

# Adult hearing screening: the Cyprus Pilot Program

C. Thodi,<sup>1</sup> M. Parazzini,<sup>2</sup> S.E. Kramer,<sup>3</sup> A.C. Davis,<sup>4</sup> S. Stenfelt,<sup>5</sup> T. Janssen,<sup>6</sup> D. Stephens,<sup>7</sup> P.A. Smith,<sup>4,8</sup> M. Pronk,<sup>3</sup> L.J.C. Anteunis,<sup>9</sup> F. Grandori<sup>2</sup>

<sup>1</sup>Cyprus Audiology Center, Nicosia, Cyprus; <sup>2</sup>Istituto di Ingegneria Biomedica ISIB, CNR - Consiglio Nazionale delle Ricerche, Milano, Italy; <sup>3</sup>Department of ENT/Audiology, VU University Medical Center, EMGO Institute for Health and Care Research, Amsterdam, the Netherlands; <sup>4</sup>MRC Hearing and Communication Group, Royal Free Hampstead NHS Trust, London, UK; <sup>5</sup>Linköping University - Faculty of Health Sciences, Division of Technical Audiology, Sweden; <sup>6</sup>Klinikum rechts der Isar, Technische Universität München (Germany); <sup>7</sup>Department of Psychological Medicine and Neurology, School of Medicine, Cardiff University, Cardiff, Wales; <sup>8</sup>Hearing Services Department, Leicester Royal Infirmary, Leicester, UK; <sup>9</sup>Department of Otorhinolaryngology and Head and Neck Surgery, Maastricht University Medical Centre, Maastricht, the Netherlands

## Background

Hearing loss is the third most common condition affecting adults over 65 (Cruikshanks *et al.*, 1998). It can affect quality of life, limiting the ability to communicate efficiently, and leading to isolation, psychological strain, and functional decline (LaForge, Spector, Sternberg, 1992; Yueh, Shapiro, MacLean, Shekelle, 2003). Communication limitations impinge on the person directly, as well as the family, friends, and social circle. Reports on hearing loss among adults indicate that less than 25% of people who can benefit from amplification are actually using hearing aids, and that people diagnosed with a hearing loss delay seeking amplification by about seven years (Kochkin, 1997). Often, family members are the driving force behind a person with a hearing loss who decides to seek help. Adult hearing screening programs might have a positive effect on raising public awareness on hearing loss and its implications, and shortening delay time for intervention. There is no routine hearing screening for the adult population in Cyprus. The health system provides hearing tests for beneficiaries upon physician recommendation or self-referral. The Cyprus pilot adult hearing screening program (ΑΠΑΣ- EVERYONE- Greek

acronym for Screening- Intervention-Hearing-Participation to Life) screened hearing in retired adults.

## Methods

This was a targeted population study with voluntary participation. Pensioner organization and municipality activity center members were invited to participate with newsletters and poster announcements of the specific dates and locations of screening activities. Most participants signed up in advance for the screening. Sessions were held at participating activity centers and regional medical offices.

Participating adults filled out a demographic/short medical history form, and answered the informal question *do you believe that you have a hearing loss*. The question was added to the test battery in an effort to increase testing sensitivity (Gates, Murphy, Rees, Fraher, 2003). They also responded to a five-item list modified from the Hearing Handicap Inventory for the Elderly (HHIE-Screening Version, Weinstein, 1986). Initially, (for the first 65 subjects), HHIE-S was translated to Greek and all ten questions administered. Trained assistants filled out the demographic and questionnaire data. In an effort to make the screening time more amenable and the questions more culturally relevant, five items were dropped and the remaining questions were modified. The list included questions on whether a hearing difficulty causes frustration when talking to family-Q1, difficulty hearing when someone whispers-Q2, complaints from family members-Q3, difficulty listening to TV or radio-Q4, and difficulty communicating when in a restaurant or coffee-house-Q5. Responses to the questions were coded with 0-never, 1-sometimes, 2-often; therefore the maximum possible score on the questionnaire was 10. The answer to the informal question was coded with 1-yes, 2- no. Testing included otoscopy and pure tone audiometry at 250-4000Hz. Referrals were made based on otoscopy or when people had a PTA (1kHz-2kHz-4kHz) greater than 35dBHL.

Correspondence: C. Thodi, Cyprus Audiology Center, Nicosia, Cyprus.  
E-mail: ctpetrou@hotmail.com

Key words: hearing, screening, adult, audiometry, presbycusis, pure tone, otoscopy.

This work was performed in the framework of the European project AHEAD III: assessment of hearing in the elderly: Aging and Degeneration - Integration through Immediate Intervention (2008-2011) (FP7, contract No. HEALTH-F2-2008-20083.

©Copyright C. Thodi *et al.*, 2011  
Licensee PAGEPress, Italy  
Audiology Research 2011;1:e18  
doi:10.4081/audiore.2011.e18

This article is distributed under the terms of the Creative Commons Attribution Noncommercial License (by-nc 3.0) which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

Parts of this work were presented at the "AHS 2010 - International Conference on Adult Hearing Screening", Cernobbio (Italy), June 10-12, 2010.

## Results

A total of 1332 people were screened by the program by May 2010, resulting in 49% referral for audiological/hearing aid evaluation. An additional 12% of the subjects had pure tone averages within 5dB

below the referring criteria (16% of participants under 70 were *just below referral*). Cerumen removal/medical evaluation was recommended for 16% of participants, based on either otoscopy or asymmetrical hearing findings. There was overlap between the *cerumen removal* and *hearing/hearing aid evaluation* groups due to non-occluding cerumen findings. Detailed data analysis was performed for 1249 people who had complete data sets.

The subjects' age distribution was: 67 subjects under 60 years of age; 351 subjects 61-70 years of age; 617 subjects 71-80 years of age; 214 subjects above 81 years of age. Pure tone averages (PTA) calculated with thresholds at 1000Hz, 2000Hz, and 4000Hz, showed the following mean value distribution: 34dBHL for people under 60 years of age; 38dBHL for subjects 60-70 years; 45.1dBHL for subjects 71-80 years old; 53.6 for subjects older than 80 years of age. Total questionnaire response scores were higher with advancing age, indicating an increase in communication difficulties and family complaints. The universal question responses showed that with advancing age more people believe they have a hearing loss. There was a correlation of 0.51 between the 3 tone average and the total score on the questionnaire. The correlation between referrals and the answer to the universal question was 0.45. Looking at individual questions, the third question *do family members complain about your hearing?* had the closest correlation to the 3-tone average referral (0.47).

Sensitivity and specificity of the questionnaire total scores were estimated based on various referral criteria: pure tone averages of 1kHz-2kHz or 1kHz-2kHz-4kHz and cut off levels of 30dBHL or 35dBHL. For a cut-off total score of 3, sensitivity ranged from 63.5% to 72.7%, and specificity ranged from 67.8% to 73.9% for the four combinations of the referral criteria. For example, referrals based on a total score of 3 and 35dBHL PTA of 1kHz-2kHz-4kHz would have a 69.1% sensitivity and 73.9% specificity.

Participants who failed the hearing screening were also offered suggestions for improving visibility of the speaker, seating suggestions for noisy environments, and assertiveness reinforcement.

## Discussion

The Cyprus pilot adult hearing screening program (ΑΠΑΣ) assessed the hearing of socially active retirees who volunteered participation. Referral rates were higher than those in population studies reported in the literature (Davis, 1989; Davis, 1990), possibly because participants noticed hearing difficulty, therefore they were ready to be tested when given the chance. This might be the first instance of *seeking help* (Kiessling *et al.*, 2003), for many participants in this pilot program. The high referral rate and the percentage of subjects just below the referral criteria may support the notion that initial communication difficulties motivated participation in the program. Participants under 70 who had an initial identification of a mild hearing loss through this program might be ready to accept help when hearing difficulties reach a critical point. It has been established that there is a 7-10 year delay between identification of hearing loss and amplification treatment (Kochkin, 1997, Davis, 1995), and that the average age for new hearing aid users is 70 years (Kochkin *et al.*, 2010). The tendency for people under 70 with marginal hearing to seek assessment indicates that increased awareness provided by well publicized screening programs and availability of assessment and rehabilitation opportunities may eventually result in more people seeking support earlier for hearing difficulties.

Subjects had positive reactions, and seemed to open up with administration of the short questionnaire. It was apparent that questions presenting specific situations where hearing loss impedes communica-

tion, or identifying the family reactions may be a first step towards removing some barriers to help seeking (awareness of the problem, negative attitudes of significant others, lack of knowledge, Kochkin *et al.*, 2010). Sensitivity and specificity features of the short, modified version of the HHIE-S were consistent with those in the literature (Lichtenstein, Bess, Logan, 1988).

Quality of life in adults with hearing loss can be improved with appropriate intervention. Emotional, communication, and cognitive function, as well as depression scores improved after hearing aid fitting (Mulrow *et al.* 1990). Timely screening for hearing loss and communication difficulty, and a preliminary counseling about even a sub-referral level hearing loss may be the first step toward successful intervention. Follow-up and outcome measures are needed to investigate the impact of screening programs and sustainability of results (Kiessling *et al.* 2003).

## References

- Cruikshanks, K.J., Wiley, T.L., Tweed, T.S., Klein, B.E.K., Klein, R., Mares-Perlman, J.A., & Nondahl, D.M., 1998. Prevalence of hearing loss in older adults in Beaver Dam, Wisconsin: The Epidemiology of Hearing Loss Study. *Am. J. Epidemiol.*, 148(9), 879-886.
- Davis A., 1995. *Hearing in adults*. London: Whurr.
- Davis A.C. 1989. The prevalence of hearing impairment and reported hearing disability among adults in Great Britain. *Int J Epidemiol*, 18: 911-917.
- Davis A.C., 1990. Epidemiological profile of hearing impairments: the scale and nature of the problem with special reference to the elderly. *Acta Otolaryngol Suppl.*, 476:23-31.
- Gates G.A., Murphy M., Rees T.S., Fraher A., 2003. Screening for handicapping hearing loss in the elderly. *J Fam Pract.*, Jan52(1):56-62.
- Kiessling J., Pichora-Fuller M.K., Gatehouse S., Stephens D., Arlinger S., Chisolm T., Davis A.C., Erber, N.P., Hickson L., Holmes A., Rosenhall U., von Wedel H. (2003). Candidature for and delivery of audiological services: special needs of older people. *Int J Audiol*. 2003;42 Suppl 2:2S92-101.
- Kochkin S., 1997. MarkeTrak IV. What is the viable market for hearing aids? *Hearing J.*, 50:31-39.
- Kochkin S., Beck D.L., Christensen L.A., Compton-Conley C., Fligor B.J., Kricos P.B., McSpaden J.B., Mueller H.G., Nilsson M.J., Northern J.L., Powers T.A., Sweetow R.W., Taylor B., Turner R.G.. 2010. MarkeTrak VIII: The Impact of the Hearing Healthcare Professional on Hearing Aid User Success. *Hearing Review*, April.
- LaForge R.G., Spector W.D., Sternberg J., 1992. The relationship of vision and hearing impairment to one year mortality and functional decline. *J Aging Health.*, 4:126-148.
- Lichtenstein M.J., Bess F.H., Logan S.A. 1988. Diagnostic performance of the hearing handicap inventory for the elderly (screening version) against differing definitions of hearing loss. *Ear Hear*. Aug, 9(4):208-11.
- 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. *Ann Intern Med*, 113: 188-194.
- Weinstein B.E., 1986. Validity of a screening protocol for identifying elderly people with hearing problems. *ASHA*, 28(5):41-5.
- Yueh, B., Shapiro, N., MacLean, C.H., Shekelle, P.G., 2003. Screening and Management of Adult Hearing Loss in Primary Care. *JAMA*, April 16, Vol 289, No. 15.