loss seems to be essential.

Walsh (2000) suggested that the specific type of media publicity chosen (e.g., television, radio) is far less important than the message that is being delivered. Walsh noted that although the NCOA study emphasized that the hearing health-care field is

offering improved quality of life, most media publicity continues to focus mainly on the advanced technology of hearing aids. Only a small part of the message emphasizes improved quality of life, which is the practical benefit. As recommended by Kochkin and Rogin (2000), Walsh stated that the message should stress that the hearing care professional is there to help individuals hear better and consequently improve the quality of their lives.

In our study, the main reason for compliance was "to improve life quality." Hence our study confirms the consequences of hearing loss on elderly persons' daily functioning, their need to improve the quality of their lives via audiological rehabilitation, and thus the importance of media emphasis on quality of life.

Literature Review Regarding Counseling and Compliance

As discussed thoroughly in the Introduction, Haynes (1976) reviewed studies that reported on the effect of individual patient counseling on compliance with follow-up recommendations. Two studies reported statistically and clinically significant effects of counseling on compliance, two reported partially successful results, and one reported no significant improvement in therapeutic outcomes. Mazzuca (1982) reviewed 30 articles addressing the use of patient education and measured compliance with a therapeutic regimen. Mazzuca suggested that subjects who received education regarding the disease and its treatment might be in a better position to participate in their own health care. Nonetheless, as noted in the Introduction, although several studies suggest that counseling can positively affect compliance, there is a lack of research in this area in general, and in hearing sciences specifically.

Possible Explanations for No Increased Compliance in Spite of the Counseling Videotape in the Present Study

In the present study, the experimental condition did not lead to greater compliance. As discussed earlier, it is possible that the sample population, from senior centers, was less in need of audiological rehabilitation.

A review of the literature revealed several factors relevant to the present study's counseling videotape. As noted by Kochkin (in Strom, 2000), the positive publicity about President Clinton's hearing loss increased the number of Baby Boomers who admitted to a hearing loss. Thus a familiar personality with hearing loss and a hearing aid sharing his personal experience with the public can be an efficient way to minimize the stigma of hearing loss/hearing aids, increase public knowledge of these topics, and consequently improve compliance with recommendations for rehabilitation. Furthermore, a familiar personality from the same age group as the target population might allow individuals to relate better to the spokesperson. However, in the present study's videotape, the presenter was a young audiology doctor with no hearing loss/hearing aids. Therefore the presenter was not familiar to the subjects, had no hearing loss or hearing aid, and was not from their age cohort. Considering the reviewed literature, these factors might affect the strength of the counseling videotape in improving compliance. Hence future studies should employ a counseling videotape with the above components to further examine the effectiveness of counseling in improving compliance.

As noted by Kochkin (1993), hearing loss is an emotional issue to many people. Furthermore, size/cosmetics is a major factor in the acceptance of hearing aids, which can also explain the success of the CIC model. However, in the present study's videotape, a

comprehensive range of hearing aid models (CIC, ITE and BTE), was presented to aid conceptualization. Considering the emotional issues involved, it is possible that the larger models presented discouraged some subjects. However, the rationale for including a comprehensive range of hearing aid models was to provide the subjects with accurate audiological information, regardless of hearing aid size. Furthermore, as noted by Kochkin, the stigma of hearing aids may be reduced by not implying that they are something that should be hidden, since this implies that the individual should be ashamed of wearing them. Hence, when conducting explanatory programs, we have to weigh carefully the balance between the visibility and the stigma of hearing aids.

Stages of Readiness

Pre versus Post Screening Stages of Readiness

Prior to the screening, subjects were asked to select a statement that best described their view of their hearing status. The purpose of these statements was to determine if stages of readiness influenced compliance. The majority of the subjects (44%) selected the following statement, which represents stage 1: "I do not think I have a hearing problem, and therefore nothing should be done about it"; 32% of the subjects selected the statement that represents stage 2: "I think I have a hearing problem. However, I am not yet ready to take any action to solve the problem, but I might do so in the future"; 14% selected the statement that represents stage 3: "I know I have a hearing problem, and I intend to take action to solve it soon"; 10% selected the statement that represents stage 4: "I know I have a hearing problem, and I am here to take action to solve it now."

In order to investigate the possible relation between counseling and readiness, statistical analyses examined the pre- and post-screening stages of readiness of the control versus the experimental group. Results revealed no significant differences in pre-screening stages of readiness between the groups. Furthermore, no significant differences in movement from pre- to post-screening stages of readiness were found between the groups. Although not significant, it is interesting to note a movement backward from stage 3 to stage 2 of five subjects in the experimental group. It is possible that the counseling videotape had some negative effect on these subjects. Nonetheless, those findings were not significant. Hence any conclusion regarding a negative effect of the counseling videotape would not be valid and thus should not be made.

Association Between Stages of Readiness and HHIE-S/Pure-tone screening

A significant, nearly linear relation between stages of readiness and failure on the HHIE-S was found: as stages of readiness increased, subjects were more likely to fail the HHIE-S. Furthermore, a strong association was also found between stages of readiness and numerical score on the HHIE-S: as stages of readiness increased, numerical score on the HHIE-S also increased. However, no significant relation, or any pattern of association, was found between stages of readiness and failure on pure-tone screening. Hence the HHIE-S seems to better represent the subjects' stages of readiness and ultimately their desire to purchase rehabilitation services.

Controversy Surrounding Hearing Screening Protocol for Adults Integrated with Present Study's Findings

Debate continues over several aspects of the design of hearing screening programs for adults. One area of debate involves which frequency and intensity characteristics of the signal should be used as Pass/Fail criteria. As noted by Fletcher et al. (1988) and Morrison (1992), the characteristics of the screening procedures strongly affect the overall feasibility of the screening program. The criteria or conditions that must be met for the test to be considered positive should be defined. A high criterion, by which people with moderate degrees of abnormality will still be defined as negative, may lead to a high number of false-negatives, whereas a low criterion may lead to high numbers of false-positives. The selected screening procedure should be sensitive enough to pick up most positive cases and specific enough to minimize false-positive cases.

Bess et al. (1989) noted that a major difficulty in the classification of hearing impairment is the imperfect association that exists between hearing impairment and hearing handicap. The debate over hearing loss criteria focuses on the most appropriate fence to use in identifying elderly subjects with significant hearing loss. To begin resolving this controversy, the association between hearing impairment and hearing handicap should be precisely described. Thus Bess et al. studied the association between four different commonly used hearing impairment criteria and two functional health status measures. The four criteria used to determine whether a subject was considered hearing impaired were:

1. the criteria of Ventry and Weinstein (a 40 dB loss at either the 1000 Hz or 2000 Hz frequencies in both ears or a 40 dB loss at 1000 Hz and 2000 Hz in one ear)
2. speech frequency pure-tone average (an average hearing loss at 500 Hz, 1000 Hz, and 2000 Hz of 25 dB or greater in the better ear)
3. high-frequency pure-tone average (an average hearing loss at 1000 Hz, 2000 Hz, and 4000 Hz of 25 dB or greater in the better ear)
4. speech recognition threshold (SRT) (an SRT of 25 dB or greater in the better ear)

The two functional health status measures were the Sickness Impact Profile (SIP), a measure of global function, and the HHIE-S, a communication-specific measure of functional impairment. Results revealed that the different criteria of hearing impairment were not independent of each other, and often subjects failed more than one criterion. Thus it was not appropriate to declare that one criterion was best to describe the association between hearing impairment and hearing handicap. Nonetheless, Bess et al. noted that there was a large subset of subjects who failed only the high-frequency pure-tone average criterion and had little in the way of communicative/HHIE-S or global/SIP dysfunction. Moreover, using this criterion doubled the prevalence of the hearing impairment condition compared with the other criteria. Furthermore, when assessing the correlation between the four criteria for hearing impairment and the two functional health status measures, the speech frequency pure-tone average criterion was most closely correlated with the SIP, and the Ventry and Weinstein criterion was most closely correlated with the HHIE-S. Hence the correlation depended on the functional scale used.

Bess et al. also reported that functional impairment increased with the number of criteria of hearing impairment failed. Thus a new taxonomy for future research into the association between hearing impairment and hearing handicap can be the number of criteria failed.

Ventry and Weinstein (1983) reported that significant hearing handicap among the elderly begins mostly when the pure-tone average (at 500 Hz, 1000 Hz, and 2000 Hz) exceeds 40 dB HL. Furthermore, they noted that including 4000 Hz produces a dramatic increase in pure-tone fail rate and will fail nearly 60% of subjects who report no handicap. In addition, the two-frequency screen is faster and less subject to ambient noise. Hence Ventry and Weinstein recommended the use of 40 dB HL as a screening level, and 1000 Hz and 2000 Hz as test frequencies, in order to obtain a meaningful and efficient, although not perfect, relationship between handicap and pure-tone screen data for screening purposes. Ventry and Weinstein suggested that a Fail on the pure-tone screen be inability to respond at any one frequency in each ear.

Schow (1991) reviewed the literature of hearing screening research and presented important factors related to hearing impairment, hearing handicap, medical concerns related to hearing, and epidemiological principles as considerations in selection of a protocol in elderly hearing screening. Schow suggested that a variety of considerations might guide us in selecting frequency and intensity characteristics of a screening protocol. In a particular setting and age group, in order to minimize over-referrals and increase compliance, a higher fence at 40 dB HL may be the screening criterion of choice. As noted above by Ventry and Weinstein (1983), the rationale suggested is that lesser impairment may not be handicapping, and consequently the referral would be

costly to the patient. In general, there is clear support for the use of a 40 dB HL fence with the institutionalized elderly. However, some clinicians feel that such a fence is too high for noninstitutionalized elderly, since many individuals seek and need hearing assistance for lesser losses. Nonetheless, from an epidemiological viewpoint, the biggest objection to the 25 dB HL level is that it will refer too many individuals. However, Schow noted that 20% to 33% of subjects who failed a pure-tone screen at 40 dB HL would not fail a handicap inventory, so some "deniers" can be missed. Furthermore, Schow noted that in order to decrease failure rate, researchers such as Ventry and Weinstein (1983), as discussed above, suggested the use of two frequencies and required two failures before referral. However, Schow noted that those advocating this referral criterion use the precaution of referring handicap inventory failure in addition to pure-tone failure. Hence Schow suggested that a better way to lessen referral rate was to make the pure-tone fence stringent at 25 dB HL but then, assuming there were no medical concerns, to refer pure-tone failures only when combined with handicap inventory failure.

It would be interesting to integrate the above research literature with our study. Bess et al. noted that there was a large subset of subjects who failed only the high-frequency pure-tone average criterion and had little in the way of communicative or global dysfunction. Furthermore, using this criterion doubled the prevalence of the hearing-impairment condition compared with the other criteria. Of the four criteria used by Bess et al. to determine whether a subject was hearing impaired, the high-frequency pure-tone average criterion was closest to the pure-tone criterion used in our study. That is to say that, although not identical, both criteria used 1000 Hz, 2000 Hz, and 4000 Hz as

choice of frequencies and essentially 25 dB HL as choice of intensity. In the present study results revealed a significantly higher failure rate on pure-tone screening than on the HHIE-S. Of the 135 subjects who failed, 85 (63%) failed only pure-tone screening and passed the HHIE-S while only 1 (1%) failed only the HHIE-S and passed pure-tone screening. Furthermore, results revealed a significantly higher failure rate at 4000 Hz using a 25 dB HL. Thus integrating the present study findings with the above research literature recommendations suggests that the use of 4000 Hz as test frequency and 25 dB HL as a screening level should be reassessed.

The comparison of pure-tone screening and HHIE-S scores to stages of readiness revealed a positive correlation only between HHIE-S scores and stages of readiness. In addition, subjects who complied obtained higher/poorer scores on the HHIE-S, albeit statistically and clinically insignificant. However, no differences were noted in outcome on pure-tone screening (altogether Pass/Fail and frequency-specific Pass/Fail) between subjects who did or did not comply. Furthermore, no significant relationship was found between compliance and the number of failed frequencies. Hence the HHIE-S better assesses the subjects' stages of readiness than the pure-tone screening. Furthermore, again, the use of 4000 Hz as test frequencies and 25 dB HL as a screening level should be reassessed.

Conclusions, Present State of Knowledge, and Directions for Future Research

Schow (1991) noted that one way of measuring the appropriateness of screening programs is by assessing the follow-up rate of the referrals and that about 50% follow-up seems feasible. In the current study, as well as in many studies reviewed earlier, the reported follow-up rates were lower. Nonetheless, as noted by Bess et al. (1989), hearing and communicative dysfunction are associated with global dysfunction. Thus, hearing is a major determinant of function among the elderly. Persons who are elderly rely on auditory input to maintain social contact and awareness of their environment, and hearing loss can lead to isolation and withdrawal from the community. Hence the ability to hear is critical to quality of life, justifying the need for an efficient hearing screening protocol that will improve compliance with follow-up recommendations.

The purpose of the present study was to investigate whether the new informative/ counseling approach would result in higher compliance with follow-up recommendation than the traditional screening protocol. The aim of the present study was not to investigate the sensitivity and specificity of a protocol, which requires completing a follow-up hearing test for every subject. Therefore, in order to examine the validity of the protocol and to assess its sensitivity, specificity, and predictive values, similar future research should be conducted on a different population/setting with a higher probability of having a hearing loss, and a comprehensive follow-up hearing evaluation should be completed for each subject.

As noted in chapter 1, although several studies suggest that counseling can positively affect compliance, there is a lack of research in this area in general, and in hearing sciences specifically. Winograd et al. (1990) noted that counseling might be more

effective in helping to manage nonmedical/nonsurgical rehabilitation. This can support the use of counseling with hearing screening, since the nature of audiologic rehabilitation for presbycusis is mostly nonmedical. Furthermore, Mazzuca (1982) noted that since chronic conditions usually cannot be treated as easily and quickly as acute conditions, the need for education to improve compliance might be greater for chronic conditions. Since hearing impairment is considered a chronic condition (Healthy People 2000, 1992), the above suggestions appear applicable to the issue of counseling accompanying a hearing screening. Nonetheless, as noted by Falvo (1994), future research is needed to enhance and strengthen the quality of patient education/counseling.

In the present study, the difference in compliance between experimental and control conditions was at best marginal. Nonetheless, the findings revealed that the counseling videotape did not increase compliance among the current study's sample. However, as discussed earlier, it is possible that the present sample was less in need of audiological rehabilitation and hence that the compliance rate was not due to the screening protocol. Thus future research similar to the present study should be conducted with a different population/setting (e.g., a geriatric clinic) to further examine the effect of counseling on compliance. Furthermore, future research, with a sufficient budget, might attempt to improve the current counseling videotape by utilizing the recommendations provided and reviewed in this chapter.

An objective limitation of the present study that should be noted is that since complete audiograms were not available for subjects who failed the hearing screening but did not follow up, their exact hearing status is unknown. Although variables such as the HHIE-S scores and stages of readiness provided valuable information about these

subjects, their exact need for rehabilitation could not be determined. Furthermore, the follow-up hearing test results (audiograms) were only available for subjects who followed up at one of the audiology departments that participated in the present study. Audiograms of subjects who followed up at other facilities that did not participate in the present study could not be reviewed due to confidentiality reasons. This is a shortcoming of the study, but we were aware of this when first designing it.

Based on the literature reviewed earlier, it appears that hearing loss in the elderly is an appropriate target disorder for screening efforts since it meets several epidemiological efficacy criteria. However, hearing screening programs are not without controversy. Questions concerning issues such as which frequency and intensity characteristics of the signal should be used as Pass/Fail criteria remain unresolved.

In the present study, of the 17 subjects for whom follow-up audiological test results were available, 7 subjects had moderate hearing loss or above in at least one ear and 10 subjects had either mild hearing loss or hearing within normal limits (using PTA at 500 Hz, 1000 Hz, and 2000 Hz). Of the 7 subjects with at least moderate hearing loss, 6 (86%) failed the HHIE-S. Of the 10 subjects with either mild hearing loss or hearing within normal limits, only 2 (20%) failed the HHIE-S. If a 40 dB HL screening level at 1000 Hz, 2000 Hz, and 4000 Hz had been used as a Pass/Fail criterion, only 3 (30%) of the 10 subjects with either mild hearing loss or hearing within normal limits would have failed the pure-tone screening. Moreover, if a 40 dB HL screening level only at 1000 Hz and 2000 Hz (without 4000 Hz) had been used as a Pass/Fail criterion, none of the 10 subjects would have failed the pure-tone screening. However, using the above two criteria, all 7 subjects with at least moderate hearing loss would still have failed the pure-

tone screening and referred for a complete audiological follow-up. In the present study, if 4000Hz had not been included, the total failure rate in the pure tone screening would have decreased from 91% to 75%. Thus, based on the present study findings and previous reviewed research, it appears that the frequency and intensity characteristics of a screening protocol for the elderly should be reassessed. To minimize over-referral and consequently noncompliance, the use of 1000 Hz and 2000 Hz as test frequencies with intensity level higher than 25 dB HL, combined with the self-perceived hearing handicap instrument/HHIE-S for assessing need and readiness/willingness for rehabilitation, is recommended and should be further studied. Therefore, while considering epidemiological principles, future research should attempt to develop a more efficient screening protocol for the elderly that will result in reduced over-referral rates and higher compliance with rehabilitation recommendations than currently existing protocols. Stated differently, ASHA guidelines, which recommend a 25 dB HL cutoff at 1000Hz, 2000Hz, and 4000Hz, go against epidemiological principles which suggest that a valid protocol is one with low over-referral and high compliance.

The fastest growing segment in the U.S. population is the elderly. The proportion of hearing-impaired individuals over the age of 65 is projected to increase due to the aging of the U.S. population. However, despite the high prevalence of hearing loss among older adults and its negative consequences, most elderly individuals do not receive audiological services. As recommended in the literature, intensive explanatory programs regarding hearing loss, its consequences, and possible remedial procedures (hearing aids) should be provided to the elderly, the general public, and relevant authorities and medical/social services that deal with the elderly. That can be an efficient way to minimize the stigma of

hearing loss/hearing aids and increase the public knowledge/education regarding these topics. Moreover, the explanatory programs should be viewed as an integral part of the screening process. By improving public knowledge regarding hearing loss, individuals might be moved forward in their stages of readiness and consequently better comply once they arrive at the hearing screening. Consequently, this might also improve the overall effectiveness of screening programs. Hence future research should attempt to evaluate and compare the impact of various strategies of explanatory programs on compliance with recommendations for rehabilitation.

In sum, there is a lack of research regarding the effect of counseling on compliance with recommendations for a complete audiological follow-up. Thus the recommendations for future research based on the present study's findings are a valuable contribution to hearing sciences research on geriatric audiology. Combined findings from the present and future research may lead to practical clinical implications regarding counseling and hearing screening for the elderly, which consequently might provide the elderly individual with an improved quality of life.

SUBJECT #___

APPENDIX A

Screening Form

Hearing Disability Screening:
[Hearing Handicap Inventory for the Elderly-Screening Version (HHIE-S; Ventry & Weinstein, 1983)]

INSTRUCTIONS: Please check "yes," "no," or "sometimes" in response to each of the following items. Please do not skip a question if you avoid a situation because of a hearing problem.

	Yes	Sometimes	No
1. **Does a hearing problem cause you to feel embarrassed when you meet new people?**	___	___	___
2. **Does a hearing problem cause you to feel frustrated when talking to members of your family?**	___	___	___
3. **Do you have difficulty hearing when someone speaks in a whisper?**	___	___	___
4. **Do you feel handicapped by a hearing problem?**	___	___	___
5. **Does a hearing problem cause you difficulty when visiting friends, relatives, or neighbors?**	___	___	___
6. **Does a hearing problem cause you to attend religious services less often than you would like?**	___	___	___
7. **Does a hearing problem cause you to have arguments with family members?**	___	___	___
8. **Does a hearing problem cause you difficulty when listening to TV or radio?**	___	___	___
9. **Do you feel that any difficulty with your hearing limits or hampers your personal or social life?**	___	___	___
10. **Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?**	___	___	___

HHIE-S Score: Pass___ Refer___

(continued)

APPENDIX A (continued)

SUBJECT #___

Hearing Impairment Screening:

Pure Tone (*R=Response; NR=No Response*)

	1000Hz	2000Hz	4000Hz
Right ear at 25dB	_____	_____	_____
Left ear at 25dB	_____	_____	_____

Pure Tone Screening outcome: Pass___ Refer___

OVERALL OUTCOME: Pass___
Refer for complete audiological follow-up evaluation___

APPENDIX B

Counseling Form

Hello. I am an audiologist, a healthcare professional specializing in the area of hearing, hearing loss, and hearing aids, and I would like to tell you a little about hearing loss.

– Hearing loss is the third most common condition affecting people over 65 years of age.

– The typical hearing loss that people of your age experience affects the inner part of the ear, and generally cannot be treated medically. Hearing aids are the treatment of choice.

– When hearing loss is not treated, it can have major effects on your ability to enjoy routine daily activities such as talking to family members and friends, understanding television or radio, and speaking on the telephone. Hearing loss can also be unsafe because you may not hear important sounds such as a car horn honking or the smoke alarm.

– It is important for you to understand that it is not normal for all older people to have hearing difficulties. You should not think of your hearing loss as your own individual secret and of hearing aids as devices that will call attention to the fact that you have hearing difficulties. Instead, wearing hearing aids will reduce the hearing problems you have and make your hearing loss less obvious.

(Continued)

APPENDIX B (continued)

– Hearing aids, which are becoming better and better at treating hearing loss, can help to overcome problems associated with hearing loss. Present day hearing aids can help you to understand people better in noisy situations and as you can see are very small and easy to handle. These are examples of different types of hearing aids, ranging from the smallest which fits all the way inside the ear canal, to an in-the-ear hearing aid which rests in the outer part of the ear, to the behind-the-ear hearing aid. When you go for a complete hearing test, the audiologist will thoroughly explain to you about the advantages and disadvantages of each. A hearing aid can cost from about $650 and up. Medicare does not pay for the hearing aid, Medicaid pays for certain types, and some insurance plans reimburse for hearing aids. However, you should know that you will be entitled to a time period in which you can try the hearing aid, with only a small charge if you choose not to keep it.

– I would like to thank you for coming for the hearing screening, and I encourage you to have a complete hearing test to determine the exact degree and nature of your hearing loss, if recommended. When you undergo the hearing test, you will be provided with the information which will help you decide about options available to remedy your hearing difficulties.

SUBJECT #___

APPENDIX C

SF-12 Health Survey

INSTRUCTIONS: This questionnaire asks for your views about your health. Please answer every question by marking one box. If you are unsure about how to answer, please give the best answer you can.

1. In general, would you say your health is:

☐	☐	☐	☐	☐
Excellent	**Very Good**	**Good**	**Fair**	**Poor**

The following items are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	Yes, Limited a lot	Yes, Limited a little	No, Not limited at all
2. **Moderate activities**, such as moving a table, Pushing a vacuum cleaner, bowling, or playing golf	☐	☐	☐
3. Climbing **several** flights of stairs	☐	☐	☐

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	Yes	No
4. **Accomplished less** than you would like	☐	☐
5. Were limited in the **kind** of work or other activities	☐	☐

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	Yes	No
6. **Accomplished less** than you would like	☐	☐
7. Didn't do work or other activities as **carefully** as usual	☐	☐

(continued)

APPENDIX C (continued)

8. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?

☐	☐	☐	☐	☐
Not at all	**A little bit**	**Moderately**	**Quite a bit**	**Extremely**

These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the past 4 weeks

	All of the time	**Most of the time**	**A good bit of the time**	**Some of the time**	**little of the time**	**None of the time**
9. Have you felt calm and peaceful?	☐	☐	☐	☐	☐	☐
10. Did you have a lot of energy?	☐	☐	☐	☐	☐	☐
11. Have you felt downhearted and blue?	☐	☐	☐	☐	☐	☐

12. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting with friends, relatives, etc.)?

☐	☐	☐	☐	☐
All of the time	**Most of the time**	**Some of the time**	**A little of the time**	**None of the time**

SUBJECT #___

APPENDIX D

Demographic Questionnaire

Name: _____ **Date:**_____

Address: _____

Telephone # _____

Please answer the following questions:

1) **Date of birth:**____ **Age:**__ **Sex:** M / F

2) **Ethnicity:**
   1) Caucasian
   2) African-American
   3) Hispanic
   4) Other_____

3) **Marital Status:**
   1) Married
   2) Widowed
   3) Never married, separated, divorced

4) **Living Arrangement:**
   1) living alone
   2) live with spouse
   3) live with others

(Continued)

APPENDIX D (continued)

5) **Highest Education:**
   1) less than elementary degree
   2) elementary degree
   3) high school (some)
   4) high school degree
   5) college (some)
   6) college degree
   7) graduate school or above

6) **Annual Household Income:**
   1) less than $10,000
   2) $10,000-19,000
   3) $20,000-29,000
   4) $30,000-39,000
   5) $40,000-49,000
   6) $50,000-59,000
   7) $60,000+

7) **Health Insurance**:
   1) Medicare
   2) Medicaid

8) Have you ever owned **hearing aids**?
   1) Yes
   2) No

SUBJECT #___

APPENDIX E

Hearing Status Questionnaire

(Pre/Post Screening)

Which of the following statements best describes your view of your current hearing status?

(Please answer by marking one statement)

1) I do not think I have a hearing problem, and therefore nothing should be done about it.

2) I think I have a hearing problem. However, I am not yet ready to take any action to solve the problem, but I might do so in the future.

3) I know I have a hearing problem, and I intend to take action to solve it soon.

4) I know I have a hearing problem, and I am here to take action to solve it now.

SUBJECT #___

APPENDIX F

Hearing Screening Results

Thank you for participating in the hearing screening study. The results of your hearing screening suggest that:

___ You have passed the hearing screening. No further follow-up is presently indicated. However, if you notice any change in your hearing later on, please consult your primary care physician, and be referred to an audiologist for a complete hearing test.

___ You should have a complete hearing evaluation. Please contact one of the following hearing centers, and make an appointment for a complete hearing test with an audiologist:

Jacobi Medical Center*	**Montefiore Medical Center***	**Montefiore Medical Park**
Pelham Parkway South & Eastchester Rd. (5th Floor, Room N51) Bronx, NY 10461	The Green Pavilion (Third Floor) 3400 Bainbridge Avenue Bronx, NY 10467	1575 Blondell Ave. Suite 150 Bronx, NY 10461

*** = Medicaid accepted.**

SUBJECT #___

APPENDIX G

Follow-up Questionnaire

Thank you, again, for participating in the hearing screening.

Please answer the following questions, and return it in the attached, addressed stamped envelope. Thank you.

Question #1: Did you make an appointment for a complete hearing test, as recommended in the hearing screening?

1) Yes __
2) No __

IF "yes", please indicate: 1)Where was your appointment? ____
2)When was your appointment? ____

Question #2: Please list the reason(s) for your decision to go or not to go for a complete hearing test.

Answer: _____
_____
_____
_____

REFERENCES

Alberti, P.W., Pichora-Fuller, M.K., Corbin, H., & Riko, K. (1984). Aural rehabilitation in a teaching hospital: evaluation and results. Annals of Otology, Rhinology, & Laryngology, 93, 589-594.

ASHA Ad Hoc Committee on Screening for Hearing Impairment, Handicap and Middle Ear Disorders. (1995). Report on audiological screening. American Journal of Audiology, 4(2). 24-40.

ASHA Panel on Audiological Assessment. (1997). Guidelines for audiologic screening. ASHA.

Bess, F.H., Lichtenstein, M.J., Logan, S.A., & Burger, M.C. (1989). Comparing criteria of hearing impairment in the elderly: a functional approach. Journal of Speech and Hearing Research, 32, 795-802.

Bess, F.H., Lichtenstein, M.J., Logan, S.A., Burger, M.C., & Nelson, E. (1989). Hearing impairment as a determinant of functioning in the elderly. Journal of the American Geriatrics Society, 37(2), 123-238.

Bridges, J.A., & Bentler, R.A. (1998). Relating hearing aid use to well-being among older adults. The Hearing Journal, 51(7), 39-44.

Carmen, R., & Ross, M. (2000). Profiles in aural rehabilitation: Richard Carmen interviews Mark Ross. The Hearing Journal, 53(3), 54-62.

Christensen, L.B. (1944). Experimental methdology. Boston: Allyn & Bacon.

Crandell, C.C. (1998). Hearing aids: Their effect on functional health status. The Hearing Journal, 51(2), 22-32.

Cruickshanks, K.J., Wiley, T.L., Tweed, T.S., Klein, B.E.K., Klein, R., Mares-Perlman, J.A., & Nondahi, D.M. (1998). Prevalence of hearing loss in older adults in Beaver Dam, Wisconsin: The Epidemiology of Hearing Loss Study. American Journal of Epidemiology, 148(9), 879-886.

Dempsey, J.J. (1986). The Hearing Performance Inventory as a tool in fitting hearing aids. Journal of the Academy of Rehabilitative Audiology, 19, 116-125.

Doehring, D.G. (1988). Research strategies in human communication disorders. Boston, Toronto: College-Hill Press of Little, Brown.

Dye, C.J., & Peak, M.F. (1983). Influence of amplification on the psychological functioning of older adults with neurosensory hearing loss. Journal of the Academy of Rehabilitative Audiology, 17, 210-220.

Erfurt, J.C., Foote, A., & Heirich, M.A. (1991). Worksite wellness programs: Incremental comparison of screening and referral alone, health education follow-up counseling, and plant organization. American Journal of Health Promotion, 5(6), 438-448.

Falvo, D.R. (1994). Effective patient education. Gaithersburg, MD: Aspen.

Fino, M.S., Bess, F.H., & Lichtenstein, M.J. (1990). Attitudes and characteristics differentiating elderly hearing aid users and nonusers. Journal of the American Academy of Audiology, 1(1), 46-47.

Fino, M.S., Bess, F.H., Lichtenstein, M.J., & Logan, S.A. (1992). Factors differentiating elderly hearing aid wearers vs. non-wearers. Hearing Instruments, 43(2), 6-10.

Fletcher, R.H., Fletcher, S.W., & Wagner, E.H. (1988). Clinical epidemiology: The essentials. Baltimore, MD: Williams & Wilkins.

Gates, G.A., Cobb, J.L., D'Agostino, R.B., & Wolf, P.A. (1993). The relation of hearing in the elderly to the presence of cardiovascular disease and cardiovascular risk factors. Archives of Otolaryngology Head and Neck Surgery, 119, 156-161.

Gates, G.A., Cobb, J.L., Linn, R.T., Rees, T., Wolf, P.A., & D'Agostino, R.B. (1996). Central auditory dysfunction, cognitive dysfunction, and dementia in older people. Archives of Otolaryngology Head and Neck Surgery, 122, 161-167.

Giolas, T.G., Owens, E., Lamb, & S.H., Schubert, E.D. (1979). Hearing Performance Inventory. Journal of Speech and Hearing Disorders, 44, 169-195.

Gemson, D.H., Sloan, R.P., Messeri, P., & Goldberg, I.J. (1990). A public health model for cardiovascular risk reduction. Archives of Internal Medicine, 150, 985-989.

Herbst, K.G., & Humphrey, C. (1980). Hearing impairment and mental state in the elderly living at home. British Medical Journal, 281, 903-905.

High, W.S., Fairbanks, G., & Glorig, A. (1964). Scale for self-assessment of hearing handicap. Journal of Speech and Hearing Disorders, 30(4), 360-364.

Hildesheimer, M., & Muchnik, C. (1992). Cooperation of hearing-impaired elderly subjects for participation in a hearing screening program. Audiology, 31, 222-227.

Humphrey, C., Herbst, K.G., & Faurqi, S. (1981). Some characteristics of the hearing-impaired elderly who do not present themselves for rehabilitation. British Journal of Audiology, 15, 25-30.

Israel, Y., Hollander, O., Sanchez-Craig, M., Booker, S., Miller, V., Gingrich, R., & Rankin, J.G. (1996). Screening for problem drinking and counseling by the primary care physician-nurse team. Alcoholism: Clinical and Experimental Research, 20(8), 1443-1450.

Janz, N.K., & Becker, M.H. (1984). The Health Belief Model: A decade later. Health Education Quarterly, 11(1), 1-47.

Jenkinson, C., Layte, R., Jenkinson, D., Lawrence, K., Petersen, S., Paice, C., & Stradling, J. (1997). A shorter form health survey: Can the SF-12 replicate results from the SF-36 in longitudinal studies? Journal of Public Health Medicine,19(2), 179-186.

Jupiter, T. (1989). A community hearing screening program for the elderly. The Hearing Journal, 42(1), 14-17.

Katz, J. (1985). Handbook of clinical audiology. Baltimore, MD: Williams & Wilkins.

Kirkwood, D.H. (1999). Major survey documents negative impact of untreated hearing loss on quality of life. The Hearing Journal, 52(7), 32-40.

Kochkin, S. (1993). MarkeTrak III: The billion dollar opportunity in the hearing instruments market. The Hearing Journal, 46(10), 35-38.

Kochkin, S. (1993). MarkeTrak III: Why 20 million in US don't use hearing aids for their hearing loss. The Hearing Journal, 46(1-2), 1-8.

Kochkin, S., & Rogin, C.M. (2000). Quantifying the obvious: The impact of hearing instruments on quality of life. The Hearing Review, 7(1), 6-34.

Koike, K.J.M., & Johnston, A.P. (1989). Follow-up survey of the elderly who failed hearing screening protocol. Ear and Hearing,10(4), 250-253.

Lesner, S.A. (1992). Hearing disorder management in patients with presbycusis. Hearing Instruments, 43(2), 11-12.

Malinoff, R.L., & Weinstein, B.E. (1989). Measurement of hearing aid benefit in the elderly. Ear and Hearing, 10(6), 354-356.

Mazzuca, S.A. (1982). Does patient education in chronic disease have therapeutic value? Journal of Chronic Diseases, 35, 521-529.

Morrison, A.S. (1992). Screening in chronic disease. New York: Oxford University Press.

Moscicki, E.K., Elkins, E.F., Baum, H.M., & McNamara, P. (1985). Hearing loss in the 0elderly: An epidemiologic study of the Framingham Heart Study Cohort. Ear and Hearing, 6(4), 184-190.

Mulrow, C.D., Aguilar, C., Endicott, J.E., Tuley, M.R, Velez, R., Charlip, W.S, Rhodes, M.C., Hill, J.A., & DeNino, L.A. (1990). Quality-of-life changes and hearing impairment: A randomized trial. Annals of Internal Medicine, 113(3), 188-194.

Mulrow, C.D., Aguilar, C., Endicott, J.E., Velez, R., Tuley, M.R., Charlip, W.S., & Hill, J.A. (1990). Association between hearing impairment and the quality of life of elderly individuals. Journal of the American Geriatrics Society, 38(1), 45-50.

Mulrow, C.D., & Lichtenstein, M.J. (1991). Screening for hearing impairment in the elderly. Journal of General Internal Medicine, 6, 249-258.

NCHS (National Center for Health Statistics) (1999). Health, United States, 1999 with Health and Aging Chartbook. Hyattsville, MD: NCHS.

NCOA (National Council on the Aging) (1999). The consequences of untreated hearing loss in older persons: Summary, NCOA Web Site: www.ncoa.org.

Newman, C., Jacobson, G., Hug, G., Weinstein, B., & Malinoff, R. (1991). A practical method for quantifying hearing aid benefit in older adults. Journal of the American Academy of Audiology, 2, 70-75.

Newman, C.W., & Weinstein, B.E. (1988). The Hearing Handicap Inventory for the Elderly as a measure of hearing aid benefit. Ear and Hearing, 9(2), 81-85.

Noble,W.G., & Atherley, G.R.C. (1970). The hearing measurements scale: A questionnaire for the assessment of auditory disability. Journal of auditory Research, 10, 229-250.

Noh, S., Gagne, J.P., & Kaspar, V. (1994). Models of health behaviors and compliance: Applications to audiological rehabilitation research. Journal of the Academy of Rehabilitative Audiology, XXVII, 375-389.

Nondahl, D.M., Cruickshanks, K.J., Wiley, T.L., Tweed, T.S., Klein, R., & Klein, B.E.K. (1998). Accuracy of self-reported hearing loss. Audiology, 37 (5), 295-301.

Norman, G.R., & Streiner, D.L. (1986). PDQ: Statistics. Toronto, Philadelphia: B.C. Decker.

Prochaska, J.O., DiClemente, C.C., & Norcross, J.C. (1992). In search of how people change: Application to addictive behaviors. American Psychologist, 47(9), 1102-1114

Reinemer, M., & Hood, J., (1999). Untreated hearing loss linked to depression, social isolation in seniors. Audiology Today, 11(4), 34.

Rubinstein, L.Z., Josephson, K.R., Nichol-Seamons, M., & Robbins, A.S. (1986). Comprehensive health screening of well elderly adults: An analysis of a community program. Journal of Gerontology, 41(3), 342-352.

Sackett, D.L., & Haynes, R.B. (1976). Compliance with therapeutic regimens. Baltimore and London: Johns Hopkins University Press.

Schow, R.L. (1991). Considerations in selecting and validating an adult/elderly hearing screening protocol. Ear and Hearing, 12(5), 337-348.

Schow, R.L., & Nerbonne, M.A. (1982). Communication screening profile: Use with elderly clients. Ear and Hearing, 3(3), 135-147.

Schuknecht, H. (1964). Further observation on the pathology of presbycusis. Archives of Otolaryngology, 80, 369-382.

Schuknecht, H. (1974). Pathology of the ear. Cambridge: Harvard University Press.

Schuknecht, H. (1989). Pathology of presbycusis. In J.C. Goldstein, H.K. Kashima, & C.F. Koopmann (Eds.), Geriatric otorhinolaryngology. Toronto: B.C. Decker.

Strom, K.E. (2000). The dawning of the new millennium: Researchers' views. The Hearing Review, 7(3), 42-101.

Tannahill, C.J. (1979). The Hearing Handicap Scale as a measure of hearing aid benefit. Journal of Speech and Hearing Disorders, 44, 91-99.

U.S. Preventive Services Task Force. (1996). Screening for hearing impairment. In Guide to Clinical Preventive Services. Baltimore, MD: Williams & Wilkins.

U.S. Public Health Service (1994). The clinician's handbook of preventive services. Alexandria, VA: International Medical.

U.S. Dept. of Health and Human Services. (1992). Healthy people 2000: National health promotion and disease prevention objectives. Boston: Jones & Bartlett.

Van den Brink, R.H.S., Kempen, G.I.J.M., & Van Heuvelen, M.J.G., (1996). Attitude and help-seeking for hearing impairment. British Journal of Audiology, 30, 313-324.

Ventry, I.M., & Schiavetti, N. (1986). Evaluating research in speech pathology and audiology. New York: Macmillan.

Ventry, I.M., & Weinstein, B.E. (1982). The Hearing Handicap Inventory for the Elderly: A new tool. Ear and Hearing, 3(3), 128-134.

Ventry, I.M., & Weinstein, B.E. (1983). Identification of elderly people with hearing problems. ASHA, 25, 37-42.

Vogt, G.H., & Kapp, C. (1987). Patient education in primary care practice: Tips on planning a workable in-office program. Postgraduate Medicine, 81(3), 273-278.

Walsh, S. (2000). The retail marketing message: Why it's not working. The Hearing Review, 7(3), 32-34.

Ware, J.E., Kosinski, M., & Keller, S.D. (1996). A 12-item short-form health survey: Construction of scales and preliminary test of reliability and validity. Medical Care.34(3), 220-233.

Ware, J.E., Kosinski, M., & Keller, S.D. (1998). SF-12: How to score the SF-12 Physical and Mental Health Summary Scales (3rd ed.). Lincoln, RI: QualityMetric.

Ware, J.E., & Sherbourne, C.D. (1992). The MOS 36-item Short-Form Health Survey (SF-36): I. Conceptual framework and item selection. Medical Care, 30(6), 473-483.

Weinstein, B.E. (1986). Validity of a screening protocol for identifying elderly people with hearing problems. ASHA, 28(5), 41-45.

Weinstein, B.E. (1989). Geriatric hearing loss: Myths, realities, resources for physicians. Geriatrics, 44(4), 42-59.

Weinstein, B.E. (1991). The quantification of hearing aid benefit in the elderly: The role of self-assessment measures. Acta Oto-Laryngologica, 476 (Suppl.), 257-261.

Weinstein, B.E. (1992). Hearing screening in the elderly: What to do? ASHA Reports, No. 21, 112-114.

Weinstein, B.E. (1998). Health promotion and disease prevention in the elderly. Unpublished manuscript.

Weinstein, B.E. (2000). Geriatric audiology. New York, Stuttgart: Thieme Medical Publishers.

WHO (World Health Organization) (1999). ICIDH-2, WHO Web Site: www.who.ch/icidh.

Wiley, T.L., Cruickshanks, K.J., Nondahl, D.M., & Tweed, T.S. (2000). Self-reported hearing handicap and audiometric measures in older adults. Journal of the American Academy of Audiology, 11, 67-75.

Willott, J. (1996). Anatomic and physiologic aging: A behavioral neuroscience perspective. Journal of the American Academy of Audiology, 7, 141-151.

Winograd, C.H., & Stearns, C. (1990). Inpatient geriatric consultation: Challenges and benefits. Journal of the American Geriatrics Society, 38(8), 926-932.