AHS 2012 Conference

Book of abstracts
The AHS 2012 Conference is designed to provide state-of-the-art scientific and clinical information on the rapidly changing landscape of adult hearing care. The conference is focused on a comprehensive spectrum of issues related to early identification, treatment of auditory dysfunctions and aural rehabilitation in adults.

AHS 2012 is the place where key experts, scientists and clinicians from multiple disciplines can share their expertise and knowledge, bridging research and clinical practice, towards the common goal of improving hearing care for adults, and is aimed at encouraging advances in research on aging and hearing as well as addressing all components of care, from early identification to tailored rehabilitation, with a specific emphasis on screening methods, technologies, criteria, and protocols.

The Conference attracted delegates from 45 different countries throughout the World. Keynote lectures by world-renown scientists covering all domains of adult hearing are complemented by more than 130 oral and poster presentations. The program is structured in concurrent sessions to let delegates follow their own preferences. Poster presentations will be an integral part of the general Scientific Program and will be organized in topics and sub-topics in a display area designed to facilitate interaction and exchange among attendees. To maintain ongoing discussion well beyond the three days of the meeting, on June 8th a Special Session has been envisaged to establish an International Working Group on Adult Hearing Screening. This shall serve as a coherent framework where colleagues from different disciplines can join forces and work together to advance knowledge and improve the standard of care for the growing number of adults and elderly with hearing problems.

Ferdi Grandori
Organising secretariat
Meet&Work srl
Abano Terme, Italy

Venue
Villa Erba Congress Center
Largo Luchino Visconti 4, Cernobbio (Lake Como)

Delegates are representing the following countries

Albania  Gambia  Russia
Aruba    Germany  Saudi Arabia
Australia Ghana    Serbia
Austria  Hong Kong Sierra Leone
Belgium  India    Slovenia
Brazil   Ireland  South Africa
Bulgaria Israel    Spain
Canada   Italy    Sweden
Cuba     Japan    Switzerland
Cyprus   Korea    Thailand
Czech Republic Malaysia  The Netherlands
Denmark  Poland    Turkey
Egypt    Portugal  UAE
Estonia  P.R. China  UK
France   Qatar    USA

This event has been made possible thanks to the contribution and support of the following Institutions and Organizations:

Advanced Bionics
Cochlear
GN ReSound
MAICO Diagnostic GmbH
MED EL
Network Udito - Onlus
Otodynamics Ltd
Otometrics
Path Medical Solutions
Sistemas Genomicos. Genomic Systems
VIVOSONIC INC.
## PROGRAM AT A GLANCE

### Thursday, June 7, 2012

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<td>Opening Session</td>
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<tr>
<td>14:45 - 15:30</td>
<td>&quot;Where We Are, Where We Are Going&quot;</td>
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<tr>
<td>15:30 - 16:00</td>
<td>Keynote Lecture</td>
<td>Neurobiological and Genetic Bases of Age-Related Hearing Loss: Biotherapeutic Implications&lt;br&gt;Robert D. Frisina</td>
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<tr>
<td>16:00 - 16:30</td>
<td>Coffee Break</td>
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<tr>
<td>16:30 - 17:00</td>
<td>Keynote Lecture</td>
<td>Understanding the Speech-Understanding Problems of Older Adults&lt;br&gt;Larry E. Humes</td>
</tr>
<tr>
<td>17:00 - 18:30</td>
<td>Speech Understanding and Aging</td>
<td>Follow-up to the European Initiative HEARCOM&lt;br&gt;Automated Pure-Tone Audiometry</td>
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### Friday, June 8, 2012

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<td>09:00 - 09:30</td>
<td>Keynote Lecture</td>
<td>Benefits of Auditory Training for Aided Listening by Older Adults&lt;br&gt;Judy R. Dubno</td>
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<tr>
<td>09:30 - 10:30</td>
<td>Hearing Aids and Auditory Training</td>
<td>Recreational and Occupational Noise</td>
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<tr>
<td>11:00 - 11:30</td>
<td>Adult Hearing Screening: Guiding Principles and Methods</td>
<td>Ferdi Grandori</td>
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<tr>
<td>11:30 - 12:30</td>
<td>Screening Strategies and Methods</td>
<td>Hearing Loss and Medical Conditions</td>
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<tr>
<td>12:30 - 13:45</td>
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<tr>
<td>13:45 - 14:15</td>
<td>Keynote Lecture</td>
<td>Adult Hearing Screening: Health Policy Issues&lt;br&gt;Adrian Davis</td>
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<td>Learning to Listen Again: The Role of Auditory Training in the Management of Hearing Loss in Adults&lt;br&gt;Theresa Haith Chisolm</td>
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<td>15:45 - 16:45</td>
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### June 8

Towards the International Working Group on AHS - open discussion<br>Room FALSTAFF, 16:45-18:00

### Saturday, June 9, 2012

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<td>09:00 - 09:30</td>
<td>Keynote Lecture</td>
<td>Evidence-Based Practice in Audiology: Rehabilitation Options for Adults with Hearing Impairment&lt;br&gt;Louise Hickson</td>
</tr>
<tr>
<td>09:30 - 10:30</td>
<td>Intervention Strategies</td>
<td>Hearing Devices</td>
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<td>11:00 - 11:30</td>
<td>The ICF Core Sets for Hearing Loss: first results</td>
<td>Sophia E. Kramer and Sarah Granberg</td>
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<td>Communicative and Psychological Effects</td>
<td>IT and Hearing Health Care</td>
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#### Speech Understanding and Aging

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<td>17:15 - 17:30</td>
<td>Central auditory listening in normal hearing adults - van Wieringen A, Demeester K, Wouters J</td>
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<td>17:45 - 18:00</td>
<td>Supra-threshold auditory processing in audiometrically normal hearing: Effects of age and cognition - Füllgrabe C, Moore BCJ</td>
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<td>18:00 - 18:15</td>
<td>A clinical protocol for assessing static and dynamic spectral-pattern discrimination - Sheft S, Shafiro V, Lorenzi C</td>
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<td>18:15 - 18:30</td>
<td>The application of pupillometry to assess processing load during listening to speech in challenging conditions - Zekveld AA, Koelewijn T, Mortier K, Festen JM, Kramer SE</td>
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#### Follow-up to the European Initiative HEARCOM

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<td>Chances and limits of self-screening: Evaluation of the digit triplets test in noise (German version) - von Gablenz P, Holube I, Buschermöhle M</td>
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<td>Epidemiological research: How good do German adults hear? - Holube I, von Gablenz P</td>
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#### Automated Pure-Tone Audiometry

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<td>Automated pure tone audiometry for screening purposes - Bisitz T</td>
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<td>18:00 - 18:15</td>
<td>A comparison between clinical audiology and screening audiology - Skjönsberg Å, Heggen C, Jamil M, Muhr P, Rosenhall U, Johnson AC</td>
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### June 8 - ROOM AIDA

**Keynote Lecture:**

**Benefits of Auditory Training for Aided Listening by Older Adults** - Judy R. Dubno

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<tr>
<td>09:30 - 09:45</td>
<td>Factors affecting speech intelligibility of people with hearing loss - Ching TYC, Dillon H, Lockhart F, van Wanrooy E</td>
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<td>09:45 - 10:00</td>
<td>Can elderly improve performance following training in psychoacoustic and linguistic tasks? - Kishon-Rabin L, Ferman S, Avivi M, Israeli E, Ari-Even Roth D</td>
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<td>Hearing aids are not the only option: Exploring the benefits of auditory training and patient education - Ferguson M, Henshaw H, Brandreth M, Wharrad H, Moore D</td>
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<td>Effect of hearing aids on cognitive function, hearing handicap, and attitudes toward wearing hearing aids in the early stages of age-related hearing loss - Doherty KA, Desjardins JL, Hoyer WJ</td>
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<td>11:00 - 11:30</td>
<td>Adult Hearing Screening: Guiding Principles and Methods - Ferdi Grandori</td>
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<td>11:45 - 12:00</td>
<td>The relation between the speech-reception threshold in noise and hearing loss in a large cohort of elderly people - Goedegebure A, Homans NC, Brocaar MP</td>
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<td>12:00 - 12:15</td>
<td>Hearing screening in adults using the Adaptive Auditory Speech Test (AAST) - Coninx F, Roets L</td>
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<td>Tuning the SUN Test to Different Languages - Paglialonga A, Tognola G, Grandori F</td>
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<td>Hearing screening and the outcomes of acute hospital care - Moody LJ, Dunning T, Savage S</td>
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<td>14:30 - 14:45</td>
<td>The effects and costs of a hearing screening and rehabilitation program in residential care homes for the elderly in the Netherlands - Linssen AM, Joore MA, Theunissen EJJM, Anteunis LJC</td>
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<td>14:45 - 15:00</td>
<td>Screening for hearing loss among older Australians with vision impairment: The vision-hearing research project - Schneider J, Dunsmore M, Gopinath B, McMahon C, Mitchell P, Wang JJ, Leeder, SR</td>
</tr>
<tr>
<td>15:00 - 15:15</td>
<td>Screening adults with intellectual disabilities; is screening (followed by intervention) useful? - Coppens-Hofman M, Maassen B, Snik A</td>
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15:15 - 15:45 Keynote Lecture:  

**Learning to Listen Again: The Role of Auditory Training in the Management of Hearing Loss in Adults** - Theresa Hnath Chisolm

### Beyond Screening

15:45 - 16:00 What if you conduct a hearing screen and few people comply with the targeted recommendations? - Lafargue E


16:15 - 16:30 Maximizing the benefits of cochlear implants for adults with significant bilateral hearing loss through hearing screening - Dowell RC, Winton E, Hollow R, Ladduwahetty S

16:30 - 16:45 Deficit in phonological awareness among healthy aging adults - Fostick L, Ronen M

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**June 8 - ROOM BOHEME**

### Recreational and Occupational Noise


09:45 - 10:00 The influence of military service on auditory health and the efficacy of a hearing conservation program - Muhr P, Rosenhall U

10:00 - 10:15 Temporary threshold and emission shift after music exposure - Helleman HW, Dreschler WA

10:15 - 10:30 Individual noise risk-estimation according to ISO-1999 requires susceptibility correction - Demeester K, Wouters J, van Wieringen A

10:30 - 11:00 Coffee Break

### Hearing Loss and Medical Conditions

11:30 - 11:45 Comorbidity in hearing impaired adults: Which chronic medical conditions are related to hearing impairment? - Stam M, Kostense PJ, Festen JM, Kramer SE

11:45 - 12:00 Short-term longitudinal study of auditory function in Alzheimer's disease and mild cognitive impairment - Idrizbegovic E, Hederstierna C, Dahlquist M, Rosenhall U

12:00 - 12:15 Multisensory deficit in individuals with Leber's Hereditary Optic Neuropathy (LHON) - Rance G, Chisari D, Kearns LS, Mackey DA

12:15 - 12:30 Systematic review of the evidence base for a causal relationship between whiplash injury and tinnitus and hearing loss - Samji A, Yeoh LH, Thiagarajan V

12:30 - 13:45 Lunch
Special Session: Hearing & Balance

14:15 - 14:45  Presbyvertigo: Diagnosis, Prevention, Treatment - Arne Ernst
14:45 - 15:00  Neurofeedback in the rehab of presbyvertigo: a double-blind, placebo-controlled study - Ernst A, Basta D
15:00 - 15:15  Hearing implants in the elderly: why and when? - Ernst A, Todt I

Manufacturers' Update

15:45 - 16:00  Improvement on speech reception threshold with ReSound mini microphone - Ceylan D
16:00 - 16:15  Audiological and quality of life benefits with Oticon Medical ponto bone anchored hearing system - Sockalingam R, Tove Rosenbom T
16:30 - 16:45  Cochlear Implanted Recipient Observational Study (IROS) – a global registry of patient related benefits following treatment of hearing impairment with implant(s) - Wyss J
June 9 - Room AIDA

09:00 - 09:30  Keynote Lecture:

Evidence-Based Practice in Audiology: Rehabilitation Options for Adults with Hearing Impairment - Louise Hickson

Intervention Strategies

09:30 - 09:45  A new web-based tool for group audiologic rehabilitation - Montano J, Preminger J, Gregory M, Hickson L

09:45 - 10:00  Hearing rehabilitation in older adults: An investigation of third-party disability and involvement of family members in rehabilitation - Scarinci N, Hickson L, Worrall L

10:00 - 10:15  Volunteer services in adjustment to hearing loss - Hall A, Pryce H

10:15 - 10:30  Evaluation of the Active Communication Education (ACE) program in two Swedish samples - Oberg M, Bohn T, Larsson U, Hickson L

10:30 - 11:00  Coffee Break

11:00 - 11:30  The ICF Core Sets for Hearing Loss: first results - Sophia E. Kramer and Sarah Granberg

Communicative and Psychological Effects

11:30 - 11:45  Decline in hearing ability in older persons: Does a fast decline over time have a different effect on psychosocial wellbeing than a slow decline? - Pronk M, Deeg DJH, Smits C, Twisk JW, van Tilburg TG, Festen JM, Kramer SE

11:45 - 12:00  Barriers and facilitators to hearing aid uptake in older females: A qualitative report - Jenstad LM, Winsor DA

12:00 - 12:15  ‘Doctors meeting Deaf’. The results of an epidemiological study on health related quality of life and co variables in the Netherlands - Smeijers AS, Ens-Dokkum M, Bogaerde B, Oudesluys-Murphy AM

12:15 - 12:30  The importance of hearing and hearing implants for older adults from the perspective of a geriatrician - Lerch M, Decker-Maruska M

12:30 - 13:00  Closing Remarks
### June 9 - Room BOHEME

#### Hearing Devices

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<td>Electric-acoustic stimulation for people with severe-profound hearing loss</td>
<td>Ching TYC, Incerti P</td>
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<td>09:45 - 10:00</td>
<td>Word comprehension with cochlear implant in single-sided deafness: Evidence from late ERPs</td>
<td>Hahne A, Zahnert T, Mürbe D</td>
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<td>10:15 - 10:30</td>
<td>Listening training in hearing aids fitting: Influence on dichotic listening</td>
<td>Lavie L, Attias J, Karni A</td>
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#### IT and Hearing Health Care

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<td>The FAS-IT program. From detection to intervention. Reaching and treating persons with hearing disorders using modern information technology</td>
<td>Lunner T, Andersson G, Oberg M</td>
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<td>11:45 - 12:00</td>
<td>Scalability of post-operative care for CI-recipients</td>
<td>Lehnhardt M</td>
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<td>12:00 - 12:15</td>
<td>Dr Google: Quality and readability of English-language Internet information on hearing impairment and hearing aids</td>
<td>Laplante-Lévesque A, Brännström KJ, Andersson G, Lunner T</td>
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<td>12:15 - 12:30</td>
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### POSTER SESSION

**June 8, 16.45 – 18.00**

#### Central Auditory Processing and Cognitive Function

1. The effect of aging on temporal and non-temporal processing in a longitudinal design - Nave A, Halperin A, Fostick L
2. Pattern and rate of change in auditory temporal processing and speech perception with aging: A comparison between cross sectional and longitudinal studies - Fostick L
3. Factors influencing informational and energetic masking in older adults - Lalonde KL, Humes LE
6. Central auditory processing in aging and hearing handicap in everyday life - Obuchi C, Harashima T, Ohgane S, Shiroma M
7. Utilization of semantic networks in the identification of environmental sounds by individuals with hearing impairments - Tabaru K, Harashima T, Katada A
9. Psychology of deafness and creativity - Dasgupta S, Witana J

#### Assessment of Auditory Functionality

10. PRESTO: Development and preliminary findings with a new high-variability sentence recognition test across diverse listener groups - Tamati TN, Gilbert JL, Pisoni DB
11. Self-efficacy for Situational Communication Management Questionnaire (SESMQ): development and psychometric properties - Jennings MB, Cheesman MF, Laplante-Lévesque, A
12. Application of universal design principles to the development of an assessment tool for hearing accessibility - Jennings MB, Shaw LE, Ninan P, Cheesman MF
15. Validation of a mobile storage device based self-administered hearing screening test in normal hearing subjects - Himmelfarb M, Zilberg T, Pri-Chen R, Levit Y
19. Circular phase clustering based auto-adaptation for the objective assessment of ABR measurement quality - Strauss DJ, Corona-Strauss FI
20. Adaptive filters for enhancing auditory brainstem responses to synthetic vowel stimuli - Fallatah A, Dajani HR
21 High frequency gain dependent word recognition - Cevette MJ, Wagner L, Oakley S, Cocco D, Pradhan G, Stepanek J, Bogle J, Zapala D


23 Sequential diagnostic tests for searching the etiology of deafness - Castilho AM, Ramos PZ, de Moraes VCS, Sartorato EL

24 Use of telemedicine in audiology – An Indian experience - Wadhera M

**Recreational and Occupational Noise**

25 Monitoring noise-induced hearing loss with OAEs - Helleman HW, Leensen MCJ, Dreschler WA

26 SOAE and DPOAE characteristics in personal music system users after listening to one hour of music - Torre P, Millman P, Martin H

27 Personal digital audio players and their headphones: Hearing risks - Santos I, Couto CM, Colella-Santos MF

28 Speech perception test in groups of workers exposed to occupational noise - Arieta AM, Costa EA, Couto CM

29 Intervention model in occupational hearing loss - Barbosa A, Sousa A, Oliveira V, Lopes P

30 Noise exposure amongst Kuantan municipal council, Malaysia workers - Ali Hanafiah N, Mohd Zain SR, Dzulkarnain AAA, Jamaluddin SA

31 Implication of noise exposure in the oil and gas industry to occupational safety and health permissible exposure level in Nigeria - Abe OT

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Age-related hearing loss – presbycusis – is one of the top three chronic medical conditions and the number one communicative disorder of our senior population. Improved hearing aid design, better cochlear implant processing algorithms for aged listeners, and eventually, bio-therapeutic interventions to prevent, slow down or reverse the progression of presbycusis will be possible with increased knowledge of the neural, genetic and molecular bases of ear and brain deficits that occur with age. Biomedical engineering experiments are yielding progress towards drug micro-delivery systems for the inner ear – cochlea. In addition, we have recently uncovered some candidate genes in mouse models of age-related hearing loss that are up- or down-regulated with age and hearing loss in the cochlea and auditory midbrain (inferior colliculus). Interesting changes occur in gene families such as those coding for key components of apoptosis pathways, antioxidants, neurotransmitters and other important cellular channels. In addition, we have discovered that the efferent feedback system from the auditory brainstem (superior olivary complex, MOC system) to the cochlear hair cells shows significant declines beginning in middle age (human, mouse), and are correlated with decreases in the presence of voltage-gated K+ channels and anatomical declines. Lastly, a new mouse model has been discovered with excellent hearing in old age, providing a novel animal model of good hearing in old age, for those rare aged listeners with “golden ears”.
KEYNOTE LECTURE

UNDERSTANDING THE SPEECH-UNDERSTANDING PROBLEMS OF OLDER ADULTS

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Approximately 30-40% of the older adults have a hearing loss that is sufficient to make speech communication difficult in everyday listening situations. In fact, one of the most common complaints of older adults with impaired hearing is that they can “hear speech, but can’t understand it.” This presentation will explore the factors that contribute to the speech-understanding problems of older adults. The results from several studies in our laboratory will be reviewed. The first series of studies focused on the identification of factors contributing to individual differences in performance among older adults when listening to speech without amplification, as well as when listening to spectrally shaped speech mimicking a well-fit hearing aid. For unaided listening, the peripheral cochlear pathology was the predominant factor, but higher-level processing, especially cognitive factors, also contributed. For aided listening, the relative roles of peripheral and cognitive processing were reversed with higher-level processing being predominant and little or no influence of peripheral pathology on aided performance (assuming that audibility has been fully restored as in these studies). In another series of studies, we extended this laboratory work to the clinic, modeling hearing-aid outcomes for clinic patients with hearing aids. The pattern for aided listening in older adults seen in the clinic was consistent with the pattern observed in the laboratory studies: cognitive and peripheral factors impacted aided speech understanding in older adults.

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**SPEECH UNDERSTANDING AND AGING**

**EXAMINING SPEECH PERCEPTION IN NOISE AND COGNITIVE FUNCTIONS IN THE ELDERLY**

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Age-related hearing disorders have a significant impact on communication abilities. Even moderate hearing loss might affect speech recognition in noise. Hearing aids can restore audibility of the speech signal and thus improve speech perception. However, peripheral hearing loss is not the only factor influencing speech perception. Growing evidence has shown that cognitive functions are also important for speech perception in adverse listening situations. Working memory, attention and executive functions might be especially relevant. These domains typically decline with age. We examined speech recognition against several background maskers such as static and modulated noise or speech. Results from speech audiometry were correlated with the outcome of a neuropsychological test battery addressing different cognitive functions. All tests were conducted with different study groups, namely young and elderly normal hearing (NH) subjects and hearing impaired (HI) persons. Results revealed that the elderly NH listeners revealed worse speech intelligibility than the young NH listeners in demanding situations. Elderly HI listeners performed worse than elderly NH listeners in all configurations highlighting the influence of hearing impairment. Nevertheless, cognitive factors also contributed significantly to the explanation of variance in the outcome of the speech recognition tests. Based on these results consequences for diagnosis of hearing problems and aural rehabilitation in the elderly will be discussed.

**CENTRAL AUDITORY LISTENING IN NORMAL HEARING ADULTS**

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**Introduction.** Listening difficulties in the elderly may be due to peripheral and/or central auditory dysfunctions. While behavioral tests exist to measure peripheral hearing (pure tone audiometry, speech in noise) standardized central auditory measures are limited. Central auditory measures assess the ability to fuse and/or segregate sounds, process rapid changes in the speech signal (in frequency and time) irrespective of peripheral hearing loss. The goal of the present study was to develop and validate a limited number of central behavioral measures in normal-hearing persons differing in age. **Methodology.** Data were collected of a Flemish dichotic digit test (Kimura, 1961), a frequency modulation test, a within-channel gap detection task, a categorical speech perception task, a non-verbal
binaural fusion task and a non-verbal binaural separation task. These tests were administered to 50 adults with clinically normal thresholds using APEX (Francart et al., 2008). **Results.** Group data per task will be presented as well as individual patterns of performance across different tasks.

**AUDITORY TEMPORAL PROCESSING AND SPEECH PERCEPTION IN NOISE OF OLDER PEOPLE**

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Aging subjects often not only suffer from progressive deterioration of high frequency signal detection, but also from a gradual decline in speech perception, especially in noisy and reverberant environments (Freigang, 2011). One possible source of this speech understanding problem is an age-related decline in the ability to process critical timing information in sound (Gordon-Salant, 2010). In the present study, 31 normal hearing subjects at the age range of 50 to 70 years and 30 subjects in the age range of 25 to 35 years were asked to perform: 1) A gap detection threshold task in which the participant’s ability to detect a temporal gap in the center of a broadband noise was measured. 2) Word recognition (PB) in quiet and in multi-talker babble noise (SNR +6dB). 3) Voicing perception of medial stops using a natural /ibi/-/ipi/ continuum, which varied in stop-closure duration. Elderly individuals exhibited higher gap detection thresholds compared to young subjects. 42% of the elderly group did not use closure duration as a cue for voicing distinction and failed to exhibit a category boundary. The rest showed voicing category boundaries that were similar to those obtained in young subjects. Our results indicate that temporal processing abilities decline with age. This decline may explain the inability of some elderly individuals to utilize temporal cues during challenging listening conditions.

**SUPRA-THRESHOLD AUDITORY PROCESSING IN AUDIOMETRICALLY NORMAL HEARING: EFFECTS OF AGE AND COGNITION**

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Recent studies seem to indicate a limited usefulness of the audiogram to predict speech intelligibility, especially in noise. Here, we report data from a large-scale (N = 95) study investigating age-related changes in the ability to process supra-threshold monaural and binaural temporal-fine-structure (TFS) information. All listeners, aged 18 to 90 years, had unilaterally (UNH) or bilaterally normal hearing (BNH), defined as audiometric thresholds of ≤ 20 dB HL between 0.125 and 4 kHz. High-frequency audiometry and otoacoustic emission measurements were also performed on a subset of listeners. Sensitivity to TFS was assessed using two psychophysical tests. In the first test, UNH and BNH listeners...
discriminated a monaurally presented harmonic tone complex from an inharmonic tone complex, obtained by shifting all components of the first complex upwards in frequency. Fundamental frequencies ($F_0$) of 91 and 182 Hz were used. The spectral envelope was fixed by applying a filter with a bandwidth of 1 $F_0$ and centered on 1 and 2 kHz, respectively, preserving only unresolved components. In the second test, BNH listeners discriminated a diotic pure tone from the same pure tone with a phase difference between the two ears. Frequencies of 500 and 850 Hz were used. The presentation level was 30 dB above absolute threshold. Listeners also completed a battery of cognitive tests (e.g. measures of processing speed, working memory, non-verbal IQ). The aims of the study were: (i) to investigate if, despite normal audiometric thresholds, TFS processing deteriorates with age, (ii) to specify when in adulthood the first signs of this deficit can be seen, (iii) to study the dependence of TFS sensitivity on audiometric thresholds at the test frequency or in the high-frequency region (i.e., 6-12.5 kHz), and (iv) to investigate the relationship between TFS processing and cognitive abilities.

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A CLINICAL PROTOCOL FOR ASSESSING STATIC AND DYNAMIC SPECTRAL-PATTERN DISCRIMINATION

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Past work has shown relationship between the ability to discriminate spectral patterns and measures of speech intelligibility in clinical subject groups. Psychoacoustic conditions of the current study evaluated discrimination ability for both static and dynamic spectral patterns characterized by low-rate modulation, a central aspect of speech that conveys intelligibility. In the static condition dependent on spectral resolution, the ability to detect a change in the phase of a sinusoidal spectral ripple of wideband noise was measured with ripple density constant at 1.5 cycles per octave. The dynamic condition determined the signal-to-noise ratio needed to discriminate 1-kHz pure tones frequency modulated by different 5-Hz lowpass noise samples drawn from the same underlying noise distribution so that discrimination was based on the temporal pattern of stimulus fluctuation. Both conditions used a modified descending method of limits with test stimuli pre-recorded on a CD for clinic use. Data were collected from 63 listeners (age: 21 to 87 years) with hearing sensitivity ranging from normal to a mild-to-moderate sensorineural hearing loss. Compared to younger subjects, thresholds from older listeners were elevated in both conditions with no effect of hearing loss among the older listeners. QuickSIN speech-in-babble thresholds were significantly correlated with both the static and dynamic discrimination measures. For each measure individually, the relationship to speech intelligibility remained significant if controlling for the effect of the other, indicating at least in part evaluation of separate auditory abilities relevant to speech perception. With each psychoacoustic measure requiring less than 10 minutes including brief practice, results suggest clinical utility of the procedures in the context of speech processing ability.

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THE APPLICATION OF PUPILLOMETRY TO ASSESS PROCESSING LOAD DURING LISTENING TO SPEECH IN CHALLENGING CONDITIONS

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Pupillometry is a useful technique to objectively quantify processing load during listening. We assessed the influence of individual factors like age, hearing loss, and cognitive ability, and external factors like stimulus type, task characteristics, intelligibility level, masker type and hearing aid use on the pupil response. In order to confirm the validity of the method, we additionally assessed the influence of test modality (textual versus auditory stimuli) on the pupil response, and examined cued stimulus recall, another measure of processing load. Several groups of young (n_{tot} = 153) and middle-aged normally-hearing (n_{tot} = 86) subjects and middle-aged hearing-impaired subjects (n_{tot} = 60) participated. Pupil dilation was recorded during measurement of speech reception threshold and text reception threshold (TRT). Sentences and words in noise were presented over a wide range of sentence intelligibility levels (1% - 99% correct), with different masker types (steady-state, fluctuating, single-talker) and in quiet. The pupil response increases with decreasing speech intelligibility level, until a plateau is reached at very difficult intelligibility levels. Middle-aged and hearing-impaired adults showed a smaller decrease in pupil responses with increasing intelligibility. Masker type modulates processing load independently of task difficulty level, with the largest processing load for speech masked by interfering speech. The data suggest interindividual differences in task approach in very challenging conditions. The TRT test is associated with cognitive load during listening, especially in such difficult listening conditions. Cognitive abilities additionally modulate the benefit obtained from hearing aids on listening effort and speech perception performance. The pupil response furthermore reflects processing load differences caused by different types of stimuli (word versus sentences), task characteristics (detection versus identification) and stimulus modality. The pupil response, cued recall data, speech perception performance and subjective measures reflect different aspects of processing load during listening. Overall, the potential of pupillometry as a sensitive and valid cognitive load index is confirmed by the data.
FOLLOW-UP TO THE EUROPEAN INITIATIVE HEARCOM

HURDIG - A NETWORK FOR MULTILINGUAL HEARING AND SPEECH INTELLIGIBILITY DIAGNOSTICS

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Audiological speech intelligibility diagnostics requires speech tests to be performed in each individual’s native language. The HEARCOM follow up EFRE-project HURDIG pursues the goal to make comparable speech audiometric tests available in as many languages as possible. Since most people first realize their hearing loss when they encounter communication difficulties in noisy environments, HurDig focuses on two types of speech in noise tests. 1) The Digit Triplet Test as a fast, reliable and anonymous self-screening test, and 2) the Matrix Test as a more thorough test administered by professionals. The Digit Triplet Test consists of spoken digits in a background of noise and determines the speech reception threshold SRT (i.e., signal to noise ratio yielding 50% speech intelligibility). As a closed format test it can be administered automated at home via Internet or telephone. It is already available in several European countries via the national telephone network. For professional speech audiometry (e.g. in clinics), the Matrix Test is a tool to further specify hearing disabilities predominantly encountered in noisy environments. Using an adaptive procedure, it determines the patient’s SRT in noise (or quiet). The test makes use of phonetically balanced speech material and consists of syntactically fixed but semantically unpredictable sentences (e.g., “Hannah wins twelve red tins”). The sentences are generated from words taken in a seemingly random fashion from an inventory of 50 words. Thus the Matrix Test can be used repeatedly with the same patient since the sentences cannot be learned. In addition to the standard open format, the test can also be performed in a closed format, making it suitable for use with patients of a different native language than the audiometrist. The present contribution reports the activities of the EFRE-project HurDig. New screening and clinical tests for e.g., Castilian Spanish, Russian and Turkish are shown.

CHANCES AND LIMITS OF SELF-SCREENING: EVALUATION OF THE DIGIT TRIPLETS TEST IN NOISE (GERMAN VERSION)

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The digit triplets test in noise was developed within the HearCom project for self-screening of auditory impairment. Available in different languages, it can easily be carried out by everyone via telephone or internet. The task is to listen to digits presented in background noise – three digits per trial – and to enter the digits using the phone’s keypad, keyboard or mouse. The speech level is varied adaptively...
within 27 trials in order to determine the signal-to-noise ratio (SNR) that leads to 50% correct answers, resulting in the speech reception threshold (SRT). After this simple test procedure, the user receives feedback whether the performance was within the normal range, below average or well below average. The German version of the digit triplets test by telephone is used in the epidemiological study HÖRSTAT currently conducted in northwestern Germany - along with pure tone and diagnostic speech audiometric testing. Therefore, HÖRSTAT provides basic data for evaluating this self-screening test in a representative population. The results of the digit triplets test in noise and corresponding audiometric results will be presented.

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**EPIDEMIOLOGICAL RESEARCH: HOW GOOD DO GERMAN ADULTS HEAR?**

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HÖRSTAT is a current survey assessing the hearing and communication abilities in the adult German population. By the end of 2012, a total maximum of 2000 adult subjects in Northwest-Germany shall be examined in this representative, cross-sectional study. Testing procedure includes otoscopy, pure tone audiometry covering air and bone conduction and two speech recognition in noise tests. Within a face-to-face-interview the examiners retrieve information referring health status, ear diseases and perceived hearing problems, potential hearing aid use and satisfaction, noise exposure and socio-economic aspects. Before audiometric testing, the study participants are asked to rate their hearing abilities using a short form of the SSQ questionnaire. With regard to selected international epidemiological research, this contribution will give interim findings on the age-related hearing impairment in German adult population, comparing as well measured and self-reported hearing impairment.

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AUTOMATED PURE-TONE AUDIOMETRY

AUTOMATED PURE TONE AUDIOMETRY FOR SCREENING PURPOSES

Bisitz T

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Pure tone audiometry gives important and basic information about the hearing of a person. Besides its standard use for diagnostics, the pure tone audiogram can be important for various other areas. Examples are the use as inclusion criterion for listening tests (e.g. for assessing the quality of audio processing algorithms etc.) or as part of an assessment procedure (e.g. in case of noise-induced hearing losses). In clinical environments, expensive audiometers are available most often which need a skilled operator for manual operation and allow measurements only up to 8 kHz. For a lot of applications, however, e.g. in research institutes without a clinical audiometer or for screening purposes, a less expensive solution without needing a skilled operator would be welcomed. Depending on the desired accuracy, a very short measurement time and an extended frequency range can be required. A software program for automated audiogram measurements is presented here. This new type of software runs on a standard PC with a high-quality sound card and audiometric headphones and is easily operated by the test subject him/herself. The implemented adaptive procedure allows fast standard audiogram measurements including high frequencies up to 16 kHz. Also very short screening measurements with a few frequencies are possible. Included in the procedure is functionality in order to avoid errors by accident or any attempt of deception. Data from normal hearing test subjects to compare the implemented automated procedure and manual audiometer measurements are presented together with an analysis of the test-retest-reliability. The challenges with respect to the dynamic range for high frequencies and calibration are addressed. Possible fields of application and limitations are discussed.

A COMPARISON BETWEEN CLINICAL AUDIOMETRY AND SCREENING AUDIOMETRY

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The purpose of this study was to compare the method of screening audiometry, which is used in many routine examinations in occupational healthcare, primary care and military health care, with the “gold standard” of clinical audiometry, pure-tone testing in a sound isolated box. The study also aims to more precisely define the limitation of screening audiometry with regards to impaired hearing of various kinds and degrees, including patients with or without tinnitus. The clinically performed audiometry were conducted due to the Swedish national standards, while the screening audiograms were conducted using automatic computerized screening audiometer (Entomed Scandinavian Audiometry 203 and 204...
together with TDH-39 ear phones equipped with Silenta noise reducing muffs) in a quiet room. The screening level was set to 0 dB HL. Audiograms from 100 patients (51 females and 49 males, 18-84 year of age) were compared and the two measurements were conducted at the same day. The audiograms were divided into four different groups depending of the type of hearing, normal hearing (n=23), sensorineural hearing loss (n=40), side discrepancy (n=18), and conductive hearing loss (n= 19). A classification of better and worse ear was done by calculating pure tone averages 0.5 - 4 kHz. The differences between the two measurements were calculated at each frequency and for the 4-tone average. The four-tone average in all four groups of different types of hearing losses the use of clinical audiometer almost always gave better hearing thresholds compared to the screening audiometer. In the group of one-side discrepancy/deaf at one ear (group 3) the screening audiometer showed better hearing thresholds. This is most likely due to the effect of “over hearing” from the better ear. The frequency that showed the most prominent difference between the measurements was 6 kHz.

**CLINICAL EVALUATION OF A COMPUTERIZED SELF-ADMINISTERED HEARING TEST**

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**Objective.** To establish the reliability and validity of a computerized self-administered hearing test.  
**Method.** Subjects were 100 adult Chinese who attended the audiology clinic in a hospital for a hearing test. All subjects completed the standard pure-tone audiometry and the self-administered hearing test via a smartphone in a sound-proof booth. Twenty percent of the subjects repeated the self-administered hearing test in the sound-proof booth and another 20% of the subjects repeated the test in a quiet office room. **Results.** There was no significant difference in the thresholds of unmasked air-conduction hearing obtained with the computerized self-administered hearing test via a smartphone and those obtained with standard pure-tone audiometry. High test-retest reliability was observed with the self-administered hearing test (intraclass correlation coefficient = 0.95), and was comparable with that observed in standard pure-tone audiometry (intraclass correlation coefficient = 0.97). The thresholds of the self-administered hearing test measured in a sound-proof booth were not significantly different from those measured in a quiet office room. **Conclusions.** The results suggest that the computerized self-administered hearing test is a reliable and valid measure of unmasked air-conduction hearing thresholds.
KEYNOTE LECTURE

BENEFITS OF AUDITORY TRAINING FOR AIDED LISTENING BY OLDER ADULTS

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Speech recognition difficulty is a common complaint of older adults with hearing loss. Whereas most hearing aids increase speech audibility in relatively quiet environments, they may not improve the signal-to-noise ratio (SNR) in noisy environments. When technology provides a less-than-optimal SNR, a complementary approach is to improve the SNR by training the listener. That is, as a supplement to aided listening in noise, an effective auditory-training program may improve the use of audible speech information, enhance communication abilities, and increase the efficacy of hearing aids. Although promising results were reported in the 1970s and 1980s, interest in and evidence supporting auditory training for adults has been limited, perhaps due to technical restrictions of those programs and the need for laboratory-based training extending over many days and weeks. More recent training programs developed to utilize newer technology and automated, home-based training generated renewed awareness and additional evidence of benefits of auditory training for older adults who use hearing aids. This presentation will review key features and recent results of auditory-training paradigms, including those that (1) focus on individual sounds, commonly used, meaningful words in isolation, or words in phrases or sentences; (2) use auditory cues alone or auditory plus visual/orthographic cues with feedback; (3) emphasize the role of contextual information, cognitive function, and comprehension; (4) include multiple talkers and speech-like background noise to simulate realistic listening environments; and (5) assure audibility using spectrally shaped speech or participants’ own hearing aids.

Work supported by NIH/NIDCD and the Hearing Health Foundation.
HEARING AIDS AND AUDITORY TRAINING

FACTORS AFFECTING SPEECH INTELLIGIBILITY OF PEOPLE WITH HEARING LOSS

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Speech intelligibility poses a major difficulty for people with hearing loss. This difficulty may be partly alleviated when sounds are made audible via amplification. To prescribe amplification that maximises speech intelligibility, we need to know the relative importance of an audible signal in different frequency regions for understanding speech by people with different degrees of hearing loss. This paper reports an investigation of the predictability of speech intelligibility from audibility for people with hearing loss. Data from 55 hearing-impaired listeners and 20 normal-hearing listeners revealed that the amount of speech information that a hearing-impaired listener can extract from an audible signal decreases as hearing loss becomes more severe. This hearing loss desensitization was computed and a new method for modifying the Speech Intelligibility Index was derived. We also examined the way in which speech intelligibility of hearing-impaired listeners was affected by different factors, including the presence of cochlear dead regions, frequency and temporal resolution, and cognitive ability. The implications of the findings for providing amplification to people with different degrees of hearing loss will be discussed.

CAN ELDERLY IMPROVE PERFORMANCE FOLLOWING TRAINING IN PSYCHOACOUSTIC AND LINGUISTIC TASKS?

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As part of the aging process, older adults are known to encounter difficulties at different levels of auditory processing. This is reflected in higher thresholds of basic psychoacoustic tasks as well as in difficult tasks that involve complex linguistic processing. It has also been suggested that the aging brain is less adaptable to changes than the brain of the young adult. The purpose of the following experiments was to determine whether despite the deterioration in auditory and cognitive capabilities, elderly can improve performance following training. Additional goals were to compare the time-course of learning, the amount of improvement, generalization to untrained conditions and preservation of learning in the elderly to that of young adults. The first experiment tested learning-induced gains following multiple-session training of a gap detection task in 10 elderly between 60-85 years old compared to 10 young adults 18-30 years of age. In a second experiment, 8 elderly between 75-85 years old and 8 young adults 18-30 years old were trained on learning an artificial language rule during 10 sessions. In both experiments, transfer of learning was tested in untrained conditions and preservation of learning was
tested one month post-training. The results show that in both experiments, the starting performance of the elderly was considerably poorer than that of the young adults. Both groups showed large learning-induced gains, and for some elderly, performance reached that of the younger adults by the end of training. The elderly, however, improved at a slower rate. Similar transfer of learning and preservation was evident in both groups. These results demonstrate that following intensive training, the elderly can learn and improve performance in auditory tasks of varying cognitive complexity. Moreover, depending on the task, implicit and declarative learning systems are involved. Such findings have important implications on auditory rehabilitation protocols of the elderly.

HEARING AIDS ARE NOT THE ONLY OPTION: EXPLORING THE BENEFITS OF AUDITORY TRAINING AND PATIENT EDUCATION

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It is becoming more widely acknowledged that hearing aid (HA) fitting alone is not the optimal intervention for people with hearing loss (PHL). Adopting additional rehabilitation strategies, such as auditory training to enhance active listening, and provision of interactive instructional videos to improve patient education, could improve patient success with HAs. An RCT of 44 non-HA users with mild hearing loss trained on a phoneme-in-quiet discrimination task (p<0.001). There were no significant improvements for speech intelligibility in modulated noise nor for simple cognitive tasks. However, significant post-training improvements were identified for complex measures of cognition (divided attention and visual working memory) in the trained group (p<0.05) but not for the control group, although between-group differences just missed statistical significance. Similar results were seen in a follow-up study of 30 HA users trained on phonemes-in-noise. Post-training improvements were evident in a complex dual-task of listening effort (p<0.001) and an informational speech intelligibility task with competing speakers (p<0.05), but only when the task was set at a level of difficulty that was not too hard and not too easy. These findings suggest that generalisable outcome measures need to be appropriately challenging in order to measure auditory training benefits. It has been shown that interactive audio-visual video clips (aka re-usable learning objects, RLOs) can enhance learning and motivation in educational and healthcare contexts. To address this in HA users, we have developed seven, short (~5-7 min) RLOs using a participatory design via (i) a delphi review of 33 UK audiology/hearing experts, and (ii) HA users. This informed the RLO content, comprising both practical and psychosocial factors, which is being evaluated in an RCT of first-time HA users (n=170). Both interventions have the potential for internet delivery, which would enable auditory training and HA user education to become more widely accessible to PHL.
EFFECT OF HEARING AIDS ON COGNITIVE FUNCTION, HEARING HANDICAP, AND ATTITUDES TOWARD WEARING HEARING AIDS IN THE EARLY STAGES OF AGE-RELATED HEARING LOSS

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Due to the gradual onset of an age related hearing loss, it can often be overlooked in its early stages, and even when people are aware of changes in their hearing, they can be reluctant to seek help. Many people wait years, even decades, before getting treatment. Previous studies have linked untreated hearing loss to depression, withdrawal from social situations, impaired memory, reduced job performance, and diminished overall health. In the present study, the extent to which hearing aids can minimize the sensory, cognitive, and social consequences of early age-related hearing loss was assessed for individuals between 46 and 74 years of age. Participants had never worn hearing aids or sought help for their hearing loss. Experimental testing, in both aided and unaided listening conditions, was performed over five test sessions in an eight week period. Participants were fit with receiver in the canal hearing aids, bilaterally, and asked to wear them every day for six weeks. The Hearing Handicap Questionnaire (HHQ) (Gatehouse & Nobel, 2004) was used to assess perceived hearing handicap, and the Hearing Aid Attitudes in Rehabilitation Questionnaire (HARQ) (Hallam & Crooks, 1996) was used to assess the participants’ attitudes and emotions towards wearing hearing aids. To investigate cognitive processing, participants were administered an auditory n-back test at three presentation levels, and in quiet and noise, the Digit Sequence Substitution Test (WAIS-III), Letter Number Sequencing Test (WAIS-III), and the Auditory Reading Span Test (R-SPIN sentences) (Pichora-Fuller et al., 1995). Results showed that wearing hearing aids for a six week period, during the early stages of age-related hearing loss, can affect a person’s attitudes towards hearing aids, decrease hearing handicap, improve sentence recognition in noise, and improve recognition memory in noise.
ADULT HEARING SCREENING: GUIDING PRINCIPLES AND METHODS

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Widespread implementation of hearing screening programs all throughout the lifespan is gaining increasing momentum worldwide. Population screening is able to give those who neglect that they are affected by a hearing problem earlier awareness so that health care can be delivered in the most cost-effective and timely manner. Early identification and intervention have the great potential to effectively improve self-confidence in everyday life and personal well-being as well as social participation and productivity on the workplace, contributing to a self-supporting life-style and improved quality of life. This is particularly relevant for adults with mild-to-moderate hearing loss, who typically choose to live with their functional impairment and activity limitations, frequently delaying access to care until they experience severe handicap. Unquestionably, the need for readily accessible and reliable hearing screening programs is becoming more and more urgent as Western populations are likely to be obliged to retire later and good hearing function will also be required for a longer period in the ‘older’ working population.

Strategies for fulfilling this need include education on hearing and hearing impairment, research on the causes and mechanisms of hearing loss and evidence-based treatments which can be translated into clinical practice. Effective screening programs should move beyond merely detecting hearing loss to more comprehensive approaches which entail identifying hearing handicap and experienced disability in daily life as well as initiating a chain of events that leads to tailored treatment and long-term benefit. Primary research needs are to develop accurate and practical screening tools and to evaluate the effectiveness of screening methods for use in various healthcare settings (primary care offices, geriatric centers, pharmacies, convenient care clinics, and senior centers).

A variety of strategies can be implemented to screen adults for hearing sensitivity loss, hearing handicap or disability. Conventional approaches make use of pure-tone testing in clinical or non clinical settings or self-administered questionnaires on experienced handicap/disability. In the recent years, there has been a rapid evolution in the development of novel techniques for low-cost and reliable screening aimed at addressing hearing impairment and predict the real experienced listening difficulties of adults and older adults. New tests based on the recognition of speech in noise are now available on portable, battery-operated devices, or distributed diffusely using information and communication technologies (telephone/internet). These speech in noise tests have attracted widespread interest and are being increasingly used in a number of local and national screening initiatives.

Directions for current and future research include assessing which screening method(s) can result in the highest rate of follow-up of individuals seeking intervention and getting real benefit, understanding and removing barriers to screening, defining the knowledge, skills, and training required for all those who should provide hearing care for adults, develop a set of suitable and reliable outcome measures, as well as defining guidelines on how and when to measure them.
SCREENING STRATEGIES AND METHODS

TOOLKITS FOR UNIVERSAL SCREENING OF HEARING IN OLDER ADULTS

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In 1996, the United States Preventive Services Task Force (USPSTF) issued a directive recommending screening of adults 50 years of age and older for hearing loss. Following a systematic review of the evidence regarding the potential harms versus benefits of screening, a 2011 draft statement issued by the USPSTF-concluded that there is a dearth of evidence linking hearing screening to improved health outcomes (Chou et al., 2011). Hence, in primary care, the USPSTF no longer recommends screening asymptomatic people over 50 years of age for hearing loss. According to available evidence, the lack of consensus on optimal age for screening, screening strategy, and likelihood of compliance with follow-up and recommended treatments complicates the landscape regarding hearing screening. The goal of this paper is to describe several toolkits which have potential for increasing the yield from hearing screening efforts in terms of health outcomes, cognitive-psychological health, and compliance. Further, a report card on hearing screening activities and the harms of not screening for hearing loss will be issued. Novel approaches to screening will be presented including a discussion of three promising questionnaires which assess functional communication impairments and tap into readiness or the likelihood that persons who might benefit from a hearing test or intervention are to actually follow-up. Reliability data, referral criteria, targeted interventions and health outcomes will be detailed as will the ideal populations on which to launch screening efforts. The presentation will conclude with a proposal for universal screening of older adults with a view toward minimizing the effects of untreated hearing loss on quality of care, activities of daily living, health economics, end of life care and caregiver encounters.

THE RELATION BETWEEN THE SPEECH-RECEPTION THRESHOLD IN NOISE AND HEARING LOSS IN A LARGE COHORT OF ELDERLY PEOPLE

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Speech understanding in noise is commonly used for screening purposes. Compared to pure-tone audiometry it has the advantage of less strict acoustical requirements and a simpler test protocol. Several smaller studies have shown a fairly good correlation between hearing loss and the speech reception threshold in noise. However, the question is if the relationship still holds in a large group of elderly people that is representative for a screening population. We were able to measure both the speech reception threshold in noise and the pure-tone audiogram as part of a large cohort study, known as “The Rotterdam Study”. In the study presented here we investigated the relation between speech reception
threshold in noise and hearing loss within a large and representative population of elderly people. We collected data in 1154 elderly people of which most were aged between 65 and 75 years old. We measured hearing loss (HL= pure-tone average at 0, 5, 1, 2 and 4 kHz) and the speech reception threshold in noise for digits (SRT-noise) under controlled conditions. The speech-in-noise was presented at the better hearing ear, using continuous noise with a speech-shaped spectrum presented at a level of 70 dB SPL. As expected, both HL and SRT significantly correlated with age (R=0.44 and R=0.39 respectively, p<0.01). A remarkably strong relationship is found when a direct comparison is made between HL and SRT-noise (R=0.81, p<0.01). The correlation does change much when only high-frequency thresholds are taken into consideration. The results indicate that the variance in the SRT-noise is mainly explained by the amount of hearing loss. This means that only a small additional role is left for other factors, such as cognitive functioning and supra-threshold processing deficits. It can be concluded that the present study confirms the high potential of using speech in noise as a screening instrument for hearing loss in elderly people.

**HEARING SCREENING IN ADULTS USING THE ADAPTIVE AUDITORY SPEECH TEST (AAST)**

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AAST – the Adaptive Auditory Speech Test, developed for speech reception threshold estimation in children over 3 years of age (Coninx 2008, 2009a, 2009b), is suitable also for elderly population. The test has been adapted into many languages already, offering excellent options to test elderly persons in their own native/first language. The test is based on an adaptive procedure implemented as an interactive PC task in multiple-choice format with only six alternatives. Depending on the applied version of the test, it allows detecting conductive and/or sensori-neural hearing loss (in quiet and steady noise), hearing loss in the higher frequencies or APD (in fluctuating noise). The AAST test is minimally dependent on some also age-related secondary subject’s skills, like reduced short-term memory, degraded speech skills and/or impaired vision. Test execution and interpretation of results is fully automatic and takes about 1 min for each procedure. The AAST was used in three field trials in the Netherlands. Results show good correlation between AAST thresholds in quiet/noise and pure tone audiometry (average mid frequency hearing loss). First pilot tests with the duoTone procedure will also be presented. This procedure is based on detection thresholds of frequency-specific stimuli, like pure tones or narrow bands of noise. In a closed set multiple choice procedure. The user has to decide between three stimuli: (1) a one long low-frequency stimulus, (2) three short high-frequency sounds or (3) silence (being a kind of catch trial). This test is, like AAST, fully automatic and multiple adaptive. Outcome of a duotone test (duration of about 80-90 seconds) are two detection thresholds at the lower and higher frequency. A quick screen is for elderly is possible by choosing a relevant lower frequency of 1.5 kHz and a higher frequency of 6 kHz.
TUNING THE SUN TEST TO DIFFERENT LANGUAGES

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Background. Increasing evidence points out that the question to be answered in adult hearing screening is how to identify the experienced difficulties in everyday life, particularly in challenging listening conditions. The concept of screening adults is now shifting from measures of hearing sensitivity (thresholds) to measures of hearing acuity, i.e. supra-threshold performances, such as speech understanding in the presence of background noise. Aim. To develop a novel speech-in-noise test for adult hearing screening, i.e.: a test specific to the impairment, fast, fully automated, easy to use, easy to interpret, self-convincing, and robust to ambient noise. Design: The Speech Understanding in Noise (SUN) test is based on recognition of a list of nonsense speech stimuli in background noise. The SUN test has been developed for the Italian, German, English, and French languages. Development in other languages (e.g., Spanish and Mandarin) is currently under way. Based on the number of stimuli in the list correctly identified (i.e., the test score), the test provides one out of three possible results: 'no listening difficulties', 'a hearing check would be advisable', or 'a hearing check is recommended'. An overall population of more than 6,000 adults and older adults was involved (age range: 18-95 years; mean: 64 years), with varying degrees of audiometric thresholds and audiometric configurations. More than 2,000 subjects were involved in the fine-tuning and evaluation phases in the different languages and in a variety test settings, both in low and in high ambient noise (up to 65 dBA). About 4,000 subjects participated in a number of pilot screening initiatives in public places, supermarkets, drugstores, and in some 'Universities of the Third Age'. Outcomes: The test is fast (less than one minute per ear), repeatable, easy to use and self-explaining, and its results are in line with the conventional clinical measures of the auditory function. The SUN test outcomes are not biased by the subject’s age, the perceived complexity and difficulty associated with the test are low. The outcomes of the SUN test are not influenced by the noise level in the test room, indicating that the test, as such, may be used either in clinical or in non clinical settings, such as waiting rooms of primary care clinics or GPs, hearing aid dispensing units, or pharmacies.
KEYNOTE LECTURE

ADULT HEARING SCREENING: HEALTH POLICY ISSUES

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Our research tell us that the impact that hearing impairment has globally is immense! Large numbers of the population are affected by hearing problems. Many of these people are over 60 years of age. We think it is a public health priority. But not many governments, local or national are prioritizing hearing. We, as professionals in hearing healthcare, think that there is a need to introduce better public health campaigns to bring about better awareness and to ensure that those with hearing problems have good access to screening and diagnostic testing. Those involved in retail – hearing aid dispensers - see a big untapped market that might give great return on investment if only they could be identified and be willing to buy or be provided with hearing aids. Despite the impact, the unmet need and the opportunities around hearing impairment, there is a need to get greater consensus and leadership on what should be done.

There is evidence emerging that the population does not always attach great value to hearing problems, even those caused by severe-profound hearing impairment. So the overall perceived impact does not register on the world stage of health or social scales of impact. From clinical experience and detailed reconstruction of what happens to people who become socially isolated and withdrawn due to communication difficulties stemming from hearing problems, we know that this gives a pale reflection of reality. What can we do to address this void?

Listen to what is being said around this conference and some of the answers are emerging, but what we have to do may take another 20 years to have an effect! Can we change the population perception faster?

The emphasis on hearing and on hearing aids may in fact be detrimental to governments’, agencies’, health & social care systems’, communities and the population’s understanding of what hearing problems means to individuals, its impact on society and strategies to overcome them.

Are hearing aids doing more harm than good? Is the vision for audiology wrongly aligned with the technological pull of the latest gismos in hearing aids and implants? Does the training and education offered to audiologists reinforce poor values? What should these values be and how do we align them with the changes at the heart of hearing and communication needs in the 2012 Europe?
TARGETED SCREENING

HEARING SCREENING AND THE OUTCOMES OF ACUTE HOSPITAL CARE

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In the absence of appropriate assessment and management, hearing loss is associated with a broad range of adverse health and mental health outcomes, many of which ultimately necessitate hospital care. Yet many health professionals, and the patients themselves, regard hearing loss as an inevitable, unstoppable and perhaps trivial consequence of ageing. While hearing loss is age-related, the health impacts of hearing loss occur over and above those attributed to ageing alone, suggesting that important opportunities for secondary prevention may lie in better hearing loss screening, prevention and management. Nevertheless, hearing loss in adults remains universally and chronically under-assessed and under managed at the individual, health service and public health levels. However, the health and wellbeing of older people is firmly on the public agenda, as governments seek novel approaches to addressing the needs of an increasingly ageing population. The acute hospital is a complex care environment, and for the older patient, preventing the unintended consequences of hospital admissions including functional decline and adverse events are carefully managed health priorities. This paper introduces a study of the impact of hearing loss on the quality and safety outcomes of acute care for a random sample of older hospital patients. The prevalence of hearing loss in the hospital population will be described. The hearing screening process, the documentation of hearing loss in medical records and the extent to which hearing loss is successfully managed in the hospital setting will be discussed. Acute hospital hearing screening is patient-centred and engages patients with hearing loss and their communication partners to develop both an immediate and longer term hearing loss management strategy. Engaging the individual in this way supports their health participation and decision making and ameliorates risk, but also provides a platform for hearing care to support rather than compete with existing public health priorities.
THE EFFECTS AND COSTS OF A HEARING SCREENING AND REHABILITATION PROGRAM IN RESIDENTIAL CARE HOMES FOR THE ELDERLY IN THE NETHERLANDS

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Objective. This study describes the effects and the costs of a hearing screening and rehabilitation program in eight residential care homes for the elderly. Intervention. The program consisted of recruitment (room visits), screening (pure-tone audiometry), consultation of the ear, nose, and throat specialist, and treatment by the hearing aid dispenser. Measurements. Participation of the residents (N=705) in the different components of the program was registered and the program costs were calculated. The primary effect outcome was the proportion of residents that benefitted from the program (scenario 1), with benefit defined as having purchased one or two hearing aids or having a prior hearing aid re-adjusted. The cost outcome was the costs per benefitting resident, calculated from the health care perspective as well as from the perspectives of the care home, hospital, hearing aid dispenser, and the residents. The effects and the costs of the program, if it had been offered exclusively to residents without (scenario 2) or exclusively to residents with a prior hearing aid (scenario 3), were assessed too. Results. Two-hundred forty-three residents (34%) participated in the screening and 222 (91%) of them were hearing impaired. Ninety-one (41%) of the screen participants with hearing impairment were willing to start rehabilitation. Forty-nine residents (7%) have benefitted from the program: 40 residents have purchased hearing aids, and nine residents had their prior hearing aid(s) re-adjusted. Hearing aid ownership among the hearing-impaired has increased from 28% at the start to 33% at the end of the program. From the health care perspective, the costs per benefitting resident were €1904 for scenario 1, €2559 for scenario 2, and €1193 for scenario 3. Conclusion. The willingness to participate in the screening and to start hearing rehabilitation was low. Consequently, the program was beneficial for only a minority of the residents.

SCREENING FOR HEARING LOSS AMONG OLDER AUSTRALIANS WITH VISION IMPAIRMENT: THE VISION-HEARING RESEARCH PROJECT

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The Vision-Hearing Research Project is a practical extension of findings from the well-known Australian Blue Mountains Eye Study. In the Vision-Hearing Project we are piloting a ‘hearing screening and education model’ in low vision clinics and collecting data to help inform policy in relation to dual sensory impairment. Three hundred clients with low vision aged 65+ years attending rehabilitation services at Vision Australia clinics participated in questionnaire interviews and a hearing screening test during 2010 and 2011. Data were collected on their perceptions of hearing difficulties, contact with services, quality of life, health history and social demographics. If participants were found to have ≥ 25dB HL at more than one of the tested frequencies (500-8000Hz) and to not already be receiving hearing services or wearing aids habitually, they were referred. These participants were advised about the availability of services, eligibility for government support when applicable, and practical implications of dual loss. They formed a follow-up cohort to be reviewed within 12 months to determine whether screening for hearing loss promoted use of hearing services/aids, or led to any positive improvements in quality of life. In this paper we will report the baseline data from the project including: a) the prevalence of dual sensory impairment among older clients attending low vision clinics; and b) the unmet need for hearing services among those with dual sensory impairment. Emerging data on participants’ perceptions of the value of hearing screening and barriers to help-seeking will also be raised.

SCREENING ADULTS WITH INTELLECTUAL DISABILITIES; IS SCREENING (FOLLOWED BY INTERVENTION) USEFUL?

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Background. A large proportion of adults with moderate intellectual disabilities (ID) suffer from hearing loss. We studied the prevalence and the effect of intervention (hearing aid fitting). Research question. Do hearing aids contribute to better communication and better quality of life in adults with intellectual disabilities and hearing loss, identified by hearing screening? Method. Altogether, 282 adults with ID were screened, 56 of them had a previously unknown permanent hearing loss, in excess of 35 dB HL. In 18 cases, the legal representative rejected hearing aid fitting and 6 subjects refused to wear hearing aids. Fourteen fittings are underway. After 6 months of device use, proxies of 16 fitted subjects assessed the benefit of the fitting, using a standardized questionnaire. Results. Hearing aids were fitted successfully, according to the NAL prescription rule. Questionnaire outcomes filled in by proxies were poor; hardly any benefit was noted. This outcome was significantly poorer than that of a group of 21 subjects with similar hearing loss and ID, that were identified by caregivers at the institutes and referred to our clinic. Conclusions. Prevalence of unidentified hearing loss amongst subjects with ID remains high. Surprisingly, many legal representatives didn’t give permission to treat. If treated, benefit of hearing aid fitting was low. Hearing screening is only useful if caregivers acknowledge the importance of hearing and verbal communication.
KEYNOTE LECTURE

LEARNING TO LISTEN AGAIN: THE ROLE OF AUDITORY TRAINING IN THE MANAGEMENT OF HEARING LOSS IN ADULTS

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Successful management of adult-onset hearing loss only begins with the use of hearing aids (or cochlear implants) to optimize auditory function. To optimize outcomes, systematic instruction in the use of technology and control of the listening environment as well as counseling aimed at enhancing participation, needs to be included. Further, optimal outcomes are dependent on learning to “listen” effectively with devices. While the listening skills can improve naturally, there is good evidence that adults can benefit from formal training. In this session, evidence from neurophysiologic, fMRI, and behavioral studies highlighting the neural plasticity of the adult auditory system will be briefly reviewed and data from the use of currently available training programs will be highlighted. Implications for current clinical practice and future research needs will be discussed.
BEYOND SCREENING

WHAT IF YOU CONDUCT A HEARING SCREEN AND FEW PEOPLE COMPLY WITH THE TARGETTED RECOMMENDATIONS?

Lafargue E

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Age related hearing loss is among the most prevalent chronic conditions affecting older adults, with its prevalence increasing and its impact on society growing. Unrecognized hearing loss diminishes the ability to communicate and its strong association with depression and cognitive decline increases and complicates its burden. As older adults continue to age in place, promoting health and preventive health care are emerging as areas of active concern in community based care, and a key principle of health promotion activities is matching preventive activities and recommendations with the individual’s lifestyle and health status. Using a mobile hearing test van, we screened the hearing of close to 1000 adults between of 60 and 90 years of age and completed comprehensive audiological evaluations on 200 persons who failed both tiers of a two tiered screening protocol. A lecture on hearing loss management preceded hearing screening at each senior center from which participants were recruited. Approximately one year post testing we attempted contacting those individuals undergoing complete evaluations to determine the proportion who complied with our targeted recommendations. For the most part, audiometric test results were consistent with age related hearing loss (ARHL). An unusually high number of individuals presented with single sided deafness (SSD), mixed and conductive hearing loss. The majority did not follow up with the targeted interventions. Hence the results of the one year follow-up were revealing in terms of the value of audologic screening, the approach to screening, and the obstacles to compliance be it a referral for medical management or some form of audologic intervention. Our findings led us to re-imagine a hearing screening protocol which might lead to increased compliance. Further, we considered the possible adverse effects of hearing screening given the consistent finding that most older adults fail to follow up with any or all recommendations.
ADULT HEARING SCREENING: FOLLOW UP AND OUTCOMES

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The Cyprus Pilot Adult Hearing Program targeted adults participating in pensioner organizations and municipality social activities. Over 2000 people had participated by November 2011. The referral rate for audiological/hearing aid evaluation was 43%. Referral for cerumen removal/medical evaluation was 17%. Participants who failed the hearing screening or reported difficulty in the questionnaire were offered suggestions for improving visibility of the speaker, seating suggestions for noisy environments, and assertiveness reinforcement. A questionnaire related to compliance with the referral recommendations and outcomes was completed by telephone for 133 randomly selected participants. Compliance with screening recommendations was overall high, however compliance with recommendations for hearing aid use was low (44%). Even two years after the initial referral, 56% of people referred for a hearing aid had not tried or used a hearing aid. Almost all people referred followed at least one of the screening recommendations (cerumen removal, hearing evaluation, hearing aid use). Screening reportedly had a severe impact on people’s decision to seek help based on recommendations. People found the screening helpful, thought that it should be offered to everybody, and stated that they would participate in a future screening. There seemed to be very few or no negative aspects to the screening process. The above findings indicate that Adult Hearing Screening offers timely identification to adults seeking help, in a manner that may encourage at least some action toward better hearing.

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) (EC FP7, contract No. HEALTH-F2-2008-200835.

MAXIMIZING THE BENEFITS OF COCHLEAR IMPLANTS FOR ADULTS WITH SIGNIFICANT BILATERAL HEARING LOSS THROUGH HEARING SCREENING

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Multichannel cochlear implants have become the standard treatment for acquired profound bilateral hearing loss. Auditory skills have improved with changes in technology, and indications have extended to include older adults, patients with significant residual hearing, and adults with congenital hearing loss.
Factors that have an impact on success include the duration of hearing loss, the age at onset of hearing loss, the surgical result, age, and structural changes to the cochlea. Improvements in auditory skills for many patients can be life-changing and over 90% of recipients show significant benefit. Despite this, there is a disparity between the number of adults in the community who could potentially benefit from cochlear implants and the number who use them. Studies in the UK and Australia estimate the proportion of adults with bilateral severe hearing loss as between 0.5 and 1%, but in Australia where cochlear implantation is well established, less than 0.05% (1 in 2000) have received implants. Reasons for this are unclear but some factors may be lack of knowledge, fear of surgery, a high proportion of elderly patients or even misleading information. An adult hearing screening program could identify many more adults who have the potential to benefit from implants. A screening program may also improve outcomes. If adults are identified with severe bilateral hearing loss earlier, they are unlikely to have a long duration of deafness, a factor known to be detrimental to outcomes. Similarly, if identified earlier, adults will be younger when they receive their implant thus mitigating some of the effects of age. Our recent study looked at the relationship between outcomes for elderly adults and early dementia. The findings indicated that early dementia leads to poorer outcomes and more difficult post-implant rehabilitation. This paper will present data supporting the benefits of adult hearing screening for cochlear implant outcomes.

**DEFICIT IN PHONOLOGICAL AWARENESS AMONG HEALTHY AGING ADULTS**

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Aging adults' deficit in speech perception is usually accompanied by an age-related reduction in auditory temporal processing (ATP). In several other populations, such as dyslexic readers and sleep deprived young adults, the reduction in ATP has been accompanied by a reduction in phonological awareness (PA). Although no complains regarding difficulties in PA or reading among aging adults are known, it seems that the same perceptual mechanism, i.e., ATP, underlies both speech perception and PA. Therefore, in the current study we tested whether the reduction in ATP among the elderly is also accompanied by a reduction in PA and reading. In order to measure the reduction in ATP and PA, and to assess its magnitude, we compared 35 healthy aging adults with age-normal hearing (age 60-86) with 40 dyslexic readers (age 21-32) and 40 normal readers (age 22-29). Aging adults had larger auditory temporal order judgment (TOJ) thresholds, as compared with normal readers, but shorter than dyslexic readers' thresholds. Aging adults' PA accuracy was lower than normal readers', and was comparable to the dyslexic readers' accuracy on these tasks. However, when asked to read words, aging adults were less accurate than normal readers but better than dyslexic readers. For reading in context (passage reading) no difference was found between aging adults and normal readers. Both groups were better than dyslexic readers. These findings show that aging adults have poor PA, in a similar severity to dyslexic readers. However, it seems that this difficulty does not affect their ability to read text in context. When most of the literature explain aging adults' difficulties in speech perception by age-related deficit in ATP, we suggest that poor PA might also be a factor explaining these difficulties.
RECREATIONAL AND OCCUPATIONAL NOISE

SPEECH-IN-NOISE TESTING AS A ROBUST AND SENSITIVE HEARING SCREENING TOOL FOR NOISE-INDUCED HEARING LOSS

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Background. Audiological screening of school-age children or noise-exposed workers is generally done by means of pure-tone threshold audiometry. However, reliable and valid screening results can only be obtained in a sound-proof room, using a high-quality and calibrated audiometer, and by a trained test administrator. Since a speech-in-noise test uses supra-threshold stimuli, the results are less influenced by the absolute presentation level and the test can be implemented as a quick automatic self-test via the Internet. We investigate the application of such a test for hearing screening in noise-exposed workers.

Aims. This study involves the development and validation of two types of screening tests based on speech intelligibility in noise, with an extra focus on high-frequency hearing loss. The sensitivity to detect mild high-frequency hearing loss is examined.

Methods. Two tests – one with digit triplets and one with CVC-words – were developed both in Flemish and in French. The speech materials were optimized by homogenizing the individual words with regard to their intelligibility. Norms were gathered for 50 normal-hearing listeners. Both screening tests and the traditional pure-tone screening audiometry were then compared to the results of a profound audiological examination in 122 noise-exposed workers.

Results. After optimization, steep slopes at the speech reception threshold (SRT) were observed for the reference psychometric functions (>15 %/dB). The SRTs were situated around -11 dB SNR, with small standard deviations (<0.8 dB) across the normal-hearing listeners. The test-retest (within-subject) variability of the SRT was within 1 dB. Measurements took less than 5 minutes per ear. Preliminary validation results show sensitivity and specificity values above 0.90 to detect mild high-frequency hearing losses (PTA3,4,6 > 25 dB HL).

Conclusions. Speech-in-noise tests with an extra focus on high-frequency hearing loss are a robust and sensitive hearing screening tool for (recreational or occupational) noise-induced hearing loss.
audiometry (both ears 0.5 - 8 kHz) at reporting to training and at discharge. In 2002-2005, after the introduction of a new MHCP, 839 male conscripts performed the same procedure completed with a questionnaire. Thresholds of 25 dB HL or more was considered a HI and a hearing decline of 15 dB or more between tests as a HD. In both studies a control-group, unexposed to military noise, was used. In the first study the incidence of HD during military service was 7.9% and the corresponding relative risk (RR) was 2.7 (CI=1.0-7.4). In the most noise-exposed sub-group, the howitzer platoons of the artillery regiment, we observed an incidence of HD of 23%. We also observed an elevated incidence of HD, in the sub-group with mild HI already at reporting to training, of 1%. In the second study after a stricter MHCP was introduced, we observed a tendency to lower incidence of HD (6.6%, RR= 1.8, CI=1.2-2.7) during service. The prevalence value of HI was 15% at reporting to training and 24% at discharge. The prevalence of tinnitus increased from 16% at reporting to training to 32% at discharge. The conscripts who had suffered from an acoustic accident during the training period had an elevated relative risk of HD, tinnitus and noise sensitivity at discharge. We observed an elevated risk of hearing impairment in both studies. We suggest improvements regarding the inclusion criteria in the Armed Forces and for education regarding the HCP.

TEMPORARY THRESHOLD AND EMISSION SHIFT AFTER MUSIC EXPOSURE

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In a laboratory setting the effect of a one-hour break in the music exposure was investigated with audiometry and otoacoustic emissions for 18 young, normal hearing subjects. Pure-tone thresholds and emission levels were measured after two different paradigms (same $L_{A,eq}$) three intervals after termination of the loud music. Individual patterns and group-averaged data are examined. Audiology is performed with an automated Hughson-Westlake procedure with 1 dB steps in order to measure small changes in audiometry. Preliminary analysis of the audiometric data show that the difference between conditions are not very large, that the effects are similar across frequency and that left and right ears react differently, especially with respect to the baseline situation. Although both ears seem to exhibit a comparable threshold shift, left ears seem to recover less fast than right ears. Statistical analysis and analysis of the OAE data are currently being performed and will be presented. Will OAEs lead to the same conclusions as the audiometric data?
INDIVIDUAL NOISE RISK-ESTIMATION ACCORDING TO ISO-1999 REQUIRES SUSCEPTIBILITY CORRECTION

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Individual susceptibility to age-related hearing loss and noise-induced hearing loss varies greatly due to an interaction of individual and environmental factors. Current noise guidelines, however, use a population-based metric to predict the risk of hearing loss and ignore the effect of inter-individual diversity. In the present study the effect of noise risk was determined by applying individual hearing thresholds to the risk algorithm described by ISO-1999. Per frequency an ‘age of hearing’ was determined, i.e. the age at which the median threshold value corresponds to a particular individual threshold, according to ISO-7029. This susceptibility-corrected metric was then applied to a population (N = 44) of screened workers at a paint fabrication facility in the Netherlands. Based on hearing threshold levels at 3, 4 and 6 kHz, it was shown that, using the proposed method the individual risk of having a 40 dB HL hearing loss at 60 years of age was underestimated in 64% of our population (average underestimation: 7% - SD: 4%). In 30% of our population, this risk was overestimated (average overestimation: 13% - SD: 11%) and in only 6% of our population the susceptibility-ignored risk corresponded with the susceptibility-corrected risk. The average population risk was not significantly different according to both algorithms (average susceptibility-ignored population risk: 33% - SD: 3%; average susceptibility-corrected population risk: 33% - SD: 10%). These findings emphasize the necessity of susceptibility correction for noise risk-assessment at an individual level.
HEARING LOSS AND MEDICAL CONDITIONS

COMORBIDITY IN HEARING IMPAIRED ADULTS: WHICH CHRONIC MEDICAL CONDITIONS ARE RELATED TO HEARING IMPAIRMENT?

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Background. Relatively little is known about the prevalence of chronic medical conditions in combination with hearing impairment (HI) (comorbidity). Studies about the relationship between HI and hypertension as well as diabetes showed contradictory evidence. Also an overview of the prevalence of other chronic medical conditions besides HI is lacking. The objective of the current study is to investigate which chronic medical conditions are related to HI. Materials and methods. Cross-sectional data of the National Longitudinal Study on Hearing (NL-SH) were used. The NL-SH is a large prospective cohort study via Internet in which both hearing impaired and normally hearing people between 18 and 70 yrs participate. Hearing ability was measured with the National Hearing Test, an online digit speech-in-noise test. In the subsequent questionnaire the presence of 27 chronic medical conditions was assessed. Both descriptive statistics and multinomial regression analyses were conducted. Results. More than 75% of participants with a poor hearing ability reported to have one or more other chronic medical conditions. Top three most reported chronic medical conditions besides HI were: 1) Infection of nose, sinus or throat (24.5%), 2) Hypertension (21.5%), and 3) Osteoarthritis of knees, hips or hands (19.9%). Participants who reported diabetes and those who reported dizziness with falling, had a two times higher odds ratio for having a poor hearing ability than good hearing ability. After adjustment for age and gender, no association was found between hypertension and HI. Conclusion. Chronic medical conditions are more prevalent among adults with HI than among their normally hearing peers. The mechanism underlying the development of hearing loss may be similar to that of developing diabetes. The use of medication could be a factor. This issue deserves attention in future research. Prospective longitudinal data of the NL-SH study might provide more insight about the causality of these associations.

SHORT-TERM LONGITUDINAL STUDY OF AUDITORY FUNCTION IN ALZHEIMER’S DISEASE AND MILD COGNITIVE IMPAIRMENT

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Background. Central auditory processing (CAP) dysfunction has been described in persons with Alzheimers’s disease (AD), and with mild cognitive impairment (MCI). MCI-persons have memory
problems and cognitive decline, but they do not fill the requirements for the diagnosis of dementia. However, many of these persons will develop dementia. A baseline study has been performed to investigate the central and peripheral hearing in patients with MCI and AD in early stage and in controls with subjective memory complaints, but normal cognition (SMC) (Idrizbegovic et al., 2011, Age Ageing, 40(2):249-54). **Aim.** To describe the first follow-up after 1.5 years after the baseline study. This period might be considered as a short follow-up, but the AD-patients could possibly be difficult to mobilize for an active participation after a longer period due to further decline of cognition. **Subjects and methods.** The total number of subjects was 104 (AD=32, MCI=40 and SMC=32). 81 subjects (78%) participated, and 66 completed the entire test protocol. They were tested with pure tone audiometry, speech in noise and dichotic digits tests (DDT). **Results.** Pure tone audiometry declined in all three groups in accordance to what can be expected by ageing. Speech in noise performance did not deteriorate in any of the groups. The DDT free recall test showed a significant decline in the AD group, left ear. The other two groups showed no decline. Seven patients developed AD during the study period, and they showed a decline of the DDT-function. **Conclusion.** The short time follow-up was long enough to disclose a CAP-decline in the AD-group, and in the subjects who developed dementia during this follow-up period. So, DDT is a suitable test to monitor the progress of AD.

MULTISENSORY DEFICIT IN INDIVIDUALS WITH LEBER’S HEREDITARY OPTIC NEUROPATHY (LHON)

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Leber’s Hereditary Optic Neuropathy (LHON) is a mitochondrial disorder which results in acute vision loss in early adulthood. Although primarily an optic nerve disease, some affected individuals have presented with additional neurologic abnormalities including multiple sclerosis, ataxia and dystonia. This study sought to establish whether hearing deficit is part of the spectrum of LHON-related deficits and to determine the perceptual consequences in affected listeners. Thirty-two individuals with vision loss and mtDNA mutations characteristic of LHON underwent a battery of monaural and binaural auditory assessments including: behavioral audiometry, electrophysiology (auditory brainstem response [ABR]), open-set speech perception (CNC-words) and binaural spatial processing (LiSN-S). A group of age, gender and hearing-level matched control subjects also participated. The LHON subjects enjoyed normal or near-normal sound detection but, in many cases, presented with abnormal auditory nerve function. Five of the 32 showed evidence of auditory neuropathy with absent ABRs despite the presence of repeatable cochlear microphonic potentials. In ears with recordable brainstem potentials, prolongation of neural conduction (wave I-V interpeak latencies) was common. Functional hearing was also affected. Monaural speech perception in quiet was only slightly impaired, but understanding in noise posed particular problems with approximately 1 in 3 LHON subjects showing CNC-phoneme scores below the normal 95% performance range. Furthermore, LHON listeners were impaired in their ability...
to use binaural cues to obtain a masking release in the presence of speech noise. These findings suggest that auditory consequences in individuals with LHON are relatively common and often severe. They add to the growing evidence that mitochondrial abnormality (manifesting in a range of neurodegenerative diseases) is a primary cause of auditory neuropathy. Early identification of auditory deficit in LHON is important as it is well established that combined visual and auditory impairment can have significant cumulative effects on functional status, independence and well-being if unrecognised.

**SYSTEMATIC REVIEW OF THE EVIDENCE BASE FOR A CAUSAL RELATIONSHIP BETWEEN WHIPLASH INJURY AND TINNITUS AND HEARING LOSS**

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**Introduction.** Epidemiological evidence demonstrating an association between whiplash and auditory symptoms has existed since the 1950’s. As the incidence of whiplash has risen (1-7/1000), so too have its auditory sequelae. Despite the long standing evidence of an association and the increasing burden of disease a pathophysiological link has not been widely reported. Existing review papers either have not addressed hearing loss and tinnitus, or failed to demonstrate any evidence for proposed pathological mechanisms. This review article aims to summarise the best current evidence for a pathophysiological mechanism linking whiplash with its auditory consequences in order to inform research and practice.

**Methods.** A literature search was performed in accordance with “the literature search process: guidance for NHS researchers”, which produced 126 results, from which 34 eligible publications were identified. Following full text review these yielded ten relevant articles. **Results.** Proposed pathophysiological mechanism for hearing loss following whiplash injury include auditory processing problems secondary to cerebral injury or parieto-occipital hypoperfusion; subliminal cochlear injury; cerumen impaction; perilymph fistula; stapes displacement; cervicoencephalitic syndrome resulting from injury to the craniocervical joint complex; and NOHL. While theories put forward to explain tinnitus following whiplash include Eustachian tube dysfunction as a result of temporomandibular joint dysfunction and degenerative cervico-spinal injury syndrome. **Conclusions:** The research published to date has identified several possible pathophysiological mechanisms, but has proven to be of variable quality - often underpowered, sometimes only anecdotal and so far no large scale prospective studies have been conducted. While it can guide future research, further investigation is needed to fully elucidate and substantiate a causal link. However, the work by Tjell et al. and Toor et al. does suggest that patients with a subjective hearing deficit following whiplash injury should be screened for APD using speech-in-noise testing, or an appropriate validated APD test battery.
PRESBYVERTIGO: DIAGNOSIS, PREVENTION, TREATMENT

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Presbyvertigo is characterized by a functional and structural decline in the vestibular, the optic and the musculoskeletal systems, respectively. It leads to gait and stance instability which finally can induce falls. Usually, balance maintenance is clinically assessed by screening tests (e.g., Tinetti’s test). There are other clinically proven tests (analysis of body sway) available which use a standardized test battery (gSBDT) to analyse the risk-to-fall (Basta et al. 2011a). The results of a double-blind, placebo-controlled clinical trial on presbyvertigo are presented and discussed (Basta et al. 2011b) and a technical screening system for presbyvertigo (VertiGuard HT) presented. Moreover, there is evidence in the literature that a careful dietary, drug intake and exercise regime can help to overcome the ageing effects in the affected body systems in part. The relevant literature will be reviewed and the interactions with hearing impairment discussed.

References:
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NEUROFEEDBACK IN THE REHAB OF PRESBYVERTIGO: A DOUBLE-BLIND, PLACEBO-CONTROLLED STUDY

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Vibrotactile neurofeedback training (NFT) is a novel rehab and prevention strategy in patients with presbyvertigo and related vestibular disorders. It is based on short-term intervention (over 10 days) which are to target postural instability and the tendency to fall. In a double-blind, placebo-controlled trial, 42 patients (65-85 yrs) with presbyvertigo were included. Using the VertiGuard NFT system, they trained over 10 days for 15 min each day. After the training, the DHI and VSS scores were reduced significantly (follow-up 12 months) and the body sway was reduced significantly in the intervention group. The placebo group (12 additional patients) showed no improvement. Vibrotactile NFT is a novel, promising approach to reduce the postural instability in presbyvertigo and to prevent falls in the elderly. In contrast to passive falls prevention programs based on counselling or self-exercises, the NFT strategy has proven efficiency with a limited period-of-intervention.

References:

HEARING IMPLANTS IN THE ELDERLY: WHY AND WHEN?

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Hearing loss in the elderly leads to a continuous hearing impairment with social consequences. The origin of the hearing loss is largely cochlear, but other sites-of lesion (auditory neuropathy, central degeneration, neurodegenerative disorders) play a role as well. Apart from the established rehab strategies (aural rehab, hearing aids), a number of hearing implants can be applied in this particular patient population. Active middle ear implants (MedEL Vibrant Soundbridge), cochlear implants or electro-acoustic systems are important tools to improve communication and prevent a social and cognitive degeneration. Based on a number of 45 implantees (65 – 84 yrs), the differential indication and surgical rehab strategies are outlined. Hearing implants are an ever-growing, important hearing rehab segment to meet the needs of the ageing Western population.

References:
MANUFACTURERS' UPDATE

IMPROVEMENT ON SPEECH RECEPTION THRESHOLD WITH RESOUND MINI MICROPHONE

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A primary problem for hearing-impaired people is understanding speech in background noise. Even though different directionality features in newest hearing aids improve signal-to-noise ratio in noisy listening situations it can still be a complaint from the hearing aid user because the signal of interest may not be in front as the directionality feature require, but instead come from behind. ReSound was the first hearing instrument manufacturer to introduce the 2.4 GHz ISM digital wireless transmission technology and its well-established advantages in hearing instruments. ReSound has recently introduced how the signal of interest directly can be received in the hearing aids with the wireless microphone: ReSound Unite™ mini microphone even when the signal is from behind. Two experiments: “SNR improvement with the ReSound Unite mini microphone” and “Effect of increasing distance on SNR benefit of the ReSound Unite mini microphone” show clearly that improvement can be achieved when using the mini microphone on speech reception thresholds in noisy listening situations. The test setup for both experiments emulated a non-ideal acoustic environment with reverberation, noise coming from all directions, and a speaker/signal of interest at varying distances as is often the case in real life listening situations. A Head and Torso Simulator (HATS) with an artificial mouth and the capability of being used as a transducer for the presentation of the Dantale II test sentences was used to represent a speaker/signal of interest. The ReSound Unite™ mini microphone has been shown to provide significantly more improvement on Speech reception thresholds tested in noise surrounding the listener and at different distances compared to a directional hearing instrument setting.

AUDIOLOGICAL AND QUALITY OF LIFE BENEFITS WITH OTICON MEDICAL PONTO BONE ANCHORED HEARING SYSTEM

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Bone Anchored Hearing systems are well established amplification option for conductive, mixed and profound unilateral sensorineural hearing loss. Since the entry of Oticon Medical in the bone anchored hearing field and its introduction of the Ponto bone system in 2009, many new developments in the design and performance of the sound processors have been witnessed. Most noteworthy of these developments are (1) digital noise reduction, (2) automatic adaptive directionality, (3) the Speech Guard compression system, (4) advanced feedback management, and (4) in situ audiometry. This presentation aims to review some of the published improvements and present new data on the audiological and
Quality of Life (QoL) benefits from two studies: a retrospective survey, and a prospective study, on some of these signal processing features in the Ponto bone anchored system. The need for more evidence on the non audiological QoL benefit will be emphasised.

OUTCOMES OF THE CLEARVOICE™ EVALUATION IN ADULTS

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Objectives. ClearVoice™ has been designed to improve speech understanding in difficult listening environments encountered in real life by cochlear implant users. An initial evaluation was conducted to collect adult feedback on the benefit of ClearVoice in various types of noisy situations. Subjects were simply switched over from HiRes 120™ to ClearVoice without further optimization of their program parameters. As further fine-tuning of these parameters could potentially enhance the benefits of ClearVoice, a follow-up evaluation is conducted to evaluate the impact of fitting the most comfortable levels. Methods. Adults were asked to use ClearVoice in two modalities (“medium” and “high”) and their usual program during one week each. Their experience with all three programs was assessed via questionnaires on demographics information, sound quality, speech perception and preference (questionnaires based on the APHAB). In the follow-up phase, the same subjects were asked to use both ClearVoice modalities again, but with most comfortable levels increased. Results. From the initial phase, 106 subjects were included across 17 centres and 53 complete datasets were analysed. Two thirds of the subjects (68%) preferred a ClearVoice program. All subscales scores as well as the global score from the APHAB results, were at least as high for ClearVoice programs as for the HiRes 120 program. Eight subjects were included in the follow-up phase. Five questionnaires were collected so far; among them four subjects participated in the initial phase and were using HiRes 120. Half of them preferred a ClearVoice program after the follow-up phase. Conclusion. The initial phase results obtained showed that ClearVoice is an efficient option to improve speech understanding in everyday life or in some noisy situations. Data collection is still ongoing for the follow-up phase.
Patient-related benefits for adolescents and adults, following treatment of permanent hearing impairment with hearing implant(s), may be longitudinally assessed through the use of commonly available self-evaluation tools such as the Health Utility Mark III scale, (HUI Mk III), a quality of life questionnaire and the Speech Spatial Qualities scale (SSQ), a hearing-disease specific questionnaire, to reflect the impact of hearing treatment upon the individual’s daily function. Cochlear has developed and launched in Sept 2011, IROS, an electronic online registry to enable and encourage clinicians and patients to voluntarily report the self-perceived benefits following hearing implant treatment with a Nucleus® Cochlear implant or Baha®, via a multi-lingual platform of evaluation tools and a locally accessed central database. In addition to the HUI Mk III and SSQ, patient profile characteristics and hearing threshold information may be recorded as desired at pre-implant and annual post implant intervals over three years for each registered implant recipient with each recipient acting as their own control. The importance of such a registry is in its potential to provide post-market surveillance data, that represents both self-perceived benefits and risks of hearing implant treatments provided in routine clinical practice. As such it may be applied to a much broader, non-select treatment population over longer observation periods than is practically possible through shorter-term small-scale clinical study evaluations. The registry data-set is aimed at complementing data sets gathered through more tightly controlled clinical studies, to help reflect recipients’ real-life outcomes which may be considered in support of clinical counselling and decisions for health service provision at local and national levels. The presentation will provide a brief overview to the registry status after several months experience in four Countries, the registered implant recipients and a summary of their subjectively perceived hearing status and quality of life at pre-implant.
KEYNOTE LECTURE

EVIDENCE-BASED PRACTICE IN AUDIOLOGY: REHABILITATION OPTIONS FOR ADULTS WITH HEARING IMPAIRMENT

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Hearing impairment has pervasive negative effects on the communication and quality of life of people with the impairment and on those around them. Adults with hearing impairment have a number of options that they can pursue to alleviate these negative effects and, in the current era of evidence-based practice (EBP), it is argued that shared decision making is essential so that patients can make an informed choice based on the evidence. This presentation will begin with an overview of the 5 steps in the EBP process: 1) Ask question, 2) Access the information, 3) Appraise the articles, 4) Apply the information, and 5) Audit the outcomes. Secondly, a summary of the evidence about two of the most common intervention options for this population (hearing aid fitting and communication programs) will be presented. These summaries are part of a new book called “Evidence-Based Practice in Audiology: Evaluating Interventions for Children and Adults with Hearing Impairment” edited by the presenter and Dr Lena Wong (Plural Publishing, 2012). Finally, research that has examined the choices made by 153 new adult patients when presented with these options using a tool that helps facilitate shared decision making (i.e., a decision aid) will be outlined. Almost half (46%) of the patients opted for hearing aid fitting, 18% for communication programs and 18% chose to take no action at this point in time. The implications of these findings for hearing screening programs will be discussed.
AHS 2012 - June 7 – 9, 2012 – Cernobbio (Lake Como), Italy

INTERVENTION STRATEGIES

A NEW WEB-BASED TOOL FOR GROUP AUDIOLOGIC REHABILITATION

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Evidence has been established regarding the benefits of offering group audiologic rehabilitation (AR) but still most audiologists are unfamiliar or uncomfortable with providing this service and do not offer group sessions in their practices. The international community associated with the Ida Institute identified the need for more information on the implementation of group AR. As a result, Ida convened a committee to study the issues related to group AR and developed an internet-based tool to supplement available books and articles on the implementation of group AR. The result was the creation of the Group Audiologic Rehabilitation Multi-Media Manual (GARMM). GARMM offers audiologists a framework allowing them to customize existing materials to match the needs of their client population and work setting. This framework is based on a four pronged approach: 1) The process for Group AR (how to lead and manage a group), 2) Group Content (what content to include along with examples and recorded demonstrations), 3) Populations (how to adapt materials for different age groups), and 4) Making it happen (financial concerns, issues related to unique practice sites). The web-based tool, designed to be interactive, combines suggestions for initiating group AR and is both theoretical and content driven. The manual uses a variety of approaches to enhance learning experiences including: group exercises, ethnographic videos, demonstration and suggestions for implementation. GARMM is available at the Ida institute website. Visitors to the site can search the project and download content as desired. Feedback is encouraged and a list serv is available for users to comment on the tool and make suggestions for future development. The use of GARMM is intended to help reduce the apprehension and anxiety audiologists might experience when they consider offering group AR.

HEARING REHABILITATION IN OLDER ADULTS: AN INVESTIGATION OF THIRD-PARTY DISABILITY AND INVOLVEMENT OF FAMILY MEMBERS IN REHABILITATION

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Research into barriers and facilitators to hearing rehabilitation in older adults highlights the critical role of significant others in the rehabilitation process. To investigate this further, this study aimed to describe the extent of third-party disability in a sample of spouses of older people with hearing impairment and to
investigate factors associated with third-party disability. Third-party disability is defined as the disability and functioning of family members as a result of the health condition of their significant other. One hundred older spouses who had partners with hearing impairment participated in this study. Spouses completed the Significant Other Scale for Hearing Disability (SOS-HEAR), the Relationship Assessment Scale (RAS), and the Significant Other Assessment of Communication (SOAC). The partners with hearing impairment completed the Self Assessment of Communication (SAC). Descriptive statistics were used to describe the extent of third-party disability, and binary logistic regression analysis was used to examine factors associated with third-party disability. This study showed that spouses of older people with hearing impairment experience third-party disability as a result of their partners’ hearing loss. Most spouses (98%) reported some degree of third-party disability on at least one item of the SOS-HEAR. Communication difficulties were the central source of stress reported by spouses, followed by emotional problems in the spouse. Three risk factors were found to be significantly associated with severe or complete third-party disability: lower relationship satisfaction as reported by the spouse (RAS), spousal age difference, and spouse perception of their hearing impaired partner’s disability (SOAC). These results reinforce the importance of including spouses in rehabilitation and possibly considering their perspectives when setting goals and choosing rehabilitation targets for the person with hearing impairment. Subsequently, a group of spouses participated in focus group interviews to explore the needs of family members in hearing rehabilitation and preliminary findings will be presented.

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VOLUNTEER SERVICES IN ADJUSTMENT TO HEARING LOSS

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Research has established that counselling and support helps people to adjust to hearing-aid use and an innovative way of delivering such counselling and support to new hearing aid users is through volunteer peer support programmes. Peer support programmes have successfully helped people to manage communication problems. In these contexts, volunteer peer support was particularly effective in enabling people to face health threats and develop coping strategies. The effectiveness of peer support in helping new hearing aid users, however, is unknown. Indeed, there is no consensus as to the meaning of effectiveness and hence, whether relevant measures should focus on audiological indices of hearing aid use and hearing acuity, or patient indices of social engagement, psychological well-being and/or other variables. We present findings from a qualitative study employing observational ethnographic, conversation and thematic analysis methods to identify the effectiveness for patients and volunteers of their encounters. We recruited volunteers from two UK NHS centres. Hearing Therapy volunteers service at Bath and North East Somerset Primary care Trust and Southmead Hospital Audiology department. These two settings were chosen to provide demographic contrast and variety in the activities undertaken by the volunteers. We included clinic based activity and home visits. One hundred and twenty observations of volunteer and patient encounters were made over a period of four months in nine
different community locations around the Bath and Bristol community area. These observations were supported by interviews with eleven volunteers and fourteen patients. From this data we identified key themes in the role of volunteers and identify what is valued by volunteers and patients. We will present these themes and discuss the role of voluntary support to audiology services.

EVALUATION OF THE ACTIVE COMMUNICATION EDUCATION (ACE) PROGRAM IN TWO SWEDISH SAMPLES

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The ACE program (Hickson et al. 2007) is a problem-solving interactive program with the primary aim of reducing participants’ communication difficulties in everyday life. It consists of five weekly two-hour sessions with six to ten participants and is designed for people with hearing losses, with or without hearing aids, and their significant others. The ACE program was translated and evaluated for two Swedish populations, people aged 87 year (n=23) and a population with a mean age of 69 years (n=49). Outcomes measured pre-post program were: communication strategy use, activity and participation, health-related quality of life and depression. Statistically significant improvements were found for communication strategy use and activity and participation for the younger population, whereas no statistically significant differences were found for the older population. Post program evaluations indicated that both populations found the program beneficial.
THE ICF CORE SETS FOR HEARING LOSS: FIRST RESULTS

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The World Health Organization’s International Classification of Functioning, Disability and Health (ICF) has adopted a multifactorial understanding of functioning and disability, merging a biomedical paradigm with a social paradigm into a wider understanding of human functioning. Altogether there are more than 1400 ICF-categories describing different aspects of human functioning and there is a need to developing short lists of ICF categories to facilitate use of the classification scheme in clinical practice. To our knowledge, there is currently no such standard measuring instrument to facilitate a common validated way of assessing the effects of hearing loss on the lives of adults. The aim of the project is the development of an internationally accepted, evidence-based, reliable, comprehensive and valid ICF Core Sets for Hearing Loss. Four preparatory studies were conducted to collect evidence for which ICF categories to use in the Core sets for hearing loss: a systematic literature review, a focus group study, an expert survey and a multi center study. Key outcomes of each of those studies will be briefly outlined.
Objective. Hearing impairment in older persons has often been associated with psychosocial problems. However, it is unknown whether the rate of decline in hearing is decisive for these problems. Additionally, it is unknown whether effects differ between various subgroups of older persons. This was investigated in the current study. Materials and methods. We used data of 1178 persons aged 57 years and older from three measurement waves (7 year follow-up) of the Longitudinal Aging Study Amsterdam. Hearing ability was measured with a speech-in-noise test (yielding a speech-reception–threshold in noise, SRTn). Psychosocial health was measured through self-report scales (depression: CES-D; social and emotional loneliness: De Jong Gierveld Scale; anxiety: HADS-A). Change scores of the SRTn and the psychosocial measures were calculated by subtracting T2 and T1 scores from T3 and T2 scores, respectively. Random coefficient analyses were used to test if the rate of change in SRTn was associated with the rate of change in psychosocial outcomes. Subgroup effects were tested using interaction terms. Results. A faster decline in hearing over time (a larger absolute increase in SRTn score) was associated with a stronger increase in both social and emotional loneliness (p<0.05). However, stratified analyses showed that the effects were only significant for certain subgroups (for instance, persons who lost their partner). We found no associations between change in SRTn and change in anxiety or depression scores. Conclusion. A faster decline in hearing caused stronger increases in loneliness in specific subgroups of older persons. Recently widowed older persons seem particularly at risk. The results of this study could contribute to the development of tailored interventions to prevent loneliness.
BARRIERS AND FACILITATORS TO HEARING AID UPTAKE IN OLDER FEMALES: A QUALITATIVE REPORT

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It has been reported that only 15% to 25% of people with hearing loss actually use hearing assistive technology such as hearing aids (e.g. Cohen-Mansfield & Taylor, 2004). The purpose of the current study was to use qualitative methods to investigate the facilitators and barriers to hearing aid uptake as reported by females with age-related hearing loss. Nine women between 60 and 75 years of age diagnosed with hearing loss were interviewed, five of whom had decided to get hearing aids while the remaining four had not. Through semi-structured interviews and thematic analysis, the overarching theme found was that there is a dynamic interplay of factors that influence each individual’s decision regarding hearing aid uptake. Within the dynamic interplay, four themes thought to influence the decision to obtain hearing aids emerged: self-perceived hearing, information gathering and informed decision making, influence of others, and cost. Some specific clinical applications of the results that have been identified are the provision of more unbiased sources of information, careful word choice of the clinician, and greater rapport building between the clinician and client.

‘DOCTORS MEETING DEAF’. THE RESULTS OF AN EPIDEMIOLOGICAL STUDY ON HEALTH RELATED QUALITY OF LIFE AND CO VARIABLES IN THE NETHERLANDS

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International research has shown that deaf adults have a significantly poorer quality of life than the general population regarding the physical and psychological domains. This is why some European countries have specialised health care facilities for deaf people. In the Netherlands such facilities are not available. We are presently performing a large epidemiological study into the quality of life of deaf and hard of hearing adolescents and adults in the Netherlands. For this we have developed an online method for using internationally validated questionnaires for hearing impaired people. This methodology enables participants to choose whether to fill out a written and/or a signed questionnaire. The WHO-QoL-BREF questionnaire, GHQ-12 questionnaire, Deaf Acculturation Scale (DAS) and a special medical and epidemiological questionnaire designed for this study were administered to 300 deaf and hard of hearing people and a hearing control group in the Netherlands. Due to the design of our study, we are able not only to make statements about the experienced quality of life of deaf and hard of hearing people in the
Netherlands, but also to evaluate quality of life in relation to (deaf) cultural, linguistic and epidemiological co-variables.

THE IMPORTANCE OF HEARING AND HEARING IMPLANTS FOR OLDER ADULTS FROM THE PERSPECTIVE OF A GERIATRICIAN

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The impact of the demographic change has not been recognized equally concerning the provision of medical care in senior citizens. Whereas as dementia and cognitive decline became one of the major topics in elderly care, sensory loss, especially decline of auditive functions, disregarding prevalence, are still stigmatized by the society, the senior citizens as well as by the health care professionals. Despite the poor acceptance of hearing aids there is tendency of elderly persons who would depend on hearing aids to maintain communication and social competence. Self-sufficiency in old age being the ultimate therapeutic goal in geriatrics, therefore mobility, stability, emotional equilibrium, continence, nutrition and cognition are looked into and targeted by a multiprofessional team. Often professionals do not recognize the prevalence of presbycusis and the options of treatment and care, and the elderly patient ignores the symptoms of an auditive decline. As a result, oral communication, as the basis of therapeutic interaction, becomes brittle. This could lead to frequent misunderstandings and behavioural changes (reduced compliance, inadequate reactions towards demands, lack of interest, social retreat, total isolation) as often experienced in dementia. All geriatric staff, as well as the caregiver, has to be educated concerning awareness (prevalence of presbycusis 52%, Lerch&Decker-Maruska 2007) and the need for handicap-adjusted communication skills. As hearing impairment implicates a relative risk factor of 2.4 for the development of dementia the differentiation between cognitive and auditive decline or their co-morbidity, in the elderly, becomes crucial. Therefore geriatric patients have to be screened for a hearing impairment before any cognitive testing (Lerch&Decker-Maruska 2009). From the geriatric perspective, staff education, increase of awareness, early screening and the most suitable augmentation of hearing (hearing aid, EAS, cochlear implant) matched with an age-adapted audio therapy, will ensure the benefit of geriatric care and rehabilitation in the elderly.
ELECTRIC-ACOUSTIC STIMULATION FOR PEOPLE WITH SEVERE-PROFOUND HEARING LOSS

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Electric-acoustic stimulation (EAS) refers to the provision of electric stimulation via cochlear implantation and acoustic stimulation via hearing-aid amplification. The two modes of stimulation can be implemented in opposite ears, sometimes referred to as bimodal fitting. Advances in technology have also made it possible for both modes of stimulation to be provided via a single device fitted to the same ear. Whereas the standard of care for people with profound deafness in both ears is electric stimulation in both ears or bilateral cochlear implantation, people with some residual hearing in one or both ears have the option of electric-acoustic stimulation in the same ear and/or in both ears. In this paper, we report 1) evidence on the benefits of bimodal fitting for people who use a cochlear implant in one ear and a hearing aid in the opposite ear; 2) the benefits of adding acoustic to electric stimulation in the same ear; and 3) clinical procedures for optimising performance with electric-acoustic stimulation. Implications for clinical management of people with severe-profound hearing loss will be discussed.

WORD COMPREHENSION WITH COCHLEAR IMPLANT IN SINGLE-SIDED DEAFNESS: EVIDENCE FROM LATE ERPs

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Patients with single-sided deafness experience communication penalties in everyday life as understanding speech in background noise as well as conversations on their deaf side are difficult. Cochlear implantation may be a possible treatment; however, it is unclear whether patients benefit from additional electrical hearing. Language comprehension with a cochlear implant often requires intensive rehabilitation. As comprehension in these patients is ensured on the healthy side, the cochlear implant-side has only restricted training possibilities which may pose serious limitations on the success. In the present study we present evidence from five patients with single-sided deafness who received a cochlear implant. All patients (33-50 years) had only a short duration of deafness prior to implantation (< 4 years). Within the first four days after first fitting we recorded EEG measures while patients were shown pictures. 600 milliseconds after picture onset we presented auditory words that were either a correct naming of the picture or not. Patients judged the match vs. mismatch of pictures and words. The auditory stimulation occurred either via the healthy or via the CI side, respectively. Presentation via the healthy ear revealed a more negative event-related potential (ERP) for incongruent as opposed to congruent stimuli starting at about 300 ms post-stimulus. This effect is commonly referred to as N400.
effect. Stimulation via the cochlear implant also elicited a more negative ERP for incongruent items in all participants; however with a greater latency. A subsequent measurement about ten weeks later already showed a latency reduction. The confirmation of an electrophysiological marker of word comprehension already few days after first fitting reveals rapid adaptive processes of the brain to the electrical hearing input and can be viewed as a success of the implantation. This corresponds to the subjective evaluation of the patients who all report a benefit after some months of CI experience.

HEARING AID SATISFACTION AND OUTCOMES FOR ADULTS WITH MILD HEARING LOSS

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Background. Only one in five persons with sensorineural hearing loss (SNHL) pursues amplification; many wait over 10 years after first noticing a hearing problem. The National Institute of Deafness and other Communication Disorders/National Institutes of Health has set an agenda to increase the accessibility and affordability of hearing healthcare (HHC) for patients, particularly those with mild and moderate SNHL to prevent its insidious effects. Purpose. To conduct a two-part study assessing past evidence for (systematic review, SR) and current levels of satisfaction with and outcomes for hearing aid wearers with mild SNHL (PTA<44 dB HL @ .5, 1, 2, & 4 kHz) who use varying levels of digital technology (postal questionnaires). Design. Systematic review and postal questionnaires. Study Sample. Adults with SNHL. Data Collection and Analysis. The SR searched databases for past studies reporting hearing aid benefit for adults with mild SNHL with findings submitted to meta-analysis. The Satisfaction with Amplification in Daily Life and the International Outcome Inventory for Hearing Aids, were sent to ~400 current entry-, mid-, or high-level digital hearing aid wearers with data submitted to ANOVA and multiple linear regression analyses. Results. Nine studies in the SR found significant benefits from amplification for patients with mild SNHL. A meta-analysis of five studies’ data produced a moderate effect size when adjusted for a small publication bias. The postal questionnaires revealed that hearing aid wearers with mild SNHL achieved satisfaction and outcomes similar to those with more severe degrees of hearing loss. Degree of loss, level of technology, and cost of hearing aids did not predict overall satisfaction or outcome. Conclusions. Adults with mild SNHL experienced outcomes similar to hearing aid wearers with greater degrees of loss, regardless of level of technology. The findings suggest future research needs and have implications for providing accessible and affordable HHC.
LISTENING TRAINING IN HEARING AIDS FITTING: INFLUENCE ON DICHOTIC LISTENING

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Functional modifications in the auditory system can be induced by auditory training. The training enables maximization of the neural system's ability to use the new signals provided by hearing-aids and can improve auditory rehabilitation. Nevertheless, in learning various sensory skills the behavioral learning might be specific to the trained stimuli, and show no generalization to non-trained stimuli. Thus certain forms of training might not be beneficial in everyday situations. Here auditory training that imitates daily conversations and provided experience of clear speech was tested as a method of enhancing auditory processing during hearing aids acclimatization. 36 elderly hearing impaired participants (age: 64-88) were fitted with hearing-aids. 27 participants were each provided with seven individual training sessions for one month. The purpose of the training was to stimulate the amplified ears by verbal auditory input. A control group of 9 participants were fitted with hearing-aids without training. The auditory processing changes were tested using dichotic listening tasks with no hearing aids.

Results. The non-dominant ears' scores improved significantly in both groups. The main effect of auditory training (as manifested in the differences between trained and un-trained participants) was on the dominant ears' scores: After 8 weeks of hearing aids use the scores of the dominant ears in the trained participants improved significantly while the scores of the dominant ears in the control group did not change. Conclusion. A relatively brief experience (altogether few hours) during listening sessions (45 minutes on each session) over the initial month after hearing-aids fitting, comprising of verbal auditory input in the clinic while using hearing aids, may improve the dominant ear speech discrimination scores in addition to the non-dominant ear.
IT AND HEARING HEALTH CARE

THE FAS-IT PROGRAM. FROM DETECTION TO INTERVENTION. REACHING AND TREATING PERSONS WITH HEARING DISORDERS USING MODERN INFORMATION TECHNOLOGY

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In a program grant from the Swedish Council for Working Life and Social Research we are investigating the use of modern information technology in hearing rehabilitation in a broad sense. We use the Internet in this research when we study hearing impaired persons from when the loss is detected to when intervention is implemented. In the research we intend to survey online resources, implement self-screening both in terms of self-assessments and actual hearing screening on the Internet, use online cognitive tests, use the Internet for medical support system aimed to be integrated in health care, test if motivational interviewing methods can be used to facilitate the decision process when seeking treatment, develop and test online counselling for hearing impaired persons, use more open-ended qualitative methods to probe the experiences of acceptance versus experiential avoidance, and finally develop and test web resources for significant others (e.g. parents of children, adult children of older adults without access to the Internet). The program is divided into nine subprojects that are at different stages of their execution. This presentation will give an overview of the activities and outcomes so far in the FAS-IT program.

SCALABILITY OF POST-OPERATIVE CARE FOR CI-RECIPIENTS

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The number of CI recipients is growing exponentially – 20,000 currently in Germany will have tripled to 60,000 in 2020. Extrapolating this on a worldwide basis means that 240,000 will have grown to 720,000. The necessity to provide adequate life-long care for all CI recipients – comprising regular speech processor fitting, rehabilitation and counseling - is indisputable. The need to fundamentally change the structure of the care-giving system is evident. Economical restrictions will not allow for additional personnel to be hired in existing clinics and rehabilitation centres, not for new centres to be established or for manufacturers to expand their service teams dramatically. This applies to practically all fields of healthcare and therefore rescaling of public and private health care has become a crucial issue. The recent development of Internet-based technologies and organizational models promise new
dimensions of scalability. Examples of cloud-computing in health care exist already and prove to be effective (see SynX platform presented by Microsoft in March 2011). The future is for CI systems reporting “online” about their functionality and about eventual problems, receiving online instructions how to fix the problem or suggest competent resources where to find a solution. Technically feasible already today and partly implemented are
- Registration online
- Share intra-operative measurement data to create first maps
- Tele-fitting (experienced expert maneuvers the software programme on the hardware of the less experienced in another location)
- Remote support (experienced therapist counsels less experienced via Skype and video camera)
- Exchange of experience amongst parents and experts in LiveOnline Rooms across countries and language barriers
- Online consultation of surgeons, therapists and other experts for parents seeking advice

Examples of current practice will be demonstrated.

DR GOOGLE: QUALITY AND READABILITY OF ENGLISH-LANGUAGE INTERNET INFORMATION ON HEARING IMPAIRMENT AND HEARING AIDS

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This study evaluated the quality and readability of English-language Internet information for adults with hearing impairment and their significant others. Two keyword pairs (hearing loss and hearing aids) were entered into five country-specific versions of the most commonly used Internet search engine in May 2011. For each of the 10 searches, the first 10 relevant websites were included. After removing duplicates, a total of 66 websites were assessed. Their origin (commercial, non-profit organisation, or government), date of last update, quality (Health On the Net -HON- certification and DISCERN scores), and readability (Flesch Reading Ease Score, Flesch-Kincaid Grade Level Formula, and Simple Measure Of Gobbledygook) were assessed. Most websites were of commercial origin and had been updated within the last 18 months. Their quality and readability was highly variable. Only 14% of the websites had HON certification. Websites that were of non-profit organisation origin had significantly higher quality scores. Readability measures show that on average, only people with at least 11-12 years of education could read and understand the Internet information presented. Based on these results, this presentation provides recommendations for website developers and clinicians wishing to incorporate Internet information into their practice.
THE APPLICABILITY OF AN INTERNET-BASED SPEECH-IN-NOISE SCREENING TEST IN OCCUPATIONAL HEARING CONSERVATION

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The Dutch national hearing association has developed an internet-based hearing-screening test: Earcheck. This test is an automatic adaptive speech-in-noise test using nine different CVC words presented in stationary noise. Earlier work in our laboratory showed that the use of a low-pass filtered masking noise increased the test sensitivity to 95% and specificity to 98% to discover NIHL in a study sample of 100 subjects with different degrees of high-frequency hearing loss. This speech-in-noise test could be a valuable addition to screening audiometry in a hearing conservation program for noise-exposed employees, in the construction industry for instance. Regular occupational screening audiometry in this sector has its difficulties in attaining the entire population at risk, because of the widespread and very transient workforce in the construction industry. The internet-based application of Earcheck has the advantage of domestic usage, which can lead to higher participation rates. In the current study, the value of Earcheck in discovering (beginning) noise-induced hearing loss in addition to regular audiometry is investigated. Therefore, Earcheck results of 400 construction workers are compared to their screening audiograms. The obtained test reliability, sensitivity, and specificity in this occupationally exposed population will demonstrate the value of Earcheck as a screening tool for occupational NIHL.
CENTRAL AUDITORY PROCESSING AND COGNITIVE FUNCTION

N. 1 - THE EFFECT OF AGING ON TEMPORAL AND NON-TEMPORAL PROCESSING IN A LONGITUDINAL DESIGN

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Previous cross sectional studies have shown an age-related decline in temporal processing. However, it is not clear whether this decline is specific to temporal processing, or rather it represents a general decline in the perception of auditory stimuli. Moreover, all of the current studies measuring the effect of age on temporal processing were carried out in a cross sectional design. However, some researchers have noted that different results can be obtained from longitudinal as opposed to cross sectional designs. The aim of the current study was, therefore, twofold: (1) To test aging effect on temporal and non-temporal processing. (2) To measure age-related decline in temporal processing using a longitudinal design. Forty-nine adults aged 30-89 performed auditory temporal processing (Temporal Order Judgment, TOJ) task, and non-temporal processing (intensity discrimination) task. To control for individual differences in hearing level, all stimuli were delivered at 40 dB HL. The tests were performed twice with a gap of seven years between. When testing age effect on temporal and non-temporal processing, significant correlation was found between age and TOJ threshold (r=.287, p<.05), but not between age and intensity discrimination threshold (r=-.095, p>.05). When first and second testing were compared on the same participants, TOJ threshold increased from the first (M=75.64 msec, SD=46.801) to the second testing (M=101.78 msec, SD=66.716; t=-2.805, p<.01), as was reported by previous cross sectional studies. The findings suggest that age-related decline in auditory processing is specific to the temporal domain and does not reflect a general decline of auditory processing. Moreover, we showed that for auditory temporal processing, longitudinal design show similar age-related decline, as in cross-sectional designs.

N. 2 - PATTERN AND RATE OF CHANGE IN AUDITORY TEMPORAL PROCESSING AND SPEECH PERCEPTION WITH AGING: A COMPARISON BETWEEN CROSS SECTIONAL AND LONGITUDINAL STUDIES

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Aging was found to be negatively associated with auditory temporal processing. This association is accompanied by the age-related decrease in speech perception. Most of the studies testing age-related...
decrease in auditory temporal processing and speech perception are cross-sectional. These studies mostly point on a difference between age groups in auditory temporal processing threshold and speech perception accuracy. However, the magnitude of change in these abilities across different age groups was not reported. Moreover, the literature suggest that there is a difference between findings obtained from cross sectional as opposed to longitudinal designs. The current study therefore addresses two questions: (1) what is the rate of age-related changes in auditory temporal processing and speech perception?; and (2) is there a difference in the pattern of age-related changes in auditory temporal processing and speech perception between longitudinal and cross-sectional designs? Sixty participants, aged 30 to 89 years were tested seven years ago and again few months ago on auditory temporal processing and speech perception tasks. The rate of change for auditory temporal processing was not correlated with age and remained the same for all age groups. However, the magnitude of decrease in speech perception was larger as people aged. Cross sectional and longitudinal designs revealed similar pattern of results for speech perception, with the larger decrease between the younger (age 30-49) and middle aged (age 50-69) groups to the elderly (age 70-89). However, while cross sectional design revealed that the larger decrease in temporal processing was between the younger group to middle age and older groups, longitudinal design point on similar reduction in this ability between all age groups. The literature of cross-sectional versus longitudinal designs will be reviewed and discussed in light of findings the current study’s.

N. 3 - FACTORS INFLUENCING INFORMATIONAL AND ENERGETIC MASKING IN OLDER ADULTS

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When a speech signal is presented in the presence of a competing speech signal, several processes may interfere with the understanding of the target speech signal. These include both energetic and informational masking. Informational masking, however, is not a unitary phenomenon. Contributions to informational masking arise from the semantic meaningfulness of the competing speech and the perceptual segregation of the target speech stream from the competing speech stream. Successful segregation forces the listener to suppress the competing speech stream or process both streams simultaneously. Some research has indicated that elderly normal hearing and elderly hearing-impaired listeners are more susceptible to informational masking and less effective at using certain segregation cues. An experiment was designed to investigate the contributions of semantic and specific acoustical content of competing speech to informational masking among young normal-hearing, elderly normal-hearing, and elderly hearing-impaired listeners. For hearing impaired listeners, spectral shaping was applied to the target and masker to ensure full auditory. Participants complete closed-set identification of words in sentences presented in quiet and with various maskers. The maskers all have the same long-term average spectrum and level and include: (1) a competing talker; (2) a time-reversed version of the competing talker; (3) steady-state noise modulated by the envelope of the competing talker sentences; (4) steady-state noise modulated by the envelope of the time-reversed speech; and (5) steady-state noise
without the temporal and spectral variations of the competing speech. The measuring paradigm also permits analysis of the time course of errors during the presentation of the competing sentences and analysis of the intrusions of competing words into the target sentence. Results will be discussed regarding age group differences in the factors underlying informational masking.

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N. 4 - HEARING LOSS AFFECTS PERFORMANCE ON THE MONTREAL COGNITIVE ASSESSMENT (MOCA)

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A potential pitfall of cognitive screening tests for dementia is that many of the to-be-repeated or to-be-remembered stimuli are presented orally. As a result, participants with compromised auditory processing may receive artificially low scores on these tests. The Montreal Cognitive Assessment (MoCA) is gaining popularity as a screening tool because of its sensitivity and specificity for detecting mild degrees of cognitive impairment. In the current experiment, the MoCA was administered to 300 older adults recruited by newspaper ads (M = 71 years, SD = 7.4). Participants were divided into normal hearing (N = 165) and hearing loss (N = 135) groups based on pure-tone averages. Total MoCA scores (/30) were determined for each participant. We also calculated one score that eliminated the digit span, vigilance, and sentence repetition items (/25) and a second score that eliminated the digit span, vigilance, sentence repetition, and delayed recall items (/20). We then calculated new pro-rated cut-off scores and examined which proportion of the normal and hearing loss groups passed or failed the cut-off. Overall, the pattern of results indicates that when the new cut-off scores are used, the number of participants who score above the cut-off increases from 54% (/30) to 72% (/25) and 91% (/20). When participants are divided into normal hearing and hearing loss groups, the number who pass the cut-off differs when the traditional total score /30 is used (good hearing: 60%; hearing loss: 46%), but the number who pass becomes more similar if the /25 score is used (good hearing: 77%; hearing loss: 67%) and the number who pass is identical when the /20 score is used (91% for both groups). These data highlight the importance of considering auditory processing when examining scores on a standardized neuropsychological screening measure such as the MoCA.

N. 5 - MISMATCH NEGATIVITY AND ERP-LATENCIES IN PATIENTS WITH ALZHEIMER’S DISEASE AND MILD COGNITIVE IMPAIRMENT

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Background. Cortical auditory event-related potentials (ERPs) provide a mean of neurophysiological testing of the central auditory function. Mismatch Negativity (MMN) is a component of ERP that gives
information about the pre attentive stage of auditory processing. Central auditory processing dysfunction has been described in patients with Alzheimer’s disease (AD), and is evident even in patients with mild cognitive impairment (MCI) (Idrizbegovic et al, 2011, Age Ageing, 40(2):249-54). The aim of the study was to investigate patients with cognitive dysfunction with ERPs, in particular MMN. The study was carried out within the framework of the investigation of patients with early AD, MCI and subjective memory complaints without cognitive decline (SMC). The baseline study and the first follow-up performed after 1.5 years are included. Method. ERPs were carried out with 500 tone pulses at 80dBnHL. Each sequence included 80% standard tones (500 Hz) (f), and 20% deviant tones (1000 Hz) (r). Two main test parameters were analysed: 1) The MMN, two comparisons of (f) and (r) recordings, amplitude and enhancement, and 2) Measurements of absolute and interpeak latencies. Results. The MMN-amplitudes of the left ear were around 200 nV for the SMC- and MCI-groups, and 156 nV for the AD-group. For the right ear there were no group differences regarding the MMN-amplitude. The amplitude differences between the AD-group and the other two groups were statistically significant. There were distinct differences between the enhancement measurements between (f) and (r) recordings. There were no enhancement differences between the three groups. No consistent latency-differences were observed. At the follow-up there were no consistent differences between the three study groups.

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Objective. Most older adults typically experience difficulties in hearing and understanding conversations due to the effect of aging on peripheral, central-auditory, and cognitive processing. This effect of aging varies among individuals, and therefore, examining aging-related changes in each processing type is important. The dichotic listening test (DLT) is widely used for evaluating central auditory processing and examines bottom-up lateralization and top-down attention processing. Most older adults show difficulties to direct their attention toward the left ear because their top-down attention control declines with aging. However, the relationship between this decline and everyday listening is not clear. The aim of this study was to investigate the relationship between central auditory processing in aging and hearing handicap in everyday life in older adults. Method. The study included 8 older adults (age 61–74 yr). The pure-tone average of all the subjects was less than 40 dBHL, and the Japanese syllable intelligibility test scores were greater than 84% for both ears. All the subjects underwent the DLT, Japanese Hearing in Noise Test (HINT-J), and a self-assessment inventory for hearing. During DLT, they were specifically instructed regarding the direction of attention: forced left ear (FL), forced right ear (FR) and non-forced (NF) attention conditions. The inventory involved self-assessment of speech perception under favourable as well as unfavourable listening conditions and of recognition of environmental sounds. Results. During DLT, 4 subjects provided considerably fewer correct assessments in the FL condition than in the FR and NF conditions. They scored poorly in HINT-
J, and hearing inventory analysis showed that they had slight hearing difficulties in everyday life. However, the remaining subjects did not show significant differences in the FL, FR, or NF conditions. Furthermore, they did not have low scores in HINT-J or hearing handicap in everyday life. **Discussion.** Decline in top-down attention control with aging may be a factor responsible for hearing difficulties in everyday life.

**N. 7 - UTILIZATION OF SEMANTIC NETWORKS IN THE IDENTIFICATION OF ENVIRONMENTAL SOUNDS BY INDIVIDUALS WITH HEARING IMPAIRMENTS**

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**Purpose.** Cummings et al. (2006) suggested the existence of semantic networks between environmental sounds (ES) and visual contexts in experiments on people with no hearing impairment (NHI). However, there are no studies that discuss the semantic networks in relation to ES as in individuals with hearing impairments (HI). Semantic networks can be examined by using the priming paradigm, and reactions are faster when the prime and ES fit together. This report discussed cognitive strategies on ES identification by individuals with HI, based on the utilization of semantic networks. **Methods.** There were ten people with NHI and five people with HI. In this study we examined conceptual priming using nine kinds of ES (target) and nine kinds of visually displayed sound sources (prime). Participants judged whether the picture and the sound fit together and pressed buttons. The reaction time was measured as the interval from sound presentation to the instant when the button was pressed. **Results.** In participants with NHI, the reaction time was faster when the picture and the sound fit together. On the other hand, the tendency was different for each stimulus in participants with HI. The reaction time was faster when the picture and the sound fit with regard to artificial sounds but it was reversed for transitory sounds. During the interview after the experiment, most of the participants with HI reported that the identification of transitory sounds was difficult. **Discussions.** The results suggested that the activation of the network was caused by prime promoted processing and confirmed semantic networks between ES and pictures in the case of participants with NHI. Individuals with HI as well as participants with NHI recognized semantic networks utilizing ES if identifying the sound was easy. However, if the identification was hard, they were more likely to use other strategies to recognize ES.

**N. 8 - MUSIC DISCRIMINATION PERFORMANCE IN ELDERLY PERSONS**

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Objective. As a part of rehabilitation programs for elderly individuals, varieties of musical activities are usually provided in many institutes. Abundant research on speech and/or environmental sound perception associated with the aging process comes in hands, but a few on music perception. The aim of this study was to identify the characteristics of music perception in elderly persons. Methods. Nine subjects aged 61-74 years whose PTA were within 35dB with no other disorders and ten young normal hearing adults age of 20-22 years as a control participated in this study. A total of 40 pairs of musical patterns using MBEA, The Montreal Battery of Evaluation of Amusia, were presented at a comfortable level of the subjects via a headphone. All subjects were asked to identify whether two musical patterns were the same or different. Correlation between the music discrimination performance and individual factors such as cognition, attention, memory, and speech perception were investigated. Results and Conclusions. The elderly persons scored 72.5% accuracy while the young ones scored 81.3%. The correlation between music discrimination ability and cognition, attention, memory, and speech perception was assessed. Further studies are needed by increasing the number of participants. These results may indicated that the music discrimination ability could not be deteriorated by aging while the higher cortical function may be degraded.

N. 9 - PSYCHOLOGY OF DEAFNESS AND CREATIVITY

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Deafness can generate significant negative psychological effects ranging from annoyance, frustration, embarrassment, markedly negative insights to frank organic depression and psychoses. Beethoven’s deafness has been under intense research in this respect but virtually no work has been done as regards the painter Goya, the acknowledged Spanish genius. This presentation studies his life and works for the first time who was afflicted with severe to profound hearing loss and the psychological effects that deafness had on him. His pre and post deafness work is analysed vis a vis his psychological reactions to show that his post deafness art form was more prolific, more intense, more creative and broke existing traditions. Indeed, these works came out of the inevitability and standard norms of the respective art form prevalent at that time and ushered in a revolution. In fact, his post deafness creations heralded future movements in the art genres, way ahead of his times and enthralling human civilisation for an eternity. Deafness in a creative genius appears therefore to directly initiate a positive attribute in his art form. Following the deafness the genius’ expression through his art becomes more complex, more spiritual and more technically advanced. This is his way of channelizing negative psychological effects to a positive creative energy in order to rise above his affliction, fight the adversity and nourish the indomitable human spirit. An explanation is proposed to explain this change in the art forms before and after deafness in Goya. Over stimulation of cross modal cortex is well recognised in deafness especially heightened visual awareness. It can be logically speculated that this great artist developed the attribute of synaesthesia to explain his post deafness brilliance driven by his psychological turmoil.
ASSESSMENT OF AUDITORY FUNCTIONALITY

N. 10 - PRESTO: DEVELOPMENT AND PRELIMINARY FINDINGS WITH A NEW HIGH-VARIABILITY SENTENCE RECOGNITION TEST ACROSS DIVERSE LISTENER GROUPS

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Traditional tests of spoken word recognition were developed to balance phonetic or phonemic content, with the view that variability in the speech signal was irrelevant. However, the ability to rapidly adapt to variability in the speech signal is a core, fundamental characteristic of human speech perception processes. In addition, individual differences in this core ability complicate predictions of treatment efficacy for people with hearing loss. Thus, new assessments are needed to better understand individual differences in speech perception under adverse conditions. The Perceptually Robust English Sentence Test Open-set (PRESTO) is a new sentence test that incorporates high levels of variability to address underlying mechanisms of speech perception beyond audibility. To better approximate real-world adverse listening conditions, PRESTO contains variability in talker (e.g., gender, dialect) and sentence characteristics (e.g., syntactic structure, length). Initial research investigated PRESTO’s sensitivity to individual differences in speech perception and its use for diverse populations (normal hearing young adults, adults with a hearing loss, and normal hearing adult non-native learners). Further testing examined the reliability of performance on PRESTO and provided a comparison with more conventional HINT sentences. Results indicated that PRESTO was a valid measure for assessing individual differences in speech recognition under adverse conditions. All groups displayed a wide distribution of performance on PRESTO. Individual performance on all noise conditions and overall was significantly correlated, suggesting that individual differences remained stable across levels of audibility. Performance on HINT sentences was significantly better than PRESTO sentences for hearing-impaired and non-native listeners, and for normal-hearing listeners at moderate SNRs. Results provide further evidence that individual differences in speech perception in adverse listening conditions are important to understand in order to enhance speech perception in auditory rehabilitation therapies of individual listeners. Clinical implications and future directions for translational research utilizing PRESTO and its theoretical bases will be discussed.

N. 11 - SELF-EFFICACY FOR SITUATIONAL COMMUNICATION MANAGEMENT QUESTIONNAIRE (SESMQ): DEVELOPMENT AND PSYCHOMETRIC PROPERTIES

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The Self-efficacy for Situational Communication Management Questionnaire (SESMQ) measures perceived self-efficacy (PSE) for managing everyday communication for adults with hearing loss. The theoretical basis for the questionnaire is Bandura’s (1977) theory of PSE. For this instrument, PSE is defined as “an individual’s judgment in his/her capabilities to mobilize the motivation, cognitive resources and courses of action needed to meet the demands of the range of everyday difficult listening environments” (Jennings, 2005). The SESMQ contains 20 situations that are rated on two scales (hearing, PSE). Respondents rate how well they can hear from 0 (not well at all) to 10 (very well) and their degree of confidence in managing the situation from 0 (not confident at all) to 10 (very confident). Total scores on each scale range from 0 to 200; higher scores indicate greater hearing ability or PSE. Psychometric properties were determined using data collected from the National Centre for Audiology (London, Canada) and the Communication Disability Centre at the University of Queensland (Brisbane, Australia). Participants were 338 adults aged 50 to 93 years with an average high frequency pure tone hearing loss in the better ear of 46 dBHL; 157 participants owned hearing aids. Both scales exhibited high internal consistency (α = .93 for the hearing scale and α = .94 for the PSE scale). A one factor solution was found to be optimal for each scale: the single variable accounted for 58% of the variance for the hearing scale and 56% of the variance for the PSE scale. Test-retest reliability on a subset of 40 participants resulted in Pearson’s correlation coefficients of .87 for the hearing scale and .89 for the PSE scale. The SESMQ may prove to be useful as an outcome measure in research and clinical practice.

N. 12 - APPLICATION OF UNIVERSAL DESIGN PRINCIPLES TO THE DEVELOPMENT OF AN ASSESSMENT TOOL FOR HEARING ACCESSIBILITY

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Measures of accessibility typically focus on the physical environment and aspects relating to getting in to and out of spaces. The transient sound environment is less well characterized in typical accessibility measures. In order to address this, we have developed a set of six principles that can be used to evaluate hearing accessibility of a space. These principles are derived from principles of universal design and include (1) Optimization of the hearing environment for all; (2) Optimization of interactions between persons and objects to promote better hearing in an environment; (3) Optimization of opportunities for people to have multiple choices of interactions with one another; (4) Optimization of opportunities for people to perform different activities in and across environments; (5) Optimization of opportunities for people to have safe, private, and secure use of the environment while minimizing distraction, interference, or cognitive loading; and (6) Optimization of opportunities for people to use the environment without extra steps for hearing access during preparatory, use and/or after use phases. We
are developing a website that can be used as a training site for the application of these six principles of universal hearing design to assessment of the auditory accessibility of, for example, public buildings, classrooms, and work environments. Our poster will describe these six principles and how they can be used.

**N. 13 - THE SUN TEST (SPEECH UNDERSTANDING IN NOISE) IN DIFFERENT LANGUAGES: TEST DEVELOPMENT AND FINE-TUNING**

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The Speech Understanding in Noise (SUN) test is a novel speech-in-noise test specifically developed for adult hearing screening. The test is based on recognition of a list nonsense speech stimuli in background noise. Results obtained both in controlled ambient noise (default settings) and in high ambient noise (field testing) show the potential of the SUN test to be used for adult hearing screening. The SUN test was developed for the Italian, German, English, and French languages. The Spanish and Mandarin versions are currently being developed. More than 2,000 subjects were involved in the fine-tuning and evaluation phases in the different languages and in a variety test settings, both in low and in high ambient noise. More than 4000 subjects were screened with the test in the Italian language. In this presentation, the main steps taken in the design and development of the SUN test in the different languages will be reviewed, the main results obtained in the different languages will be illustrated, and some directions for current and future developments will be discussed.

**N. 14 - ASSESSMENT OF SPEECH PERCEPTION IN A VIRTUAL SOUNDSCAPE**

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Improvement in auditory perception is a center objective of therapeutic interventions for the hearing impaired. Numerous tests are proposed to guide these interventions and assess their benefits. Optimally, these tests should explore complex abilities such as those encountered by hearing impaired persons in
daily life. The Hearing In Noise Test (HINT) is based on the repetition of sentences against a 65 dBA speech spectrum noise coming from the front, right or left side. The test has been standardised as an adaptive procedure to determine a speech reception threshold (SRT); in clinics it is frequently administered with predetermined signal to noise ratios (+10, +5, 0 dB). While sentences appear as a realistic daily stimulus, one can argue that a speech spectrum noise issued from fixed positions with variable or arbitrarily predetermined signal to noise ratios can be far from real life. Yet, it is possible nowadays to recreate realistic soundscapes through multichannel AV systems. This project proposes to develop a virtual environment that will reproduce common sound experiences and support a more realistic testing condition to assess speech perception. The pilot project is based on a 6-channels system where multichannel recordings of common daily environments are presented through speakers equidistantly placed on a horizontal 220° arc. Sound level samples were taken at the recording sites to set the noise level and the signal to noise ratios for each environment. Six subjects (3 normal hearing, 3 hearing impaired) were assessed with the HINT in each virtual environment. Their performance was compared to the results obtained with the test administered in the most conventional clinical mode, that is with the speech spectrum noise at 0° and fixed signal to noise ratios. Results will be presented, emphasising the difference between testing in a conventional clinical environment and in a virtual soundscape reproducing real life environments.

**N. 15 - VALIDATION OF A MOBILE STORAGE DEVICE BASED SELF-ADMINISTERED HEARING SCREENING TEST IN NORMAL HEARING SUBJECTS**

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Home screening for hearing loss among the elderly population may appeal to individuals reluctant to seek evaluation in a medical facility. These tests are now available as applications for mobile storage devices, such as Smartphones, for use anywhere. The aim of the present study was to validate the uHear™ (by Unitron) self-administered hearing sensitivity screening test application developed for iPhone/iPod. **Methods.** The manufacturer’s instructions advise performing the test in a quiet room (QR) using insert (IP) or over-the-head (HP) earphones. Pure-tone stimuli are delivered at frequencies of 250, 500, 1000, 2000, 4000 and 6000 Hz, and the threshold is self-determined. Hearing is categorized as normal or indicative of mild, moderate, severe and profound loss. Twenty normal-hearing adults, 20-30 years old, were tested in four conditions: IPs and HPs in a QR (average ~49 dBA) and IPs and HPs in a soundproof room (SPR). The results were compared to those of their findings by traditional audiometry. **Results.** uHear™ thresholds measured in a SPR had an 85.4% correlation with audiometric thresholds, whereas those measured in a QR had a 55% correlation. The correlation was 31.3% at 250 Hz and improved gradually to 94.4% at 2000Hz, then dropping to 78.1% at 6000 Hz. Averaged IP-screened hearing sensitivity had a 74.2% correlation with audiometric results and a 66.2% correlation with HP-screened hearing sensitivity. Screening with IP and with HP in a SPR had an 87.9% and 82.9% agreement with audiology, respectively, while agreement with testing in a QR was only 60.4% and
49.6%, respectively. **Conclusions.** Auditory screening with Smartphone technology is feasible when testing is conducted under very quiet conditions. IPs yielded better results than HPs. Correcting factors should be developed in order to compensate for the influence of background noise.

**N. 16 - THE EVALUATION OF THAI-VERSION FIVE MINUTE HEARING TEST TO SCREEN HEARING LOSS IN THE COMMUNITY**

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**Introduction.** Hearing loss is a common condition. Hearing loss causes difficulty on communication and social interaction of persons. It disturbs daily life, education, occupation, family burden and depression. A simple, non-professional test that can be used as a mass screening will help to find more hearing loss persons. **Objectives.** This research is aimed to study the sensitivity of Thai Version-Five Minute Hearing Test (Thai-FMHT) in comparison with audiometry as a gold standard for screening hearing loss in the community population. **Materials and Methods.** A prospective diagnostic study was done in Phu Wieng district, Khon Kaen province. All people aged over than 18 years old who lived in one municipal and another non-municipal area of Phu Wiang district were welcome to participate. After giving consent, they were firstly interviewed by Thai-FMHT questionare. Then the audiologist who did not know the result of Thai-FMHT tested their hearing by means of audiometry. The ear examination and treatment were done by otologists. **Results.** 558 persons were involved, in the age range 18-87 years old; 176 males (32%) and 382 females (68%). Unilateral hearing loss was found in 78 persons (14%) and bilateral hearing loss was found in 136 persons (24.4%). Among those who had bilateral hearing loss, there were 107 cases of mild hearing loss, and 28 cases of hearing disabilities. One case had impact cerumens and moderate hearing loss. When impact cerumens were removed, hearing turned into mild hearing loss. The sensitivity and specificity of Thai-FMHT to screen for mild hearing loss were 55.2% and 72.5%, while the sensitivity and specificity to screen for hearing disabilities were 86.2% and 69.4% respectively. The optimized cut-off point for the total score of Thai-FMHT was 10. **Conclusion.** Thai-FMHT has appropriate sensitivity and specificity to be used as a screening test for hearing disability in community.

**N. 17 - AUDITORY MIDDLE-LATENCY RESPONSES IN ELDERLY PERSONS: A CASE OF ABNORMAL WAVEFORMS**

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Purpose. Many elderly persons have hearing problems. A few studies have shown abnormal waveforms on the auditory middle-latency responses (AMLRs) in elderly persons, although many audiological examinations have been performed. The purpose of this study is to examine AMLRs in elderly persons and the relationship between AMLRs and hearing difficulty. Methods. We examined 9 elderly persons (6 male and 3 female, 59–73 years old). Auditory functions were assessed by pure-tone audiometry and a monosyllabic-word identification test. Neuro-electrical activity was recorded from 3 scalp locations on the coronal plane, i.e., Cz, Cl (halfway between the left meatus and Cz), and Cr (halfway between the right meatus and Cz). AMLRs were elicited by clicks at the rate of 2 clicks/sec. The examination was performed while the subjects were awake and resting comfortably on a bed. EEGs were amplified to a bandwidth of 20–500 Hz. EEGs from 500 trials were averaged until 200 ms. Results. Of the subjects tested, one subject had a hearing problem in the right ear, although the hearing threshold as determined by pure-tone audiometry was within the normal range and the results of the word identification test were normal. The waveforms of the AMLRs recorded from the left and right hemispheres were asymmetric. The amplitude of the Pa-Nb component was reduced in the AMLRs recorded from the left hemisphere. Discussion. Jerger et al. (1991) performed an electrophysiological test on a young woman who complained that she had difficulty in hearing in her educational environment. They observed that the AMLRs in this subject were asymmetric. The results of this study suggest that AMLRs could be used as electrophysiological indices for assessing auditory processing disorders in elderly persons. Further research on AMLRs is required to establish the physiological indices of auditory processing disorders in elderly persons.

N. 18 - A PRELIMINARY STUDY OF THE SHORT-TERM AND LONG-TERM NEURAL ADAPTATION OF THE AUDITORY BRAINSTEM RESPONSE BY THE USE OF RANDOMIZED STIMULATION

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Brainstem auditory evoked response (BAER) signals represent the electrical activity of the auditory brainstem associated with a stimulus. The study of BAER at high stimulation rates is of great interest in the field of audiology since it presents several advantages: the reduction of the recording time, an earlier diagnosis of certain neural diseases, and the study of adaptation, which consists on a variation of the auditory response during a constant stimulus condition. This preliminary study is based on a novel stimulation technique that allows the recording of BAER at high rates of stimulation. This methodology consists on the average of auditory responses evoked by stimuli whose period varies randomly. Compared to other analogous techniques, this stimulation technique is the only methodology that allows the categorization of auditory responses according to the interval of the preceding stimulus. This premise has been used to design an experiment to check whether adaptation is a short-term or a long-term process. Only 6 normal hearing adults participated in this study. The results of this test suggest that
though both factors are involved in the hearing process, subjects can be classified according to their
tendency towards a short-term or a long-term adaptation process. Understanding the biological
mechanisms or the possible hearing diseases that influence such dispersion may have important
repercussions in the field of audiology. Although a study with more subjects would be necessary to reach
more solid conclusions, these preliminary results open up a new research line that may lead to a better
understanding of the adaptation phenomenon.

**N. 19 - CIRCULAR PHASE CLUSTERING BASED AUTO-ADAPTATION FOR THE
OBJECTIVE ASSESSMENT OF ABR MEASUREMENT QUALITY**

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The objective assessment of the measurement quality of auditory brainstem responses (ABRs) recently
became an important component of clinical practice/hearing screening. Most of the known ABR quality
measures are based on simple morphological time-domain features such as amplitude and latency, e.g.,
by comparing single ABR sweeps to the averaged response. However, such morphological approaches
may suffer in measurement conditions in which externally induced noise cannot be further reduced and
thus result in a weak morphological stability of the ABR response. To approach this problem, we present
a new quality measure which is based on the circular clustering of the instantaneous phase of ABR single
trials, i.e., a correlate of neural synchronization processes. For this, band-limited Hardy space
projections are employed to obtain the instantaneous phase of consecutive ABR single-trials which are
arranged in a matrix representation. In this representation the instantaneous phase is evaluated along a
fixed trace by means of directional statistics on the unit circle. The quality measure is now derived from
the circular difference of the phase distribution of trials of the spontaneous activity, i.e., no auditory
stimulation, from the distribution of trials after auditory stimulation. Twenty subjects (mean age approx.
25y, std: approx. 4y) with no history of hearing problems and normal hearing thresholds (below 15 dB
(HL)) participated in our study. ABR single trials were obtained by calibrated broad band chirps at 20,
30, and 40 dB SPL and in the case of no stimulation, i.e., the spontaneous activity. Using these data, we
show that our approach (a) allows for an auto-adaptation to the measurement condition, (b) allows for a
robust and objective quantification of the measurement quality, and (c) can also be used for the objective
ABR detection with a minimum number of trials by combining it with novelty detection machines.

**N. 20 - ADAPTIVE FILTERS FOR ENHANCING AUDITORY BRAINSTEM
RESPONSES TO SYNTHETIC VOWEL STIMULI**

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The measurement of speech Auditory Brainstem Responses (speech ABR) is a promising technique that has been used to assess auditory function in children with central processing disorders and some types of learning disabilities. There is evidence that speech ABR may also be useful in the assessment of the aging auditory system and monitoring the progress of auditory rehabilitation. However, the development of this field has been hindered by the long recording durations that are usually required to achieve an acceptable signal-to-noise ratio (SNR) in the recorded response, based on the standard approach of coherent averaging over hundreds or thousands of trials. There is therefore a need for the development of methods to reduce the required number of trials. In this study, we implemented four different adaptive algorithms to achieve this goal, namely the Wiener Filter (WF), Steepest-descent, Least-mean-square Adaptive Noise Canceller (LMS-ANC), and normalised LMS ANC (nLMS-ANC). These algorithms were applied to 12 speech ABRs evoked by a synthetic vowel /a/ in three normal hearing subjects (total of 36 response signals), with each response signal based on coherent averaging over 250 trials. The overall response SNR, the local SNR at F0 and F1, and mean square error (MSE) were used to evaluate the performance of the algorithms. The average improvement in SNR and reduction in MSE with these algorithms in a 250 trial response exceeds that obtained by coherently averaging 12 of these responses (corresponding to 3000 trials). In addition, the algorithms successfully reject pure EEG noise samples. Therefore, these adaptive approaches promise to significantly reduce the required recording time of speech ABR and so help in its development as a clinical tool.

N. 21 - HIGH FREQUENCY GAIN DEPENDENT WORD RECOGNITION

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Introduction. As high frequency audibility increases word recognition scores increase (1). Pascoe demonstrated an improvement in speech recognition with the addition of high frequency information (2). Turner and Henry demonstrated that adding audible high frequency speech information in the presence of a relatively intense background noise was beneficial in all cases regardless of the degree of hearing loss (3). Currently there is no established method to apply additional high frequency gain during standard word recognition testing to determine the influence of audibility on performance. The objective of the present study was to investigate the influence of high frequency gain during word recognition testing. Methods. Ten adult patients with word recognition scores of 80% or less were re-tested with an additional 14dB of gain at 1000 Hz and above using an Ultra-Curve Pro digital sound processor. The filtered signal was delivered through a Grason-Stadler 61 diagnostic audiometer at the same level as the baseline presentation. Results. Word recognition testing with an additional 14 dB of high frequency (HF) gain indicated a 50% increase as compared to baseline (mean HF gain, 84%; mean baseline 56%). There was a statistically significant difference between HF gain condition and baseline speech performance with p=0.0053. Conclusions. The present study was designed to evaluate any possible influence on word recognition performance with the addition of 14dB of gain above 1000 Hz during the conventional audiologic battery. There is a highly significant benefit in word recognition performance for adults with hearing impairment when baseline word recognition scores fall at 80% or below. These
findings may have relevance for both the method of testing word recognition and for counseling potential hearing aid users.

References

N. 22 - A NEW METHOD FOR MEASURING HEARING LOSS. PART I: A STUDY AMONG A SAMPLE OF STANDARD POPULATION

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Background. Liminal Tonal Audiometry (LTA) and data from self assessment questionnaires (HHIE-S, SAC, QDS) may have operational limitations in certain populations groups with “special needs” or disabilities. The purpose of this work is to develop an objective screening method that allows the audiologist to corroborate the results from subjective tests if no subject cooperation exists. Method. We evaluated the hearing sensitivity of a sample of standard population. Different video sequences were recorded during the traditional audiometric screening test (LTA) in order to analyze the patient’s behaviour. In these video sequences, different computer vision solutions had been applied in order to automatize different process, so, the methodology will be able to detect the instants when the expert is sending the auditory stimulus and the instants when the patients responds consciously to it, in this case, by raising his hand. Given that the reaction time is measured as the time that goes by from the beginning of the auditory stimulus until the moment when the patient responds to it, we will be able to measure all the reaction times of a patient. Results and Discussion: The proposed method has been tested on several video sequences from different individuals yielding highly accurate results. Our method has demonstrated objectivity, accuracy and repeatability; this allows the audiologists to quantitatively evaluate the responsiveness of the patient. Further studies will focus on the detection of unconscious facial reactions to pure tones to allow the audiologist to obtain or to allow the audiologist to obtain or verify the hearing thresholds of subjects with operational limitations, such as people with cognitive impairment.
N. 23 - SEQUENTIAL DIAGNOSTIC TESTS FOR SEARCHING THE ETIOLOGY OF DEAFNESS

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Deafness is the most prevalent sensory disorder in humans, caused by a variety of environmental and genetic factors. Although a simultaneous testing approach including laboratory, imaging and genetic tests expands the etiological diagnosis, it overloads the healthcare system due to high costs. The goal of the present study was to evaluate the effectiveness of imaging and genetic tests and their impact on public health, as well as to establish a diagnostic protocol aiming at increasing efficiency and reduce costs of the etiological diagnosis of hearing loss. An analysis of 100 patients with sensorineural hearing loss submitted to cochlear implantation was conducted. A detailed investigation was performed in each patient, including imaging and genetic analysis, which reduced the number of individuals with unknown cause from 72 to 42 (42% of reduction). Genetic and imaging results contributed to the diagnosis of 19 and 20% of the cases, respectively. Both tests were important to identify the etiology of hearing loss. However, molecular analysis contributed mainly for diagnosis of patients with congenital deafness, while radiologic exams had greater contribution for the cases with progressive or sudden hearing loss. The high prevalence of mutations in the GJB2 gene was confirmed, especially the c.35delG mutation. The molecular research had an important contribution to the etiological diagnosis of deafness, besides providing genetic counseling and a better prognosis for cochlear implantation, as suggested by previous studies. Even with a careful investigation, the unknown etiology prevailed as the main cause which points to the need of carrying out detailed genetic studies in those cases with idiopathic hearing loss in order to elucidate the diagnosis. Based on specific tests results and on etiological findings we suggest a sequential protocol that enables an optimization of the etiological diagnosis and reduction of cost, as opposed to simultaneously holding imaging, laboratory and genetic tests.

N. 24 - USE OF TELEMEDICINE IN AUDIOLOGY – AN INDIAN EXPERIENCE

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Objective. Although "face-to-face" interaction will always be the most desirable form of service delivery for audiologists, however, "face-to-face" encounters are not always possible or feasible because of lots of reasons like distance or lack of trained Audiologists. Hence the aim of this study was to evaluate the role and scope of telepractice in Audiology (using high-speed Internet) and to validate its use for electrophysiological tests like ABR, ASSR, OAE, ECochG etc. Subjects and Methods. The ABR, ASSR, OAE and ECochG tests were carried out in 50 patients each using both face to face setting and remote setting with real time transmission using internet. The test efficacy, client and clinician acceptance and
satisfaction, and cost and time effectiveness of this use of telepractice in Audiology was evaluated. Also, the effectiveness of this telepractice as a training and ongoing monitoring tool was assessed. **Results.** The outcomes of this method have been very encouraging supporting the use of telepractice in Audiology. The remote testing took slightly longer time but there was no difference in the results obtained through each method. Both patients as well as clinicians were quite satisfied and readily accepted even the remote testing. The remote testing was found to be significantly cost-and time-effective. Also, telepractice was found to be a great and cost-effective training/ongoing monitoring tool. **Conclusion.** Results suggests that telemedicine in audiology can be effectively used by audiologists to deliver hearing services and training to locations where no services now exist without compromising on quality. Telepractice may also offer rural consumers continuity of services, a high level of professional expertise, up-to-date information, and a family-oriented system (by reducing travel costs and lost wages).

**RECREATIONAL AND OCCUPATIONAL NOISE**

**N. 25 - MONITORING NOISE-INDUCED HEARING LOSS WITH OAES**

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The role of OAEs in hearing conservation is being investigated by different groups around the world. There is no widespread consensus on the paradigms that should be used, on the interpretation of results on individual level and on boundary conditions that are required for suitable measurements. With that in mind, this study presents OAE and audiometric data of groups of subjects working in different occupations where individuals are exposed to noise (printing industry, construction industry and orchestras). In order to reliably monitor hearing status over time, emissions should be present with a certain signal-to-noise ratio. This study shows that a large proportion of subjects have low emissions in the high-frequency range which does not allow any room for decline. Data from the different occupations is currently being investigated with the focus on measurability and applicability. For subjects with a pre-existent hearing loss or for older subjects, it can be questioned whether OAEs can be used reliably to monitor hearing status over time.

**N. 26 - SOAE AND DPOAE CHARACTERISTICS IN PERSONAL MUSIC SYSTEM USERS AFTER LISTENING TO ONE HOUR OF MUSIC**

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With development of digital personal music (PM) systems and their use with earphones, concerns have been raised as to whether or not young adults are using these devices in a hazardous way. Use of PM
systems may become a risk factor for earlier onset hearing loss. Young adults between 18-30 years of age volunteered and a randomly chosen test ear was determined. After otoscopy, tympanometry, and a hearing screening (500 Hz through 4000 Hz at 20 dB HL) to ensure normal hearing, spontaneous otoacoustic emissions (SOAEs) and distortion product otoacoustic emissions (DPOAEs) were measured. SOAEs and DPOAEs were measured after each participant listened to one hour of music set to their preferred listening level. The dBA level was determined using a probe microphone. SOAEs were measured from the ear canal for three minutes in order to obtain a sufficient signal-to-noise ratio. Frequency and level for present SOAEs were determined. DPOAEs were recorded between 2f1-f2 frequencies of 1000 and 6000 Hz, in 2 Hz steps, using stimulus tones (L1,L2=55,40 dB SPL, f2/f1=1.22; f2>f1) swept in frequency at 8 sec/octave and collapsed into third-octave bands. To date, 19 of 35 participants have measureable SOAEs. After music, over 75% of SOAEs either stayed at the same frequency (n=17) or shifted higher in frequency (n=29). Almost 70% of the higher shifts were between 1-3 Hz, although one SOAE did shift higher by 9 Hz. In the 19 individuals with present SOAEs, all had measureable DPOAEs well above the noise floor. Mean DPOAE change varied from a decrease of 0.1 dB at 1000 Hz to a 1.2 dB decrease at 6000 Hz. The smallest changes were between 1000 and 3000 Hz, which is the frequency region where most of the SOAEs were present. Present SOAEs may have minimized the effect of music on DPOAEs.

N. 27 - PERSONAL DIGITAL AUDIO PLAYERS AND THEIR HEADPHONES: HEARING RISKS

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Introduction. Personal Digital Audio Players, headphones and their use can cause a hearing injury, because the sound is delivered directly in the ear canal. Today the use of this kind of technology is growing, mainly for the young people. However, different kind of headphones can be used: In ear and earbud. Aim. This study aimed to characterize the use of Personal Digital Audio Players and the sound pressure that young people are exposed to when they make use of it with two kind of headphones: In Ear and Earbud. Materials and methods. This study was conducted in two stages. First, the young (27 young people) answered a questionnaire about the use of Personal Digital Audio Players, like time of use, type of headphone and places of use. Second, the young passed by a probe microphone measurements. Results. The young people typically used the personal digital audio players for an average of 1.83 hours per day for an average volume of 67.41% of total volume, in external places like streets or on the bus. When the probe microphone measurements were made, it was possible to see that there is a statistically significant difference between the headphones evaluated, showing that in Ear Headphone had higher levels of sound pressure than the Earbud Headphones for all frequencies measured. There was a significant difference between ears at some frequencies (500, 1000, 2000, 3000 and 8000 Hz) with the two headphones. Conclusion. It was concluded that Ear Headphone generates a higher sound pressure level than the Earbud Headphone. However, young people do not change their habits and keep using
personal digital audio players at high sound pressure levels, which can cause a hearing loss and/or a cochlear lesion.

**N. 28 - SPEECH PERCEPTION TEST IN GROUPS OF WORKERS EXPOSED TO OCCUPATIONAL NOISE**

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The HINT–Brazil (Hearing in Noise Test, version in Portuguese of Brazil) is a test of speech recognition in noise, recently standardized in Brazil, which simulates hearing situations similar to those of day-to-day. Used in different countries, it assists auditory disabilities and becomes an important diagnostic tool, particularly in workers exposed to occupational noise. **Goal.** To evaluate the results of the HINT-Brazil in workers exposed to occupational noise, with and without sensorineural hearing loss, all workers being normal responses to the Percentage Index of Speech Recognition (PISR). **Method.** HINT contains 240 short sentences, with everyday speech, phonetically balanced, easy to understand and with the same degree of difficulty. Sentences are distributed in 12 lists of 20 sentences each, presented with headphones, in four situations: quite (Q); signal and noise bilateral (NF), noise right (NR), noise left (NL) and noise composite (NC), which is a weighted average of the three sound presentations. We examined 49 normal hearing workers without exposure to noise (G1), 25 workers exposed to noise, without hearing loss (G2), and 20 workers exposed to noise with hearing loss (G3). The average age of the subjects was 27.7 years (SD=10.1) for G1; 45.1 years (SD=10.9) for G2; 50.6 years (SD=8.9) for G3. All subjects showed PISR value within the normal range. **Results.** The mean values (in dB) were: Group G1: 26.5 (Q), -5.1 (NF), -12.3 (NR), -12.3 (NL) and -8.7 (NC); Group G2: 21.5(Q), -4.3(NF), -11.8(NR), -11.9(NL), -8.1 (NC); Group G3: 29.9(Q), -3.6(NF), -9.9(NR), -9.8 (NL), -6.7 (NC). Conclusion. There was a significant difference between the values of the group of unexposed workers (G1) compared to normal hearing exposed workers (G2) and those with hearing loss (G3); among exposed workers there was a significant difference between the normal hearing (G2) and those with loss (G3) only in the presentation made without the noise.

**N. 29 - INTERVENTION MODEL IN OCCUPATIONAL HEARING LOSS**

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Due the constant and permanent progress of medicine, its intervention and exercise in health care are more and more focused in prevention, on demand for a more efficient approach. For what occupational health is concerned, there are several consequences from exposure to harmful agents. Specially regarding
to hearing loss, NIHL (Noise Induced Hearing Loss) is the most common occupational disease of Europe and its effects are permanent. Therefore an interventional model is proposed for occupational hearing health, which is suitable to intervene since childhood in a more significant way (through prevention) and later on to the rest of the population, taking into account prevention, diagnosis and hearing loss rehabilitation. The main reason why it is given additional attention to the young population instead of what is normally defined (active population) is due to the aim of this article, which is prevention as a mechanism of suppression of misconducts related with occupational hearing health in adult life. So, this model in divided into three different areas: audiology in schools, audiology in the community and occupational audiology. As far as audiology in schools is concerned, the performance should have its main focus on prevention and hearing health promotion, through teaching programs and implementation of programmatic contents integrated into courses, among others. Finally children’s follow-up and their evaluation as a complement to this intervention. As to audiology in the community, its intervention should be complementary and this action follows two main segments: a non-occupational and occupational performance. In occupational audiology the path of action should include specific measures due to its direct relation with the active population. For this reason, in order to achieve an efficient awareness for this theme, it is essential to implement a hearing conservation program suitable with the proposed objectives.

N. 30 - NOISE EXPOSURE AMONGST KUANTAN MUNICIPAL COUNCIL, MALAYSIA WORKERS

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Occupational hearing loss continues to be among the ten leading occupational diseases among industrial workers. Hearing loss is a sensorineural hearing deficit that begins at higher frequencies (3 kHz to 6 kHz) and develops gradually as a result of excessive exposure of noise. A cross sectional study of hearing status among employees in Kuantan Municipal Council (MPK), Malaysia was conducted in August 2010 until mid of January 2011. Seventy-seven subjects (eleven females and sixty-six males) aged between 20 to 58 year-old (mean: 39.45 ± 8.63 yrs) were involved in this study. Subjects were recruited from five different units which are Landscape, Mechanical, Vector, Special Action Unit and Maintenance Unit. The aim of this study was to measure the hearing level and noise dose amongst Kuantan Municipal Council workers who work under noise exposure. Hearing statuses were accessed by using tympanometry and pure tone audiometry tests. Other factors that might be associated to hearing loss were also determined in this study. Results showed that 52 subjects (67.5%) had normal hearing and 25 subjects (32.5%) had hearing loss. Noise exposure measurements showed that the noise level in the workplace reached the action level of 85 dBA and exceeded the permissible exposure level of 90 dBA. Pearson Correlation Coefficient revealed that there was no significant relationship between service length and hearing level at 3, 4 and 6 kHz. Thus, this study revealed that MPK workers are at substantial risk of developing hearing
loss due to the noise exposure. Urgent action should be taken by the MPK’s administration to ensure individual noise exposures are within permissible limits.

**N. 31 - IMPLICATION OF NOISE EXPOSURE IN THE OIL AND GAS INDUSTRY TO OCCUPATIONAL SAFETY AND HEALTH PERMISSIBLE EXPOSURE LEVEL IN NIGERIA**

Abe OT

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**Background.** Noise exposure in Nigeria oil industry poses an increasingly safety and health hazards to adult oil workers and oil communities. There are no efficient guidelines controlling noise exposure let alone monitoring effective hearing conservation. Restiveness and ransom taking in Niger Delta has grown to a serious proportion. Federal, State and local government sometimes take proactive measures which have not provided the desired results. **Objective.** This paper assesses the implications of noise level generated in the oil and gas industrial machines. This paper is creating awareness and need for individuals and governments to commence making appropriate laws to arrest this scourge in the Nigerian oil and gas industry. Many Nigerian oil workers do not know the level at which sound becomes harmful. In Industry, permissible noise exposure levels are specified by the Occupational Safety and Health Administration (OSHA, 1997). Noise levels in five textile factories in Lagos were 95dB – 115dB (Oleru, S. 1980). Miners in Johannesburg, South Africa, were exposed to noise level 85dB and above (Hessel, S. & Sillius – Cremer, A.1989). Problems related to noise include hearing loss, stress, high blood pressure, sleep loss, distraction and loss of opportunity for tranquillity (Katherine, 1997). **Methods.** The study employed survey research design using ex- post- facto type. Five major multinational oil companies were randomly selected in Lagos, Warri and Port Harcourt. Noise levels generated by industrial machines were tested. **Results.** The study revealed noise exposure level of 121 decibels. The oil and gas industrial workers spent ten hours per day at work instead of thirty minutes stipulated by Occupational Safety Health and Administration. **Conclusion.** Oil workers and communities are overexposed to loud noise. There is need to initiate hearing conservation Programme Through Design (PTD) which includes hearing screening practice, policy, research and education.

**INTERVENTION STRATEGIES**

**N. 32 - PROFESSIONAL ONLINE REHABILITATION OF ADULT HEARING-AID USERS, A RANDOMIZED CONTROLLED TRIAL**

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AHS 2012 - June 7 – 9, 2012 – Cernobbio (Lake Como), Italy
By using the Internet in the audiologic rehabilitation process it is possible to cost-effectively include components in the rehabilitation, such as guidance about communication strategies, hearing tactics and how to deal with hearing aids. In related fields, the Internet has proven to be a good medium to use in different rehabilitation processes. In different studies, patient groups who suffer from tinnitus, anxiety and depression have been helped by participating in Internet rehabilitation. The purpose of this study was to examine and evaluate the effect of an online rehabilitation program for experienced hearing-aid users. The rehabilitation program consisted of self-study, guidance by professional audiologists and the possibility to discuss with other participants in a monitored, online discussion forum. The effects of the rehabilitation program were evaluated with online questionnaires and the results were compared with a control group. The control group had access to literature about historical hearing aids waiting to undergo the online rehabilitation program. In this study we had 78 participants, recruited via advertisements in newspapers. The participants were on average 69 years and had used their hearing aids at least one year. Results from the study showed significant improvements for the intervention group. For example, they estimated their problems related to the hearing loss as significantly lower after the study than they did before they took part in the rehabilitation program, while participants in the control group did not change the perception of their activity limitation and participation restriction.

N. 33 - THE CHANGING FACE OF AGING AND AURAL REHABILITATION: BABY BOOMERS AND GROUP THERAPY

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We felt the need to explore less traditional routes of aural rehabilitation and widen the range of services offered in order to reflect the changing face of aging and prepare the way for the baby boomer generation. Keeping in mind that this demographic group may instigate a considerable increase in future demands made on rehabilitation services, we opted to develop group therapy sessions, thereby maximizing the number of participants being seen. Our various groups allow us to accompany and work with participants in a variety of environments which, depending on their progress and comfort-level, can range from attending a group session at our rehabilitation centre to going out and practicing communication strategies in realistically noisy environments. We are also sensitive to the fact that in order to attract participants, our services must reflect how they perceive themselves and their hearing impairment. A survey conducted amongst 50 to 64 year-old French-speaking Quebecers revealed that this segment of the population does not view itself as ‘elderly’ or ‘aged’. In fact, it revealed that for francophone baby boomers, aging begins at 80 (Aqess, 2010). Particular attention is paid to the number of meetings proposed for each group; our findings indicate that participation rate is highest when 4 to 6 meetings are suggested. More meetings may not be viewed favourably by participants as they may...
interfere with leisure activities. Given that one of the ultimate goals of aural rehabilitation is to encourage social participation, the duration of therapy should not hamper the participant's schedule. So far, our group drop-out rate has been very low. Three trial groups, at various stages of development, will be presented: 1. Communic-action: based on the Active Communication Education (ACE) intervention framework (Hickson, 2007). 2. Social participation and communication strategies group. 3. Conversation therapy in noisy environments.

**N. 34 - SOUND ADVICE FOR ADULT COCHLEAR IMPLANT USERS**

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Cochlear implantation in adulthood involves managing complex technology and managing changing communication abilities in everyday life, which have an impact on both the individual and their family. Sound Advice is a service which has been developed in response to a questionnaire and interview survey of users with the goal of supporting long-term implant use at home and work. It provides both group and individual sessions:

- A forum for users and their families to meet and talk
- Themed meetings on communication skills, voice skills, music
- Group and individual opportunities to explore the use of the accessories provided with the CI system
- Group and individual opportunities to try assistive listening devices, such as FM systems
- Communication training in group, with partner, or individually
- Listening training – face to face and using web-based materials
- Opportunity to try out differing telephone systems and to have training and practice in their use

Providing the sessions with a multi-disciplinary team of hearing therapist, speech and language therapist and audiologist together with other users has ensured that the sessions combine professional expertise with user insights. The numbers attending the sessions has increased by three fold over the past year, the age range is 19 – 90, and attendees come from throughout the UK. Adults thinking about cochlear implants now attend to meet others, and we are developing the service to include hearing aid users, and bone-anchored hearing aid users.

**N. 35 - ISSUES IN THE REHABILITATION OF ADULTS WITH HEARING DISORDERS IN BULGARIA**

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People receive most of the information from the environment through hearing. In adulthood the occurrence of hearing disorder can change dramatically individual’s quality of life. This study reviews some issues in the rehabilitation of adults with late onset of hearing disorder in Bulgaria. Recently the
process of evaluation, selection and fitting of individual hearing aids in the country is run both by audiologists at ENT clinics and professionals at trade companies, representing well-known producers of assistive listening devices like Phonak, Widex, Oticon, Siemens, etc. A good variety of modern digital hearing aids is offered and partially funded by the National Health Insurance Company including some battery supply. On the other hand patients are rarely offered assistance in adapting to the new device/s followed by rehabilitation. The main purpose of the study was to assess the needs of rehabilitation and daily use of hearing aids by adults with late acquired hearing disorder. The subjects were randomly selected, 18 adults with moderate to severe hearing loss with onset at age of 35 and later. Mark at 60 years identified two subgroups according to employment status (employed/ retired). The research focused on the correlation between two rehabilitation issues: (a) the awareness of the importance of aided hearing for normal social functioning, and (b) the frequency of use of hearing aids. All subjects were questioned and their experience starting from the acquisition of hearing aids to the final stage of rehabilitation – use of device/s in natural environment, was recorded and analyzed. Some differences were found in the correlation between awareness and social functioning in each subgroup. Patients under 60 especially demonstrated higher level of awareness but still had poor performance in common social interactions because of lack of rehabilitation.

**N. 36 - A HEARING ASSESSMENT AND REHABILITATION PROGRAM IN MONGOLIA**

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Mongolia is an independent country of 3 million people, located in Central Asia. The economy is based on agriculture and mining, with many of its people living in remote rural communities under harsh conditions. Prior to 2005 there were no local audiological services, with international aid agencies providing limited diagnostic services and humanitarian hearing aid provision. In 2009 the Mongolian Government commenced a hearing assessment and rehabilitation program, using the services of a newly established independent provider, Mon-Anir. This program was built around the government decision to provide binaural fittings of state-of-the-art hearing aids to eligible welfare clients with a hearing loss greater than 40 dB. To meet this objective the provider employed qualified ENT Doctors, skilled in the management of ear disease and counselling hearing-impaired clients. They were trained in diagnostic hearing assessment and to program digital hearing aids using current software packages and IT based data storage. The program was funded to provide 5000 hearing aids per year for 5 years. Mongolia is divided into eastern, central and western regions, with a total of 21 provinces. Five teams including an ENT doctor and an otoplastics engineer traverse the country on a two or three week cycle. Clients referred by the local doctor are assessed to determine their aural health and tested to determine hearing handicap and hearing aid candidacy. Ear impressions are taken and processed on site. A customised hearing aid is fitted the next day with appropriate counselling and training in hearing aid management. This paper will describe the structure of this rural and remote hearing services program. It will detail the rationale used to determine hearing aid candidacy and hearing aid selection and aid fitting protocols.
Data collection procedures and the measures used to determine hearing aid outcomes will also be discussed.

**HEARING AIDS AND IMPLANTABLE DEVICES: OUTCOME STUDIES**

**N. 37 - IMPROVED SPEECH RECOGNITION AND GOOD SELF-REPORTED BENEFIT FROM COCHLEAR IMPLANTATION IN ADULTS**

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An increasing number of older and elderly adults with severe to profound hearing impairment are referred for cochlear implantation (CI). The aim of the study was to assess speech audiometric results and self-reported benefit from CI in adults with a special emphasis on older and elderly adults. All CI recipients who were ≥18 years at implantation and who had been implanted in the CI program at the Dept of Otolaryngology at Linköping University Hospital, Linköping, Sweden, and who had had their CI for at least 12 months were eligible for the study. Since the start of the program in February 1992 until September 2010, the number of CI recipients was 131. In addition to audiological tests, the pre-operative assessment of adult patients includes tests of working memory capacity, phonological and lexical processing skills, and these data were recruited from the patient files. Glasgow Benefit Inventory (GBI), a self-assessment instrument covering general health, degree of social support and physical state, was mailed to the CI recipients. Response rate was 90% (n=118), 43% of the participants being males and 57% females. The mean age at implantation was 61 years. The mean post-operative maximum monosyllabic speech recognition score was 74.8% (SD 17.0) in the age group <65 years (n=59) and 59.9% (SD 20.0) in the age group ≥65 years (n=46). GBI results were comparable to previous reports in CI populations. Analyses of the cognitive test results and more detailed analyses of speech reception and GBI among the oldest olds (≥75 years) will be reported. According to our preliminary results, CI gives good benefit in the whole group. Provided that a careful assessment of cognitive abilities has been made and general health is reasonably good, a good outcome can be expected also in the oldest part of the population.

**N. 38 - SENSITIVITY TO TEMPORAL FINE STRUCTURE AND HEARING AID OUTCOMES**

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The relationship between sensitivity to temporal fine structure (TFS) and hearing aid outcomes was investigated in 80 presbycusic patients in receipt of their first hearing aid(s). Only weak associations between age and hearing loss were observed; GHABP self-report scores were not associated with age or hearing loss. Given the broad range of ages and hearing loss observed this suggests that patients attending audiology for their first hearing aid have similar levels of self-rated hearing difficulty and handicap regardless of actual loss. Pre-defined situations on the GHABP tended to underestimate the degree of difficulty and handicap experienced by patients pre-fitting compared to the self-nominated situations. SSQ-A self-reports scores were moderately associated with degree of hearing loss. This suggests that either the breadth of situations covered by SSQ-A or the range of scores available make it more sensitive than the GHABP for identifying potential areas of concern. Sensitivity to TFS was weakly associated with age, but not hearing loss or GHABP self-reports. This suggests that impairments to TFS information are fairly independent of age and hearing loss. About 1/3rd of patients were identified as having poor sensitivity to TFS. Listeners with good sensitivity to TFS rated their hearing abilities higher at pre-fitting (SSQ-A) than those with poor sensitivity to TFS, but reported the least amount of improvement following provision of hearing aids (SSQ-B). This data suggests that when paired with an appropriate outcome measure, the identification of a patient’s ability to process TFS information at an early stage in the treatment pathway could prove useful in managing a patient’s expectations about hearing aid outcomes.

N. 39 - ASSESSMENT OF THE BENEFIT OF HEARING AIDS BY USING HINT-BRAZIL

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Candidates for hearing aids fitting are evaluated by tests of speech perception, carried out in good conditions of audibility, which do not reproduce the auditory reality of the patients who, often, complain of difficulties in understanding speech, mainly in noisy environments. The HINT-Brazil (Hearing in Noise Test, version in Portuguese of Brazil) is a test of recognition of speech with noise, which simulates auditory situations of real world. This test has been recently standardized in Brazil and its inclusion in audiology clinic for the hearing aid fitting allows a better evaluation of the auditory skills of patients and its improvement with hearing aids. The aim of research was to assess whether there is improvement in speech recognition in noise with the use of hearing aids. For this purpose, we measured speech understanding without and with hearing aids by using the HINT Brazil test in 52 subjects with sensorineural hearing loss and using bilateral hearing aids, with average age of 63.4 years. The test contains 12 lists of 20 sentences each that are representative of daily speech, phonetically balanced, easily understood, and with the same degree of difficulty. The test was applied in free field, without and
with hearing aids, with frontal speech in four situations: without noise (Q); frontal noise (NF), noise to the right (NR), noise to the left (NL). The average values (in decibels) for the signal to noise ratio without hearing aids in the four conditions were: 52.2 (Q); 3.1 (NF); 3.1 (NR); 0.4 (NL). With the hearing aids, the average values were: 39.4 (Q); 0.8 (NF); 1.4 (NR) and -1.6 (NL). The findings for all four conditions demonstrate a better speech/noise ratio with hearing aids in free file, indicating that there was benefit with hearing aids.

**N. 40 - BENEFITS AND SATISFACTION OF OPEN FITTING**

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A lot has been published about the adaptation of hearing aids (HA) in patients with descendant hearing loss. The occlusion effect is one of the main complaints of users depending on the configuration of hearing loss. Considering the updates on the development of hearing aids and the particular configuration of hearing loss in these cases, mini BTE open fit hearing aids specifically bring major benefits to these individuals. The open fit devices are used along with a very thin tube in place of a template to connect the device to the ear. It can be called RITE, when the receiver is used in the ear canal and connected to the device through a very fine tube or RITA when they present the receiver in the hearing aid itself. **Objective.** An experimental study to verify the performance of RITA and adaptations of RITE by measuring in situ, speech perception and level of user satisfaction with the application of the SADL questionnaire. **Methods.** Participants in this project were 20 individuals, older than 18 years, with audiological diagnosis of bilateral sensorineural hearing loss of mild and moderate levels. The individuals were divided into two groups of 10 participants, paired in age and configuration of hearing loss, where the G1 (group 1) was fitted with an open fit hearing aid receiver with the apparatus and G2 (group 2) was fitted with an open fit hearing aids receiver with the channel. The adjustments were assessed through measurements with a probe microphone, speech perception (HINT) and satisfaction with the use of hearing aids (SADL instrument). **Results.** Observed closer to the target devices RITE, for satisfaction and perception of speech in the responses are similar.

**N. 41 - PROGRESSIVE HEARING LOSS IN ADULTS, AUDITORY AIDS AND SPEECH**

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**Introduction.** Older people can find very difficult to see a gradual progressive hearing loss. Common symptoms include difficulty understanding speech in noisy environments, difficulty in hearing sounds with lower frequencies and an inability to recognize similar higher frequencies sounds (e.g., S, TH),
and often, people complain to the immediate environment and speak loud. Etiology of progressive hearing loss in adults can be caused by age (presbyacusis), otosclerosis, ototoxic drugs (gentamicin), consequence of disease Neurofibromatosis Type II (tumors of the auditory nerve), trauma and head injury, working with vibrating machinery, impact noise and continuous exposure to noise, heredity, various syndromes and many other unknown factors. The aim of the study is to investigate progressive hearing loss in adults and type of auditory aids, which are applied in order to maintain good articulation skills of voice, speech and language. The methodology was monitoring the impact of application of hearing aids and cochlear implants on speech and language in adults with progressive hearing loss. The conclusion is that adults with progressive hearing loss get the most benefit with hearing aids and cochlear implants, which are the most appropriate choice in the preservation of voice, speech and language.

N. 42 - EARLY RESULTS OF LIVING WELL (COUNSELING TOOL) IN MANAGING EGYPTIAN ADULT HEARING IMPAIRED

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The “living well tool” is a counselling tool that enables the patient to identify and share communication situations in daily life which relevant and important to them. The living well tool is developed by Ida institute where a group of audiology authorities in this field has contributed to create such tool. A group of Adult patients living in Cairo area, was involved. 10 hearing impaired were fitted with new hearing device; we used the “living well tool” for counselling by implementing new effective strategies of communication, setting goals, and formulating a plan for achieving these goals.

PATIENTS’ PERSPECTIVE

N. 43 - DIFFERENCES IN CLIENT AND CLINICIAN VIEWS OF THE IMPORTANCE OF FACTORS IN THE CLIENT-CLINICIAN INTERACTION THAT INFLUENCE HEARING AID ADOPTION

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The impact of client-clinician communication on outcomes of care such as client satisfaction, adherence, and health status are well established. Client-clinician interaction is one of the best predictors of therapy outcome. However, differences in the viewpoints of clients and clinicians have been reported in several aspects of care such as the quality of the client-clinician relationship and provision of information. Poost-
Foroosh, Jennings, Shaw, Meston, and Cheesman (2011) explored the collective views of clients and clinicians to identify factors in client-clinician interaction that influence hearing aid adoption. Using a concept mapping approach, 122 statements were generated, forming eight conceptually homogenous clusters of factors that were perceived to influence hearing aid adoption. The present study evaluated a broad and geographically diverse sample to compare how clients and clinicians rate the importance of each of these eight concepts in hearing aid adoption. Eighty three clinicians, including both audiologists and hearing instrument practitioners, and 54 clients rated the 122 statements. Results of this study indicated a significant difference in the importance ratings for four of the eight concepts between clients and audiologists and two of the eight concepts between hearing instrument practitioners and clients. There was no significant difference between audiologists’ and hearing instrument practitioners’ views on the importance of the client-clinician interaction factors. The largest discrepancy between the importance each participant group assigned to the concepts were with the concepts of conveying device information by clinician, which was ranked much higher by clients and factors in client readiness, which was ranked much higher by clinicians. These results have implications for training of students and clinicians in facilitating the integration of shared decision making and client-centered care in hearing aid adoption.

N. 44 - OPTIMIZING MAPPING OF DISEASE-SPECIFIC PATIENT-REPORTED OUTCOMES ON UTILITY LIKE SCORES IN AUDIOLOGY

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Health economists and hearing health care specialists have conflicting requirements towards Patient-Reported Outcome (PRO) measures. The first favour comparability, the second sensitivity. Optimized mapping from disease specific PROs to generic quality of life (QoL) scores potentially allows comparative cost-effectiveness analysis (CEA) without forcing clinicians to use a “one size fits all” preference weighted general health-related QoL instrument. Methods. This confirmative, observational, cross-sectional, methodological pilot study had two pseudo-randomly allocated groups of participants. The first group completed the screening version of the Hearing Handicap Inventory for the Elderly (HHIE-S). For the second group, HHIE-S items were transformed into corresponding outcome statements which were scored independently for importance and satisfaction before becoming algebraically combined into opportunity scores. Opportunity scores and handicap scores were both correlated to disease specific Standard Gamble (SG) scores. The disease specific SG used “best hearing” and “no hearing” as upper and lower anchor respectively. A convenience sample of adult English speaking participants was recruited into the study through Facebook. Results. Sixty eight fully valid questionnaires were submitted. Responders mean age was 50 years (range: 18 to 75). Handicap scores were only weakly correlated to SG scores (r = -0.20), opportunity scores showed a moderate to strong correlation (r = -0.38). Ordinary least square (OLS) multiple regression with handicap and general risk attitude as independent variables explained up to 24% of the SG score variance. Corresponding models with opportunity and general risk
attitude as predictors explained up to 62% of the SG variance. **Conclusion.** Providing that generalizeability can be established with a larger study sample, the research outcome suggests that the inclusion of importance aspects into the design of disease-specific PRO tools can improve mapping from disease-specific PROs to utilities. Such optimised calibration can combine the sensitivity of disease specific PROs with the comparability of utilities.

**N. 45 - ATTITUDES OF TURKISH DEAF ADULTS TO THE FACILITIES RELATED WITH THE HEARING AND SPEECH: ARE THEY AGAINST SCREENING, HEARING AIDS, COCHLEAR IMPLANTS AND ‘SPEAKING’?**

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Disclaimations of the hearing and speech facilities (HSFs) by the Western Deaf communities are a raising issue within transnational networks. Investigations should not only be limited to relate this process with the current means of democracy and human rights, but also with the socio-cultural and historical backgrounds of the societies. Therefore, in this study, Turkish Deaf parents with deaf and hearing children and members of the Deaf NGOs in Turkey were questioned regarding their attitudes towards HSFs. It’s found that although a negativity to use of hearing aids indicated, they are not against newborn hearing screening, early fitting, and speaking of their deaf children. But, withdraw support for such process was clearly observed among deaf adults stating ‘it costs and does not work anyway’. Historical data were also examined to discuss low expectations of HSFs among Turkish Deaf. Considering available statistics, it could be estimated that Turkish health and special education systems provided ‘hearing-in-device and speech’ only to 1/3 to 1/2 of all subjects with bilateral severe deafness between 1940 and 2002. Age of diagnosis was 4.5 years in 1970s, 2.4-3.4 years in 1990s; only 21% of all with hearing loss were using hearing aids in 2002. These data support the findings why Turkish deaf adults discredit HSFs. Negative experiences indicated without associating with ‘no matter what’ opposition to HSFs - as occurs in some Western communities. Although they use Turkish sign language (SL) (one of the oldest SL in history and both the governmental system and religion accepted SL in all routines during the Ottoman’s Empire, followed by a strict prohibition in the schools during the Republic period), they accept HSFs’ necessity for their children, but also ask for public service and education in SL for both them and the next generations in case early HSFs do not work.
EPIEMIOLOGY OF HEARING LOSS AND RELATED MEDICAL CONDITIONS

N. 46 - AN EPIDEMIOLOGIC STUDY ON HEARING IMPAIRMENT IN ELDERLY POPULATION IN FOUR PROVINCES, CHINA

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Objective. To investigate the prevalence of hearing impairment in elderly population in Jiangsu, Sichuan, Guizhou and Jilin Provinces in China, to provide scientific data for the global database and to draw up prevention and intervention strategies. Methods. Using the probability proportion to size (PPS) method, 3766 residents over 60 years old were investigated in 150 clusters in four provinces with the WHO Ear and Hearing Disorders Survey Protocol. Every subject had an ear examination and pure tone audiometry. Definitions of disabling hearing loss and the classification of hearing impairment used were in accord with WHO recommendations. Results. The prevalence of hearing impairment and disability were 59.9% and 26.1% of investigated individuals respectively. 33.8% of the sample had a mild hearing loss, 19.8% a moderate degree of hearing loss, 5.4% a severe and 0.9% a profound hearing loss. There was a significant difference in the prevalence between males and females, urban and rural dwellers, as well as for different ages. The causes of hearing impairment were ear diseases (12.3%), infectious diseases (0.2%), genetic condition (1.0%), non-infectious condition (86.2%) and undetermined causes (8.0%). Overall, 63.3% of investigated persons were assessed to be likely to benefit from hearing aids, while 10.0% of persons needed medication, 2.4% non-urgent surgery and 13.4% other treatments. Conclusions. The high prevalence of hearing impairment and disability is a heavy burden on social development and also hinders normal family life. The government and society as a whole should show more concern about hearing problem in aging people. Strategies for prevention and intervention will be discussed in this presentation.

N. 47 - HEARING LOSS IN ADULTS – EPIDEMIOLOGICAL STUDY IN KARVINA REGION IN THE CZECH REPUBLIC: THE FIRST INFORMATION

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Background: Hearing impairment in adults is one of the most common chronic health conditions, and have important implications for quality of life, such as functional decline, depression and social isolation.
In the Czech Republic there are not accurate data about frequency of hearing loss. **Aims:** Based on epidemiological study comprising a significant large number of respondents, the aim was to assess the number of people with hearing loss in Karvina region related to age and sex and to find out an impact of the hearing loss on their social and emotional sphere. **Methods:** The ENT consulting rooms in the region of Karvina for hearing examination with sufficient equipment took part in the cooperation. The entry criterion for including into the study is the age of individual (the person older than 18 years), the individual looking for ENT doctor, the Czech nationality and willingness to participate in the study. Exclusion criterion for cancelling of participation in the study was the low age and the place of residence outside the region. The required data are collected by dialogue with respondents using questionnaire. Hearing is examined by means of audiometric and tympanometric examination for the right and the left ear respectively. The dialogue and filling out a questionnaire included hearing threshold examination is provided by professionally skilled audiologic nurses. The short questionnaire is focused on the specification of person, age, sex, work and social sphere, risk factors, the type of hearing loss and possible correction of hearing by compensation of hearing aids. All respondents filled out the hearing handicap inventory - screening version - form. **Conclusion:** The study should help to identify groups at risk for hearing loss in Karvina region, to improve the monitoring of risk factors for the assessment of the epidemiological situation and the effectiveness of prevention and compensation of hearing loss persons.

**N. 48 - PREVALENCE OF HEARING IMPAIRMENT IN AN ADULT POPULATION IN SAUDI ARABIA**

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The objective of this study was to screen and estimate the prevalence of hearing impairment in adult population in Saudi Arabia using the WHO (World Health Organization) questionnaire form. This was conducted in Saudi Arabia from the main four provinces of the country. In this respect, the aim was to screen 6000 nationals. This was completed in the year 2008, wherein 5,136 individuals with complete data were analysed. These were divided into four groups according to age. Clinical examination, otoscopy and pure-tone audiometry were conducted. The average of hearing thresholds level (HTL) at frequencies 0, 5, 1, 2 and 4 KHz of the better ear was taken. The prevalence of hearing impairment was 38%, which is high compared with other studies (western population 11.5%; Taiwan 23.7 %). Otitis media, aging, and noise were among the main risk factors (10.3%, 18.2% and 2.5%, respectively). The prevalence in certain areas was higher due to middle ear infection.
N. 49 - AUDIOLOGICAL PROFILE OF PEOPLE WITH HIV/AIDS ATTENDED AT A STATE REFERENCE CENTER

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Introduction: It’s point the many people who live with HIV/AIDS in Brazil and the world, studies report a high incidence of related disturbances including alterations in hearing as well as hearing loss. The problem can reside in the outer, middle or inner ear, with etiology suggestive of the prolonged use of antirretroviral drugs, the action of the virus in the auditory system and or the presence of opportunist diseases. Objective: To describe the audiological profile of HIV/AIDS patients attended at a State Reference Center for Infectious and Parasitic Diseases in Santa Catarina. Methodology: A prospective transversal study was conducted with a non-probabilistic sample, with adult HIV/AIDS patients in 2011. It evaluated: age, sex, income, schooling, type and degree of hearing loss, presence or not of otoneurlogocial signs and symptoms, audiometric configuration, tympanometric curve, contralateral acoustic reflexes and indication of the use of hearing aid in the individuals diagnosed with hearing loss. Conclusions: The results allow observing the prevalence of bilateral neuro-sensorial hearing loss with greater incidence among males and greater loss at higher frequencies. Patients with normal hearing have descendent audiometric configuration, tympanometry with a type A curve and an absence of collateral acoustic reflexes.

N. 50 - ANALYSIS OF THE CALORIC RESULTS AND THE MAIN VERTIGO COMPLAINTS OF A BRAZILIAN POPULATION EVALUATED

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Balance is a sensorimotor function that aims to stabilize the visual field and maintain the upright posture. For this to happen, it is necessary the integration of vestibular, visual and proprioceptive systems. When there is conflict between the informations from these systems, there are signs and symptoms of body imbalance. The correct diagnosis can identify the lesion and establish the prognosis of the disease. Our present study aimed through the interview assesses the main vertiginous complaints and correlate with the caloric test result. We evaluated 99 patients who underwent the bilateral caloric test with cold and warm air irrigation, in a private doctor’s office of Otolaryngology and Speech Pathology in Itaúna, Brazil. The principle of caloric stimulation is that labyrinths have normal symmetrical caloric response within a normal range, in this case were found 39.39% of the standard tests. Another result was found in 27.27% of BPPV, where the posterior semicircular canal was the most affected. The postural dizziness was the most frequently reported complaints. In these cases, all patients
were treated with otolith repositioning maneuvers. The Hyperreflexia was found in 26.26% of patients, especially those who reported imbalance, vertigo for a long-term and anxiety. In peripheral vestibular disorders, hyperreflexia can be found on the contralateral side from the labyrinth with deficit response and in central vestibular disorders, bilateral hyperreflexia can be observed. In our study 69.23% of patients presented bilateral hyperreflexia. Nodular lesions in the flocculus of the cerebellum increase the excitatory state of the vestibular nucleus causing this situation. The central result was found in 5% of cases and the deficit syndrome in 2% of patients. The caloric test has its importance, because it aims to evaluate the peripheral vestibular function where correlating with vertigo symptoms allows to assist in the diagnostic hypothesis.

N. 51 - OBJECTIVE AND SUBJECTIVE EFFICACY OF A CUSTOMIZED REHABILITATION PROGRAM

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Vertigo / dizziness has a high prevalence in adult population. Vestibular rehabilitation (VR) is a therapeutic treatment applied in patients with balance disorders. The aim of VR is to accelerate the process of central compensation and recover functional equilibrium through neuronal plasticity and to stimulate the adaptation faculties inherent to the global balance system. The Dizziness Handicap Inventory (DHI) is used to evaluate the impact of dizziness on quality of life of patients and their perception of physical, emotional and functional aspects. The Sensory Organization Test (SOT) objectively identifies problems with postural control by assessing the patient's ability to make effective use of (or suppress inappropriate) visual, vestibular, and proprioceptive information. The purpose of this study was to determine significant changes in the SOT and DHI scores in patients before and after a vestibular rehabilitation customized program. Efficacy of the program was tested in 17 patients by comparing pre-treatment and post-treatment DHI and SOT test scores.

N. 52 - IMPACT OF CONTROL OF BLOOD GLUCOSE LEVEL DURING TREATMENT OF SUDDEN DEAFNESS WITH DIABETES: THE RELATIONSHIP WITH PROGNOSIS

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Background and Objectives. Diabetes is known to be a negative prognostic factor and steroid therapy has become a standardized treatment in sudden deafness in these days. Therefore, hyperglycemia, which is one of the complication of steroids, has become a problem in treating sudden deafness patients with diabetes. Thus, the aim of our study was to find out the effects in prognosis and limitations of steroid therapy in relation to the control of blood sugar during the process of treating sudden deafness patients.
Materials and method. A retrospective review of medical records was carried out on 22 patients who had sudden deafness with diabetes from January, 2005 to September, 2010 at our institution. We reviewed pure tone audiometry and blood glucose level during sudden deafness treated period. Result. Blood glucose level was calculated on average upon admission and were divided into four groups; Group A was less than 200, Group B was less than 300, Group C was less than 400, and Group D was greater than 400. The level of improvement was not statistically significant upon control of blood glucose level during admission.(p=0.203). Conclusion. Control of blood sugar during treatment of sudden deafness does not have a direct relation to the prognosis of sudden deafness.

N. 53 - BJORNSTAD SYNDROME - SENSORINEURAL HEARING LOSS AND PILI TORTI

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Bjornstad syndrome is an extremely rare congenital condition involving deafness and hair abnormalities. It was first characterized in 1965, in Oslo, by prof. Roar Theodor Bjørnstad and thirty-eight cases have been reported after it was described. The Bjornstad syndrome is characterized by sensorineural hearing loss and pili torti. The hearing loss is congenital, typically sensorineural, affects both ears and with variable severity. The hearing deficit may become evident in the first three to four years of life. The hearing problems vary from deafness to reduced hearing in defined frequencies. Pili torti (twisted hairs), is a condition in which the hair shafts are flattened at irregular intervals and twisted 180 degrees from the normal axis, making the hair extremely brittle, and it is usually recognized early in childhood. Both autosomal dominant and recessive inheritance patterns have been reported in the medical literature. Currently, an autosomal recessive mode of inheritance is suggested for the syndrome, and the gene locus has been mapped to the 2q34-q36. However, when pilli torti is seen without associated findings is often inherited autosomal dominantly. There are two possible candidate genes of causing Bjornstad syndrome: 1) the IFAP gene and closely linked genes coinheritance in the 2q34-q36 region, who products are intermediate filament and intermediate filament-associated proteins and 2) the BCS1L gene that disrupt the assembly of mitochondrial respirasomes, which are the basic unit for respiration in human mitochondria. The aim of the present work is to describe a rare disorder associated with sensorineural hearing loss.

GENETIC AND BIOLOGICAL STUDIES

N. 54 - X-LINKED HEARING LOSS IN CANADA: IMPLICATIONS FOR CLINICAL CARE

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X-linked hearing loss is rare, accounting for less than 3% of all genetic, non-syndromic types of hearing impairment. In this study we describe 2 X-linked families from Canada: (1) a family with a \textit{POU3F4} gene mutation from Ontario and (2) a very large \textit{SMPX} family with multiple affected branches that originates in Newfoundland but with relatives dispersed across Canada. Although rare in the hearing impaired population, in communities with large X-linked pedigrees, the condition may be encountered more frequently in clinical practice. Identification of the genetic mutation and understanding of its transmission and natural history can inform clinical monitoring and decision making. For example, the hallmarks of \textit{POU3F4} etiology, presenting in male patients, are congenital mixed hearing loss with abnormal temporal bone features and stapes fixation. Recognition of the \textit{POU3F4} phenotype is critical because the course of treatment precludes stapedectomy due to the risk of perilymphatic gushing and deterioration of the sensorineural hearing loss; appropriate intervention typically involves the use of amplification. Furthermore, in X-linked families, female carriers are more mildly affected or unaffected due to random X-inactivation, leading to missed identification of their carrier status and missed opportunities for screening, surveillance and diagnosis of hearing loss in these individuals and their offspring. Benefits can be realized in the streamlining of identification of individuals who are carriers of a familial mutation and elimination of siblings and other relatives who are not carriers, so that clinical services can be best utilized for individuals truly at risk for hearing loss, and family concern and clinical surveillance of non-carriers can be eliminated. These examples serve to demonstrate how family-based clinical services which incorporate genetic assessment and counseling in the empowerment of families as well as individuals, could improve Canadian healthcare and outcomes for hearing loss.

**N. 55 - AUDIOLOGICAL EVALUATION IN 81 CHINESE PATIENTS CARRYING MITOCHONDRIAL DNA MUTATIONS**

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**Objective.** The aims of this study were to determine incidence, onset, and characteristics of hearing loss in Chinese with mitochondrial encephalomyopathies and to investigate a possible cause of hearing loss. In addition, we investigated the prognostic value of hearing loss as a predictor of the disease. **Study Design.** From Jan 2008 to Dec 2011, 81 patients ranging in age from 6 to 65 years (mean 22 years) were studied. These patients were diagnosed in the neurologic department. **Methods.** The mitochondrial disorder was diagnosed by means of clinical and laboratory testing, including analysis of the mtDNA. Audiological evaluation consisted of measurements of pure-tone and speech audiometry, tympanometry, and acoustic reflex threshold testing; auditory brainstem response; electrocochleography, and evoked as well as distortion-product otoacoustic emissions. **Results.** A sensorineural hearing loss was identified in 64 patients. Two of these were diagnosed as having classic KSS; thirty eight as having MELAS; eighteen
as having CPEO; three as having MIDD; and three as having MERRF. Audiological test results in all patients suggested cochlear as well as retrocochlear origin of the hearing loss presenting independently from the severity of hearing impairment. Within this study group only certain genetic defects were associated with hearing loss, and for individuals harbouring the A3243G point mutation, the severity of the hearing loss correlated with the percentage level of mutated mtDNA (mutation load) in blood and urine cells. No correlation between the characteristics and degrees of hearing loss and the number and severity of clinical neurological symptoms could be found. **Conclusions.** The present study demonstrated a high incidence (79%) of sensorineural hearing loss in patients with mitochondrial encephalomyopathies. The hearing loss does not have a prognostic value for the progression of the disorder. Based on our findings, we recommend regular audiometric examinations in patients with mitochondrial disorders.

**N. 56 - MTHFR 677T IS A STRONG DETERMINANT OF THE DEGREE OF HEARING LOSS AMONG POLISH MALES WITH POSTLINGUAL SENSORINEURAL HEARING IMPAIRMENT**

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Hearing impairment (HI) is the most common sensory handicap. Whereas congenital HI has often a genetic basis the etiology of nonsyndromic postlingual HI (npHI) usually remains unidentified. Our purpose was to test whether the MTHFR C677T (rs1801133) polymorphism affecting folic acid metabolism is associated with the occurrence or severity of npHI. We studied rs1801133 genotypes in 647 npHI patients (age < 40 years, sudden sensorineural loss excluded, HI characterized as mean of better ear hearing thresholds for 0.5-8kHz) and 3273 adult controls from background population. Genotype distribution among patients and controls was similar but among male cases (N=302) we found a dose dependent correlation of MTHFR 677T with degree of HI (mean thresholds in dB: 38.8, 44.9 and 53.3, for CC, CT and TT genotypes, respectively; \(P=0.0013, P_{\text{corr.}}=0.017\)). Among male patients rs1801133 TT significantly increased risk for severe/profound HI (OR=4.88, \(P=0.001\)). Among controls the known effect of MTHFR 677T on homocysteine concentration was more pronounced in men than women (\(P<0.00004\) for genotype-sex interaction) suggesting that in Poland folic acid deficiency is more prevalent in males. In conclusion, we report a novel effect of MTHFR 677T on homocysteine concentration was more pronounced in men than women (\(P<0.00004\) for genotype-sex interaction) suggesting that in Poland folic acid deficiency is more prevalent in males. In conclusion, we report a novel effect of MTHFR 677T among males with npHI. The functional significance of rs1801133 suggests these patients may benefit from folic acid supplementation.
N. 57 - AUDIOLOGICAL CHARACTERISTICS OF PATIENTS WITH THE MUTATION M.A1555G

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Many commonly used medications may be in a transient and reversible, or permanent adverse effect on the level of hearing impairment in humans. It is believed that some aminoglycoside antibiotics can damage the sensory epithelium in the inner ear. In case of ototoxic aminoglycosides (e.g., gentamicin, amikin, streptomycin) causing the damage to the bacterial ribosome, mitochondrial ribosome may be destroyed because of its similarity. Susceptibility to such antibiotics effect is passed in the maternal line, indicating the mitochondrial type of inheritance. Many mutations in the mitochondrial genes 12S rRNA and tRNAser related to "aminoglycoside" hearing loss were described. One of them is m.A1555G mutation which occurs in a highly conserved region of 12S rRNA molecule, leading to reduced production of ATP in the cells of the cochlea. The aim of this study was to assess the level of hearing loss among patients with the mutation m.A1555G. We studied a group of 1933 patients of the Institute of Physiology and Pathology of Hearing for the presence of mutation m.A1555G using RealTime PCR technology. In the studied group 25 patients with this mutation were found.

N. 58 - SEARCHING FOR AUTOIMMUNOLOGICAL AETIOLOGY OF ADULTS’ SENSORINEURAL HEARING LOSS

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In the serum of the patients with sensorineural hearing loss the number of specific antibodies against the antigens of inner ear are analyzed. The antigen of the mass 68kD, indentified as the protein of heat shock (HSP 70), is suggested to be of greatest analyzed. It is present in 58% of patients with autoimmunological inner ear disease. It is interesting in how many patients with sensorineural hearing loss the immunological aetiology can be suspected on the base of circulated immunological complexes and HSP 70. The aim of the study was to estimate in the patients with sensorineural hearing loss the level of circulated immunological complexes, free HSP 70 and the presence of HSP 70 in immunological complexes. 29 patients aged 23-65 with sensorineural hearing loss- progressive and sudden- were tested. The estimation of the level of circulated immunological complexes was done using Creighton’s method, their isolation by precipitation in PEG, their dissociation in merykaptoethanol and identification of HSP 70 by Dot Blot method. In 11 cases (38%) the increased level of circulated immunological complexes were noted. In serum of 3 patients the positive reaction for the presence of HSP 70 was observed. The positive answer to HSP 70 was noticed in dissociated circulated immunological complexes isolated from the serum. In more than one/third of the patients with sensorineural hearing loss the increased level of
circulated immunological complexes could be observed. In part of them HSP 70 could be identified both in the serum and in isolated and dissociated immunological complexes. It seems to be of great importance to search for the mentioned immunological reactions in fast diagnosis and monitoring the patients with sudden and progressive sensorineural hearing loss.

N. 59 - OTOF MUTATION SCREENING IN CONSANGUINEOUS GJB2-NEGATIVE ARNSHL FAMILIES: REPORT OF A NOVEL FRAMESHIFT MUTATION

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Mutations in the OTOF gene have been reported to cause nonsyndromic hearing loss in different populations. The purpose of this study is screening for OTOF mutations in an Iranian population. Thirtyeight consanguineous, GJB2 and GJB6 negative families affected with autosomal recessive nonsyndromic hearing loss were screened by haplotype analysis and direct sequencing to find OTOF mutations. A novel homozygous frameshift mutation was found to cause hearing loss in one family. Our results show that OTOF mutation is not a major cause of ARNSHL among Iranian population.

N. 60 - NEW TRANSPLANTATION ROUTE FOR STEM CELL TRANSPLANTATION INTO THE COCHLEA: PRELIMINARY REPORT

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**Objectives.** Cell transplantation provides a potential method to replace the irreversible loss of auditory hair cells and neurons. A fundamental requisite is to deliver the potentially restorative cells to the target area, organ of Corti and spiral ganglion. Minimal trauma to the homeostasis of the host is mandatory. But it is particularly difficult to application of stem cell transplantation in the inner ear due to its highly specialized and complex anatomy. In this study, we will prove the intravenous route of stem cell transplantation to the inner ear and the efficacy of the umbilical cord blood-derived mesenchymal stem cell transplantation in hearing restoration of deaf animal model. **Materials and methods.** 5 Guinea pigs were induced to deaf after intratympanic injection of ouabain and neomycin. About 100,000 umbilical cord blood-derived mesenchymal stem cells which were tagged a PKH26 were infused to deaf Guinea pig intravenously. After 1 week and 3 weeks, auditory brainstem response test was checked and we obtained a Guinea pig cochlea. A Cryosection of each cochlea every 120 μm was obtained and we calculated stem cells for 3 sections of each animal. **Results.** No hearing gain was shown after stem cell transplantation, but PKH 26 tagging mesenchymal stem cell was found in modiolus, Rosenthal’s canal and organ of Corti. Cells were not found in scala tympani, scala media and scala vestibuli. Average number of cells in the inner ear about 88 cells (59–123 cells/section). Most cells were found in spiral
ganglion and migrated into the organ of Corti. **Conclusion.** In this study, we demonstrated that cord blood-derived mesenchymal stem cells could be delivered into the inner ear with intravenous infusion. Based on these results, intravenous injection of stem cells may be used in the treatment of sensorineural hearing loss, regeneration of the auditory hair cells and neurons.

**N. 61 - INDUCTION OF DIFFERENTIATION INTO INNER EAR HAIR CELLS AND NEURONS FROM AMNIOTIC MEMBRANE-DERIVED STEM CELLS**

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¹College of Medicine, The Catholic University of Korea, Seoul St'Mary’s Hospital, Department of Otolaryngology-Head & Neck Surgery, Seoul, Republic of Korea; ²College of Medicine, Han-Yang University, Han-Yang University Hospital, Department of Otolaryngology-Head & Neck Surgery, Seoul, Republic of Korea

**Objectives.** A Placenta, umbilical cord and blood is an alternative source of stem cells. It is normally discarded at birth, but it provide an easily accessible adult stem cells. And it is clinically used in many diseases, hematologic diseases, burn, ocular surface reconstitution etc. So, we designed an experiment to isolate and culture stem cells from human amniotic membrane. And we make a plan to induce auditory hair cells and neurons from the stem cells of amniotic membrane. **Materials and methods.** Human amniotic membrane was obtained under the permission from patients & IRB (KCo8CIMI0344). We dissociated amniotic membrane with Trypsin and transferred to culture medium which was containing 10% fetal bovine serum and 1% penicillin-streptomycyn. We sub-cultured until the third generation were used for further experimental procedures. For differentiation into neural progenitor cells, we cultured amniotic membrane stem cell in EGF (epidermal growth factor) and β-FGF(fibrous growth factor) and for differentiation into hair cells and neurons, we cultured in neurobasal medium. **Results.** We could isolate and culture stem cells from human amniotic membrane. By flow cytometric analysis of stem cells from human amniotic membrane, they showed positive responses at mesenchymal stem cell marker (CD73, CD90, CD105) and negative responses at hematopoietic stem cell marker (CD34, CD14, CD19, HLA). The results of culture at different culture medium showed a differentiation to neural progenitor cells, hair cells and neuron, and we confirm by immunofluorescence staining and RT-PCR. **Conclusion.** In the current study, it was demonstrated that amniotic membrane-derived stem cells could be differentiated into neuronal progenitor cells, and this could lead to the differentiation into hair cells and neurons. Based on these results, amniotic membrane-derived stem cells or neuronal progenitor cells could be used to treat intractable inner ear disease, especially in sensorineural hearing loss, on a cellular level.

**N. 62 - NEURAL CONTROL OF EUSTACHIAN TUBE: PHYSIOLOGICAL AND IMMUNOHISTOCHEMICAL STUDY**

Testa D, Nicolò D, Nunziata M, Coletta M, Ferrillo B, D'Angelo L

Institute of Otolaryngology, Second University of Naples, Italy
Literature studies about mechanism of regulation of middle ear’s airway pressure are several. In 1987 Eden et al. had already endorsed the hypothesis that the middle ear’s pressure could be regulated by the Eustachian tube through the action of a neural reflex arc. So, the existence of baro and chemoreceptors situated on the mucous membrane covering the cavity of middle ear and of mechanoreceptors situated on the tympanic membrane was hypothesized. This receptor system seemed to be sensitive to a change of pressure and/or to a change of concentration and chemical composition of gases (variation of partial pressure and chemical composition in N₂, H₂O, O₂, CO₂) that were manifested in the tympanic cavity either in physiological or pathological conditions determining, once activated, a stimulation of the neurons of the brainstem which in turn controlled the periodical opening of the Eustachian tube through the contraction of muscles around the tube. Our study is aimed, through immunohistochemical and clinical instrumental experiments, to demonstrate the presence of potential baro and/or chemoreceptors distributed on the medial wall of the mucous membrane covering the tympanic cavity and to give a further contribution to clarify the possible role of the subtle and complex mechanism of neural control that presides to the regulation of pressure in the middle ear. For this reason, the potential mechanoreceptors situated on the internal face of the tympanic membrane and the baro and chemoreceptors distributed on the mucous membrane covering the middle ear that it is hypothesized are part of the afferent plexus of the neural reflex arc, they have been blocked through a topical administration of lidocaine hydrochloride; thus, through the study of the efferents of the neural reflex arc and through manometric tests, the tubal function before and after the block induced against the afferent system was evaluated.
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