

Outcome Measures Comparing Two Tools for Identifying Audiological Needs in the Elderly Homebound Population

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The purpose of the study was to determine if the section concerning hearing ability on the Outcome and Assessment Information Set (OASIS B-1) form is comparable to the Hearing Handicap Inventory for the Elderly Screening version (HHIE-S) in identifying elderly homebound individuals in need of further audiological services. Results from these two tools were compared to the 3-frequency pure-tone-average threshold (PTA) in the better ear for 41 elderly homebound individuals. The OASIS B-1 had a higher correlation with the PTA ($r = .65$) compared to the HHIE-S ($r = .43$). Results indicated either tool could be administered or the OASIS B-1 can be used first, followed by the HHIE-S, although results may be dependent on the experience of the individual administering the OASIS B-1.

Hearing loss is one of the most prevalent chronic conditions affecting elderly individuals (Maurer & Rupp, 1979; Schick, 1986). Kramarow, Lentzner, Rooks, Weeks, and Saydah (1999) reported the incidence of hearing loss to be as high as 25% in those aged 70-74 and 50% in people over age 85. The number of elderly individuals receiving home care is also high. The National Center for Health Statistics has reported that 955,200 individuals 65 years old or older received home health care in 2000 (Department of Health and Human Services, National Center for Health Statistics, 2000). Given that there is an increase in individuals with

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communication needs who are elderly and homebound it is clear that identifying those elderly homebound individuals with a hearing loss who are in need of further services and initiating rehabilitation is important, as a hearing impairment can affect social and emotional well-being, and the quality of life.

Recent trends in health care have focused on the quality and value of care and this can be evaluated through the use of outcome assessment measures (Beck, 2000). According to regulations from the Department of Health and Human Services and the Health Care Financing Administration (HCFA; 1999), in order to continue Medicare/Medicaid participation, home health agencies must complete a comprehensive assessment of each patient, using the Outcome and Assessment Information Set (OASIS) for adult patients not requiring maternity care. One of the areas assessed by the OASIS B-1, which is the currently used form of the OASIS, is hearing and speech discrimination and understanding (Shaughnessy, Crisler, Schlenker, & Hittle, 1999). Determining the need for audiological services has required assessments that are done outside of the home environment. It is, therefore, of interest to determine if the question on the OASIS B-1 related to hearing ability can be used in the home to determine the need for further services.

Audiologists use self-assessment questionnaires to evaluate hearing handicap in non-institutionalized elderly individuals (Matthews, Lee, Mills, & Schum, 1990; Mulrow, Tuley, & Aguilar, 1990; Weinstein, Spitzer, & Ventry, 1986). Hearing handicap is a term that refers to how hearing loss affects daily life by addressing the emotional and psychosocial effects of the hearing loss (Colodzin et al., 1981; Gatehouse, 1990; High, Fairbanks, & Glorig, 1964; Ventry & Weinstein, 1982). Accurately assessing perceived hearing handicap helps to ensure appropriate and adequate intervention based on each person's individual needs.

The Hearing Handicap Inventory for the Elderly (HHIE) is a self-assessment tool frequently used to evaluate hearing handicap. The HHIE was designed to measure the social, situational, and emotional handicap experienced by these individuals as a result of their hearing loss (Ventry & Weinstein, 1982; Weinstein et al., 1986). A screening version of the HHIE (see Appendix A) was developed and has been previously used with the elderly homebound population served by The Visiting Nurse Service (VNS) in New York City (Jupiter & DiStasio, 1998).

Jupiter and DiStasio (1998) evaluated the use of the HHIE-S with the homebound population and results indicated that hearing loss measured using the pure-tone-average threshold (PTA) was significantly correlated with hearing handicap. It was determined that the HHIE-S can be valuable as a substitute for pure-tone screening in identifying elderly homebound individuals in probable need of follow-up audiological services.

The OASIS B-1 also assesses hearing status, as well as living arrangements, respiratory status, activities of daily living, and sensory status. Within the information area concerning sensory status, there is a subset dealing specifically with hearing ability and spoken language understanding. There are five statements related to hearing sensitivity that are judged by the interviewer and that form a rat-

ing scale from 0 to 4 (see Appendix B). A major concern with this rating scale is that there are no data available in the literature regarding the reliability or validity of the scale. The OASIS B-1 is not a standardized measure of hearing ability or disability. The rating is assigned based on limited observation of the individual. Because the HCFA requires that patients receiving home health care receive the OASIS B-1 assessment, the content validity of the statements related to hearing impairment needs to be addressed, particularly if further audiological services were to be recommended through the use of this assessment. It would also be of interest to determine if a nurse is able to identify individuals with hearing loss who are in need of services based on his/her observations.

Use of a hearing handicap screen together with a pure-tone screen to identify individuals in need of audiological services has been recommended (Ventry & Weinstein, 1983); however, pure-tone testing is not always possible for the home-bound elderly. The HHIE-S has previously been established as a reliable method to identify perceived hearing handicap (Jupiter & DiStasio, 1998). Jupiter and DiStasio used PTA as a criterion measure, as it is used by audiologists to determine a loss of hearing sensitivity. To assess whether the OASIS B-1 has validity in identifying individuals in need of audiological follow-up, the same procedure was implemented in the current study, comparing the OASIS B-1 findings to PTA. In addition, obtaining pure-tone thresholds allowed manipulation of the low fence cut-off and evaluation of the associated outcomes on the HHIE-S and OASIS B-1.

Prior to the HCFA mandate requiring administration of the OASIS B-1, the VNSNY nurses in the long term care program administered the HHIE-S to evaluate the audiological needs of their clients. Because it has been mandated that the nurses use the OASIS B-1 statements to assess the hearing ability of the client, it is probable that the HHIE-S will not be administered in the future. If the procedure and the hearing-related statements of the OASIS B-1 do not bear any relation to the PTA or to self-assessment of hearing handicap as measured using the HHIE-S, then individuals who need further services will most likely be missed.

The purpose of this study was to determine if the section of the OASIS B-1 regarding hearing and ability to understand spoken language has content validity and is comparable to the HHIE-S in identifying the need for further audiological assessment and aural rehabilitation intervention for elderly individuals receiving home health care.

DESIGN AND METHOD

Participants

Forty-one elderly individuals receiving home health care under Medicare participated in the study. All participants were enrolled in a program for individuals who receive home care long term, were over the age of 64, and had intact cogni-

tive abilities as established by the Mental Status Questionnaire (Kahn, Goldfarb, Pollack, & Peck, 1960). All but 2 participants were fluent speakers of English. For the 2 who did not speak English fluently, a translator was available to explain the instructions and help the individual with reading English if they had difficulty with any words, as the task was a paper and pencil test. The design and purpose of the investigation was initially presented to 12 nurses. Three of the 12 nurses agreed to participate and had had at least 5 years of experience in home health care working for VNS. The elderly individuals in the study were chosen from the caseload of the three nurses. The nurses agreed to have an audiology graduate student accompany them on their visits to their clients, conduct the pure-tone testing, and administer the HHIE-S. The VNSNY nurses identified potential participants from their caseloads, obtained informed consent, and evaluated the individual using the OASIS B-1. None of the participants used amplification or assistive listening devices.

Materials

The assessment of hearing handicap was obtained using the HHIE-S, and the statements on the OASIS B-1 related to hearing ability were judged by the nurse. The HHIE-S is a 10-item self-assessment questionnaire consisting of two subscales, one focusing on emotional factors and the other on social/situational aspects of hearing handicap. Responses to each item can be *yes* (scored as 4 points), *sometimes* (scored as 2 points), or *no* (scored as 0 points; Ventry & Weinstein, 1983; see Appendix A). Reading glasses were used by the participants if needed. The OASIS B-1 utilizes a 0-4 rating scale, which the administrator uses to judge the level of impairment evidenced by an individual with regard to hearing and speech discrimination, with 0 indicating no observable impairment and 4 indicating complete inability to hear or understand familiar words or common expressions consistently, or patient non-responsiveness (Shaughnessy et al., 1999; see Appendix B).

Procedures

Hearing testing was conducted by two graduate students enrolled in the Audiology Master's Degree graduate program at St. John's University. Both students were trained by the first author and had completed the majority of their required clinical hours.

Audiometric data were collected in each participant's home, in the quietest room possible. A carpeted room was utilized where available. Pure-tone air and bone conduction thresholds were determined by graduate student clinicians using a Maico MA-20 portable audiometer, equipped with TDH 3910 headphones under Telephonics 510CC 17-1 cushions, and B 70-A bone conduction oscillator. The Carhart-Jerger (1959) procedure for obtaining pure-tone thresholds was utilized for audiometric evaluation. The three-frequency PTA was obtained in both

ears using 500, 1000, and 2000 Hz. For test reliability purposes, the threshold at 1000 Hz was obtained twice. Calibration of the audiometer was completed prior to the investigation and was periodically checked during the duration of the study. Prior to testing the student clinicians performed a biological calibration of the audiometer by screening their own pure-tone thresholds. In general, the thresholds obtained were within 5 dB of behavioral thresholds of the student clinicians.

The home care nurse responded to the OASIS B-1 question related to hearing assessment and the HHIE-S was self-administered. Order of administration of the two tools was counterbalanced and always preceded the pure-tone testing. The nurses did not know the results of the pure-tone testing or the HHIE-S while in the participant's home.

RESULTS

The mean age of the participants was 82.6 years (range = 65-101). There were 27 females and 14 males. The mean three-frequency PTA in the better ear for these participants was 35.8 dB HL (range = 13-65 dB HL). Nearly half of the participants (46%; $n = 19$) had a mild hearing loss; 25% ($n = 10$) had normal hearing; 14% ($n = 6$) had a moderate hearing loss; and 14% ($n = 6$) had a moderate-to-severe hearing loss. This is similar to the distribution in the geriatric population (Gatehouse, 1990).

The mean HHIE-S total score was 9.5 with a range of 0-36. Based on the criteria established by Weinstein (1986), 68% of these participants had no perceived handicap with scores of 0-10 ($n = 28$), 22% reported a mild-to-moderate handicap with scores of 12-24 ($n = 9$), and 10% reported significant hearing handicap with scores of 26-36 ($n = 4$).

Since the study was conducted in the field it was impossible to obtain intra-judge reliability for the OASIS B-1. However, mean ratings for the three nurses (0.90, 0.91, and 0.89) were almost identical. The overall mean rating on the OASIS B-1 was 0.90 (range = 0-3); 37% of the participants ($n = 15$) were rated as having no observable impairment (rating = 0); 39% ($n = 16$) were rated as having minimal difficulty (rating = 1); 22% ($n = 9$) were rated as having moderate difficulty (rating = 2); and only 1 subject (2%) was rated as having severe difficulty (rating = 3). No participants received the highest rating of 4, which indicates inability to hear or understand, or patient unresponsiveness.

Table 1 contains the distribution of HHIE-S scores and OASIS B-1 ratings for different hearing loss categories. The majority of the individuals who had a mild hearing loss did not feel handicapped by their hearing loss, as indicated by their HHIE-S scores. For those participants with hearing loss in the moderate range, hearing handicap ranged from no handicap to significant handicap. In general, perception of handicap increased as hearing loss increased; however, even for some individuals with greater than moderate hearing loss, there was a report of no handicap.

Table 1

Distribution of Participants by Hearing Handicap Inventory for the Elderly Screening (HHIE-S) Total Score and Outcome and Assessment Information Set (OASIS B-1) Rating Based on the Degree of Hearing Loss

| Degree of hearing loss | HHIE-S total score | | | OASIS B-1 | | | | | |
|--|--------------------|------|-------|-----------|----|----|---|---|---|
| | <i>N</i> | 0-10 | 12-24 | 26-40 | 0 | 1 | 2 | 3 | 4 |
| Normal (PTA = 0-25 dB HL) | 10 | 9 | 1 | 0 | 7 | 3 | 0 | 0 | 0 |
| Mild (PTA = 26-40 dB HL) | 19 | 14 | 5 | 0 | 8 | 8 | 3 | 0 | 0 |
| Moderate (PTA = 41-55 dB HL) | 6 | 3 | 1 | 2 | 0 | 4 | 2 | 0 | 0 |
| Moderate to severe (PTA > 55 dB HL) | 6 | 2 | 2 | 2 | 0 | 1 | 4 | 1 | 0 |
| All | 41 | 28 | 9 | 4 | 15 | 16 | 9 | 1 | 0 |

The distribution of ratings on the OASIS B-1 is similar to that on the HHIE-S. Most individuals in the mild hearing loss category appeared to experience little or no difficulty, while individuals with greater hearing loss were rated more poorly. In addition, it is interesting to note that there are no OASIS B-1 ratings of 0 for individuals with a moderate or moderate-to-severe hearing loss, whereas on the HHIE-S, 5 of these individuals perceived no handicap. In the mild hearing loss category there was an equal number of individuals who were rated as having either little or no handicap (0-1), whereas the majority of this group reported no handicap on the HHIE-S. In the normal hearing category, 3 individuals were assigned the first rating of handicap on the OASIS B-1 (rating = 1); and on the HHIE-S, 1 normal hearing individual reported a severe hearing difficulty. In summary, individuals with normal hearing or mild hearing loss tended to report less handicap and were rated as having less hearing difficulty than those in the more moderate hearing loss category.

In order to determine the relationship between the HHIE-S, OASIS B-1, and PTA, Pearson Product Moment correlations were calculated. The correlation between the HHIE-S and PTA was .43 (for the emotional subscale, $r = .33$; for the situational subscale, $r = .49$). The correlation between the OASIS B-1 and PTA was somewhat stronger ($r = .65$). The correlation between the OASIS B-1 and the HHIE-S was intermediate ($r = .52$).

The sensitivity, specificity, and predictive values of both the HHIE-S and OASIS B-1 were determined using several different cut-off scores, pure-tone averages, and a prevalence rate of 50% for hearing impairment in the non-institutionalized elderly population in order to determine the best scores to use with the homebound (Jupiter & DiStasio, 1998; Weinstein, 1986). The formulas used were those described by Weinstein (1986). The sensitivity and specificity tests indicate whether or not a condition can be identified or ruled out for every indi-

Table 2

Sensitivity, Specificity, Predictive Value Positive (PVP) and Predictive Value Negative (PVN)
Outcomes for Alternative Referral Criteria on the
Outcome and Assessment Information Set (OASIS) B-1
and Hearing Handicap Inventory for the Elderly Screening (HHIE-S)

| Total performance characteristics | Cut-off scores | | | | |
|-----------------------------------|----------------|----|--------|----|----|
| | OASIS B-1 | | HHIE-S | | |
| | 1 | 2 | 10 | 12 | 14 |
| Sensitivity (%) | 100 | 58 | 75 | 50 | 50 |
| Specificity (%) | 52 | 90 | 72 | 79 | 79 |
| PVP (%) | 68 | 91 | 78 | 83 | 83 |
| PVN (%) | 96 | 70 | 81 | 67 | 67 |

vidual tested. Sensitivity indicates the probability that truly impaired individuals will fail the test; and specificity, the probability that truly unimpaired individuals will pass the test. In addition, the predictive value of a screening test is associated with the prevalence of the condition in the population. The higher the predictive value of the test, the more likely it is to accurately predict the presence of the condition (PVP). The predictive value of a negative test indicates how many unimpaired individuals have negative results (PVN; Mausner & Kramer, 1985).

The results of examining different cut-off scores are shown in Table 2. When the OASIS B-1 cut-off score was changed from 1 to 2, the sensitivity changed from 100% to 58% and specificity from 52% to 90%. When changing the cut-off score on the HHIE-S from 10 to 12 the sensitivity changed from 75% to 50% and specificity from 72% to 79%. There was no further change at a cut-off of 14. The best overall results for the OASIS B-1 were obtained with a cut-off score of 1, which yields a sensitivity of 100%, specificity of 52%, PVP of 68%, and PVN of 96%.

Examining the data for the HHIE-S, the best overall percentages appeared when a cut-off of 10 on the HHIE-S and 40 dB HL PTA were used as the criterion standard (sensitivity of 75%, specificity of 72%, PVP of 78%, and PVN of 81%). The highest PVP (83%) was obtained when 12 or 14 was used as the cut-off on the HHIE-S. These results are similar to those reported by both Weinstein (1986) who reported specificity of 83% and sensitivity of 65% and Jupiter and DiStasio (1998) who found specificity of 83% and sensitivity of 60% using 10 as the cut-off score. Ventry and Weinstein (1983) recommended using a cut-off score of >10 on the HHIE-S and 40 dB HL at 1000 and 2000 Hz when screening the elderly in the community; therefore, 10 was chosen as the lowest HHIE-S cut-off score to use when calculating sensitivity and specificity in the current study. Other studies have recommended a cut-off score of 8 (American Speech Language Hearing Association, 1987; Bess, Lichtenstein, Logan, & Burger, 1989; Wiley et al., 1998); however, this would have resulted in a high over-referral rate

for the participants in this study.

DISCUSSION

The purpose of this study was to determine if the item on the OASIS B-1 regarding hearing and ability to understand spoken language is comparable to the HHIE-S for assessing the need for further audiological follow-up for elderly individuals receiving long term home health care. The mean three-frequency PTA found for this participant group (35.8 dB HL) was similar to that found by Jupiter and DiStasio (1998). Other studies have found similar levels of hearing loss for elderly individuals in the non-homebound populations (e.g., Weinstein & Ventry, 1983). Seventy percent of the participants in this study had normal hearing or a mild hearing loss based on the three-frequency PTA, also consistent with previous findings (Jupiter & DiStasio, 1998). The percentage of participants passing the HHIE-S based on the criterion established by Weinstein (1986; a score of 0-10) was 68%, which also replicates the findings of Jupiter and DiStasio (1998).

The utility of the OASIS B-1 as opposed to the HHIE-S to identify elderly homebound individuals in need of further audiological services was demonstrated by the findings from the current study. Both measures were found to be appropriate screening tools based on these data. In the current investigation, the correlation between the OASIS B-1 and PTA was considerably higher than between the HHIE-S and PTA. Although both tools can be used to establish communication difficulties, the OASIS B-1 is a rating determined by a nurse, while the HHIE-S is a self-assessment. It is well known that denial of hearing loss is common in the elderly population (Newman & Weinstein, 1986). This is supported by the correlation of .43 obtained in the current study between PTA and HHIE-S. When the elderly participants assessed their degree of handicap, they may have underestimated their communication difficulties. The prevalence of low scores on the HHIE-S among our participants is consistent with findings reported by Wiley et al. (1998) of a decrease in self-reported hearing handicap with an increase in age.

It is often difficult to evaluate the degree of hearing loss or hearing handicap an elderly individual has due to a variety of reasons. The individual may be able to hear but not understand speech, or may have difficulty in noisy situations. Because the onset of hearing loss in the elderly is insidious, individuals may be unaware that they have a hearing impairment. In addition, the elderly who are homebound often have other physical disabilities that may take precedence over a hearing loss. They may also have fewer interactions with other individuals. The awareness of a need for further audiological services can depend on the activities of daily living experienced by the elderly. Elderly who are homebound may not have a lifestyle that places much demand on communication. Of course, there will be a great deal of variability depending on the individual and this is why an assessment of hearing handicap as well as impairment is desirable prior

to initiating any further services. Even though this is the ideal protocol, it is not practical or possible to obtain audiometric data in the home. Home care nurses do not evaluate hearing sensitivity using pure-tone audiometry. The use of a hearing difficulty rating may, then, be more efficacious for the identification of those individuals who may need audiological services. Although it can be difficult for a caregiver to be aware of a hearing problem, it is apparent that individuals may be less likely to think they have a hearing impairment than a nurse or caregiver. The correlation between PTA and the OASIS B-1 underscores this finding.

The disadvantage of using the OASIS B-1 as the referral assessment tool is that degree of difficulty is a subjective assessment, and the rating will be dependent on the nurse evaluating the individual. In addition, whether or not an individual will want to obtain and use a hearing aid can only be determined by that individual. Those who do not believe that they are handicapped by a hearing loss are less likely to use a hearing aid, even though they may benefit from amplification. Previous research with the same population has indicated that the HHIE-S is a good tool to use in determining the need for further audiological services. In the previous study with this population, Jupiter and DiStasio (1998) recommended a cut-off score of 14 for referral for future services. In this study, using 14 as the cut-off score, 29% of the participants would have been designated as in need of services, whereas 68% of the participants would have been referred if 10 were the criterion for referral. If a cut-off rating of 2 were used on the OASIS B-1 to determine the need for hearing intervention, 24% of the individuals in this study would have been referred for services. Using a cut-off rating of 1 to warrant hearing related service referrals, 63% would have been referred. A cut-off score of 1 on the OASIS B-1 and a score of 10 on the HHIE-S may result in an overly high referral rate, resulting in referral of even those with mild hearing loss.

In order to refer only those individuals who need and will benefit from further testing, a two-tier process is recommended. First, identify individuals who obtain at least a 1 on the OASIS B-1 hearing difficulty item. Then, for those individuals, administer the HHIE-S and refer if the score is 12 or higher. Alternately, either tool can identify many (though not all) individuals who are in need and will benefit from further services if the referral criterion is 2 on the OASIS B-1 or 12-14 on the HHIE-S. It should be noted that the results of the rating on the OASIS B-1 may be dependent on the experience of the individual administering the tool.

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APPENDIX A

**HEARING HANDICAP INVENTORY FOR THE ELDERLY
SCREENING VERSION (HHIE-S)**

Please check “yes,” “no,” or “sometimes” in response to each of the following items. Do not skip a question if you avoid a situation because of a hearing problem. If you use a hearing aid, please answer the way you hear without the aid.

E = emotional S = social “Yes” = 4 “No” = 0 “Sometimes” = 2

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

Note. From “Identification of Elderly People with Hearing Problems” by I.M. Ventry and B.E. Weinstein, 1983, *ASHA*, 25, p. 42. Reprinted with permission.

APPENDIX B***OUTCOME AND INFORMATION ASSESSMENT SET (OASIS) B-1
SENSORY STATUS SUBSET***

Hearing and Ability to Understand Spoken Language in patient's own language (with hearing aids if the patient usually uses them):

- 0 – No observable impairment. Able to hear and understand complex or detailed instructions and extended or abstract conversation.
- 1 – With minimal difficulty, able to hear and understand most multi-step instructions and ordinary conversation. May need occasional repetition, extra time, or louder voice.
- 2 – Has moderate difficulty hearing and understanding simple, one-step instructions and brief conversation; needs frequent prompting or assistance.
- 3 – Has severe difficulty hearing and understanding simple greetings and short comments. Requires multiple repetitions, restatements, demonstrations, additional time.
- 4 – Unable to hear and understand familiar words or common expressions consistently, or patient nonresponsive.

Note. From *Medicare's OASIS: Standardized Outcome and Assessment Information Set for Home Health Care – July 1999* (p. 7) by P.W. Shaughnessy, K.S. Crisler, R.E. Schlenker, and D.F. Hittle, 1999, Denver, CO: Center for Health Services and Policy Research. Reprinted with permission.