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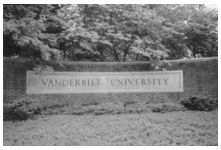
Vanderbilt Journal Club: Hearing Aid Research with Clinical Implications

TODD A. RICKETTS & ERIN M. PICOU

MARCH 8, 2017



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Why isn't this about features?

Vanderbilt Audiology Journal Club – Research Examining Benefit of Hearing Aid Features

- Todd Ricketts presented
- AO Course #27893, recorded September 14, 2016

Topics covered included

- Children's preferences for digital noise reduction
  - Scollie et al (2016)
- Effects of frequency compression on speech recognition for adults
  - Miller, Bates & Brennan (2016)
- Effects of training as a supplement to hearing aid fittings
  - Saunders et al (2016)

AudiologyOnline

CONTINUED™

Today's Focus

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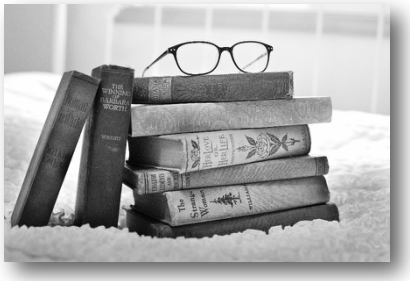
Hearing aid research with direct clinical implications
- Based on research published February 2016 to late last week…

Pre-fitting
- Singh & Launer (2016)

Service Delivery
- Humes et al (2017)

Features
- Korhonen et al (2017)
- Moore & Sek (2016)
- Neher, Wagener & Fischer (2016)

Post-fitting
- Joseph et al (2016)
- Caposecco et al (2016)



Learner Outcomes

List recent key journal articles on the topic of hearing aids that have implications for audiology clinical practice.

Describe the findings from recent key journal articles on the topic of hearing aids that have implications for audiology clinical practice.

Explain the implications for audiology clinical practice from recent key journal articles on the topic of hearing aids.

Disclosures

Employed by Vanderbilt University Medical Center

Receive funding for research from
- Sivantos
- Oticon
- Phonak / Sonova
- Resound
- Starkey
- NIH NIDCD
- NSF
- ASHA

Todd Ricketts
- Board of Directors for American Academy of Audiology
- Recent Section Editor for the *Journal of Speech Language and Hearing Research*
- Audiology advisory board for EarLens

Erin Picou
- Editorial Board of the *American Journal of Audiology*
- Associate Section Editor for *Ear and Hearing*

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Social Context and Hearing Aid Adoption

PHONAK

GURJIT SINGH & STEFAN LAUNER

(2016) *TRENDS IN HEARING, 20,* 1-10

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What they asked…

- Is there an association between attendance by significant others at audiology appointments and hearing aid adoption?
- Is the association between attendance by a significant other and hearing aid adoption related to degree of hearing loss?
- Are return rates associated with attendance by significant others at audiology appointments?

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A little background…

Hearing aid adoption is low

Factors that increase hearing aid adoption

- Higher degree of hearing loss
- Greater awareness of communication difficulties
- Self-reported hearing disability
- Better finger dexterity and visual acuity
- Low stigma
- More openness to new experiences
- Less neuroticism
- An internal locus of control
- Positive expectations

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A little background…

Social support and hearing aid outcomes

- Reported availability of social support best distinguished "successful" from "unsuccessful" hearing aid users
- Social support the best predictor of hearing aid satisfaction

Social support in the appointment room

- Significant others may minimize perceived risk associated with purchase decisions
- Significant others may act as interpersonal sources of information, support decision-making processes, and increase confidence

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Why it matters…

- ❑ Millions of people have hearing loss
- ❑ Hearing aids can improve audibility, quality of life, and well-being
- ❑ The results of this study will inform audiologists the extent to which engaging a significant other during the appointment may be helpful in encouraging hearing aid adoption

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What they did…

Procedure:

- Retrospective examination of 60,964 patient records from a private chain of audiology clinics in the United Kingdom
- First-time patients who all received hearing assessments and were recommended to pursue at least one hearing aid
- Patients were encouraged to bring significant other
- Noted if patients attended "*alone*" or with "*SO*"

	Alone	**SO**	***p***	***Significant?***
Sample size	33,933	27,031	0.000	YES
% Female	56.5	54.4	0.000	YES
Age (mean; SD)	70.4 (12.4)	74.5 (1.6)	0.000	YES

Adapted from Singh & Launer (2016)

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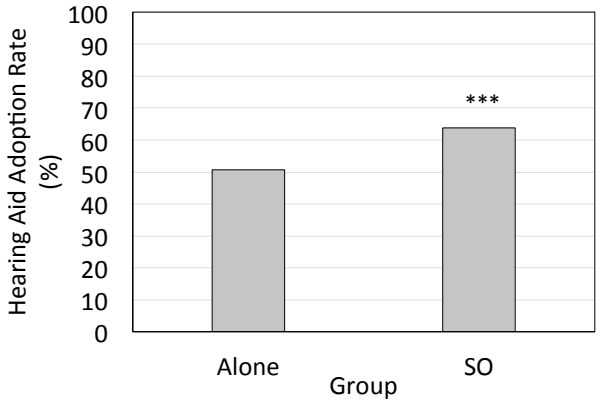
What they found…

Significant relationship between attendance of significant other and hearing aid adoption rate



Adapted from Singh & Launer (2016)

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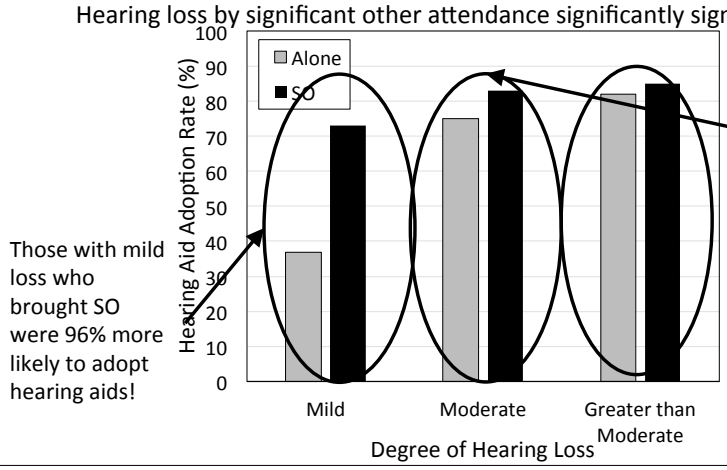
What they found…

Hearing loss by significant other attendance significantly significant



Those with mild loss who brought SO were 96% more likely to adopt hearing aids!

Those with moderate loss who brought SO were 15% more likely to adopt hearing aids

Adapted from Singh & Launer (2016)

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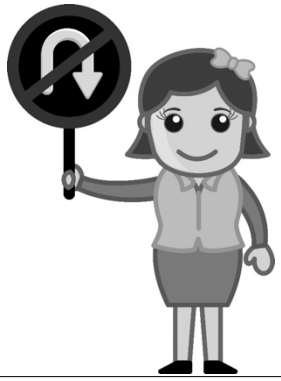
What they found…

Return rates were not associated with age, gender, or significant other attendance status



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Why is this important?

Important implications for involving significant others in hearing healthcare, especially for listeners with mild loss

Possible explanations:

- Preexisting differences
  - Motivation, personality traits
- Coercion
  - Social pressure to pursue hearing aids
- Preadoption uncertainty
  - Individuals consult with others when uncertain about decision
- Combination of these hypotheses
  - May vary based on a particular pair

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Does it matter clinically?

Exploratory study limited by:

The Effects of Service-Delivery Model and Purchase Price on Hearing-Aid Outcomes in Older Adults: A Randomized Double-Blind Placebo-Controlled Clinical Trial

LARRY E. HUMES, SARA E. ROGERS, TERA M. QUIGLEY, ANNA K. MAIN, DANA L. KINNEY AND CHRISTINE HERRING

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What they asked…

- Can individuals with normal cognitive status (screening) and mild-to-moderate hearing loss (through audiological assessment), self select a frequency response (from one of three options) and coupling that yields outcomes that are equivalent to the same instruments fitted to individualized NAL-NL2 targets using probe microphone techniques?
- Are these outcomes different than a placebo fitting and are they affected by purchase price.

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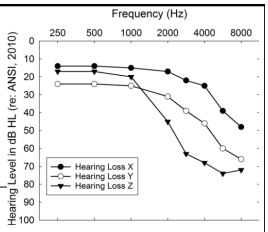
Why it matters…

- Accessibility and affordability of hearing health care for the millions of older adults with hearing loss is a crucial and important issue – recently receiving a much-deserved increase in national and international attention.

What they did…



- Selected adults, ages 55–79 years, with mild-to-moderate hearing loss. There were 188 eligible and 154 completed.
  - 323 responded to recruitment – 41% were not eligible, most commonly too much or too little hearing loss – worth examining further regarding self-identification of mild-to-moderate hearing loss?
- Prospective, double-blind placebo-controlled randomized trial with three parallel branches using the same RIC instrument with all features active:
  1. Verified - Fit to NAL-NL2 with probe microphone, professional orientation, no adjustment at follow-up.
  2. Self-Selected - Selected dome, receiver wire length and frequency response from three options (X, Y and Z) based on the three most common hearing configurations in mild-to-moderate loss. Professionally developed PowerPoint/Video self-orientation – call with questions.
  3. Placebo - fitted with 0 dB insertion gain.
- Outcome measures were obtained after a typical 6-week trial period
- Follow-up 4-week trial for those initially assigned to groups 2 and 3.
  - Assigned to different payment groups, but no effect on outcomes.

What they found, what it means…

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- Compared to placebo there was no differences in outcomes on the Profile of Hearing Aid Performance or Connected Sentence Test for the Verified or Self-selected groups. Both groups performed significantly better than the placebo groups.
- The Self-selected groups had significantly lower ratings on the Hearing Aid Satisfaction Survey (HASS) – (hearing aid features and functions and dispenser-related processes subscales) and were less likely to purchase hearing aids after the trial (55% vs 81%; 36% - placebo).
  - True Placebo? Instruments appear to have compression (more than 0 dB gain for soft?) and some implemented directional microphones.
- More cost effective service delivery models may be applied without significantly reducing hearing aid benefit - if appropriate controls are applied.

Evaluation of a Wind Noise Attenuation Algorithm on Subjective Annoyance and Speech-in-Wind Performance

WIDEX®

PETRI KORHONEN, FRANCIS KUK, ERIC SEPER, MARTIN MØRKEBJERG, AND MAJKEN ROIKJER

(2017) *JOURNAL OF THE AMERICAN ACADEMY OF AUDIOLOGY, 28,* 46–57

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What they asked . . .

- Wind crossing the hearing aid microphone port openings creates turbulence. These vibrate the diaphragm generating relatively high noise levels.
- Can LMS processing applied for the purposes of wind noise management, reduce wind noise and improve speech recognition in wind for one environment?

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Why it matters. . .

- Fewer hearing aid wearers reported being satisfied with their hearing aids performance in wind noise than any other type of noise listed (MarkeTrak, 2010).
- Wind noise can reduce speech intelligibility at 3 m/s, and totally mask speech at 6 m/s (Zakis and Hawkins, 2015).
- Doubling wind speed increases wind noise by more than 12 dB (Kates, 2008; Morgan and Raspet, 1992).
- Physical modifications help (~18 dB) – but still many complaints.

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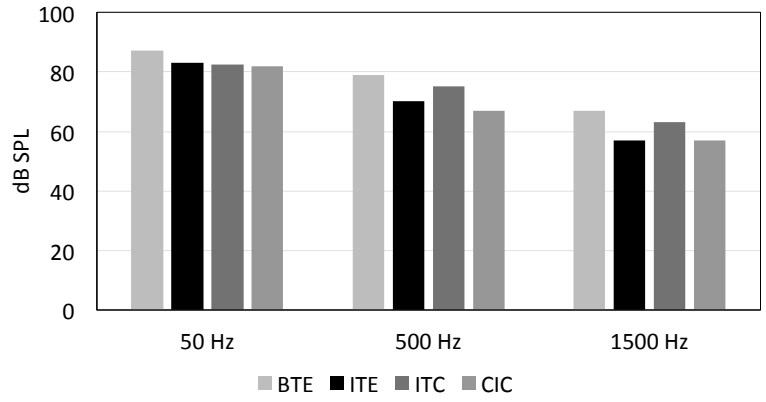
Wind noise levels through hearing aids are how high? (adapted from Dillon, 2005)



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A little background…

- Because it is turbulence (not a true noise), the noise generated is highly uncorrelated, therefore traditional spectral subtraction techniques are largely ineffective.
- Lack of correlation at the two microphone openings in a dual mic hearing aid makes it possible to identify since speech and many noises are highly correlated at the two mics.
- Traditional techniques once identified? (no expected speech recognition improvement)
  - Reduce low-frequency gain
  - Switch to omni mics (at least in the low frequencies)

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The technique: LMS WNR

- Least Mean Square (LMS) filters are designed to identify the filter coefficients that minimize the squared error between the desired and the actual signal (occurs when the desired and actual signal correlate) – therefore they can reduce uncorrelated noise.
- LMS wind noise reduction has been shown to reduce wind noise by up to 15 dB (Korhonen et al., 2017).

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What they did . . .

- Fifteen adults with bilaterally symmetrical hearing loss participated (12 hearing aid wearers).
- All stimuli were prerecorded in a wind tunnel (KEMAR) and presented via an insert earphone (left only).
- Subjective rating for wind noise annoyance was measured for wind presented alone from 0 and 290 degrees at wind speeds of 4, 5, 6, 7, and 10 m/sec.
- Phoneme identification performance was measured using a Nonsense Syllable Test presented at 60, 65, 70, and 75 dB SPL from 270 degrees in the presence of wind originating from 0 degrees at a speed of 5 m/sec.

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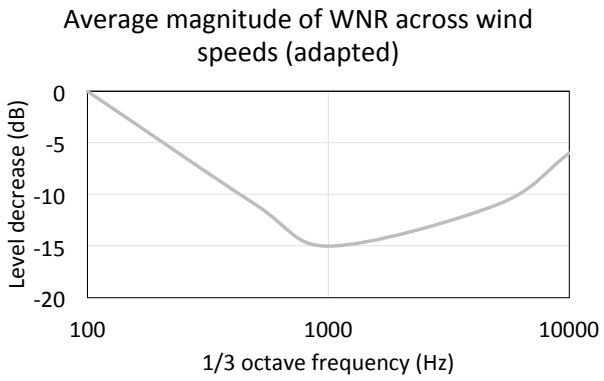
What they found (Acoustic). . .



Adapted from Korhonen et al (2017)

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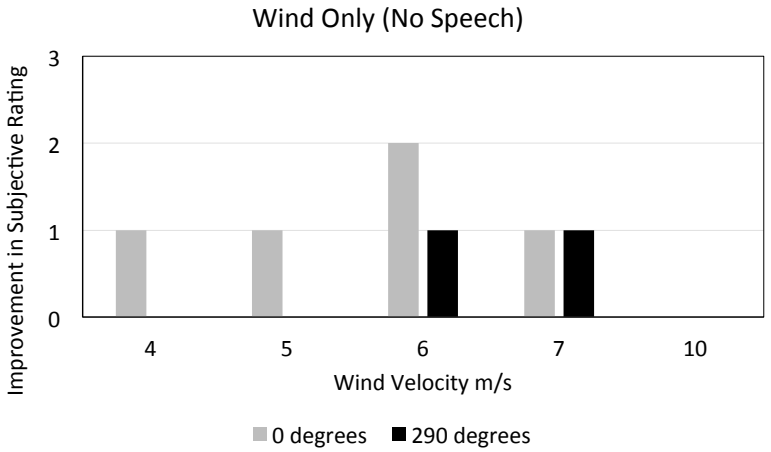
What they found (Subjective ratings – 7 point Scale). . .



Adapted from Korhonen et al (2017)

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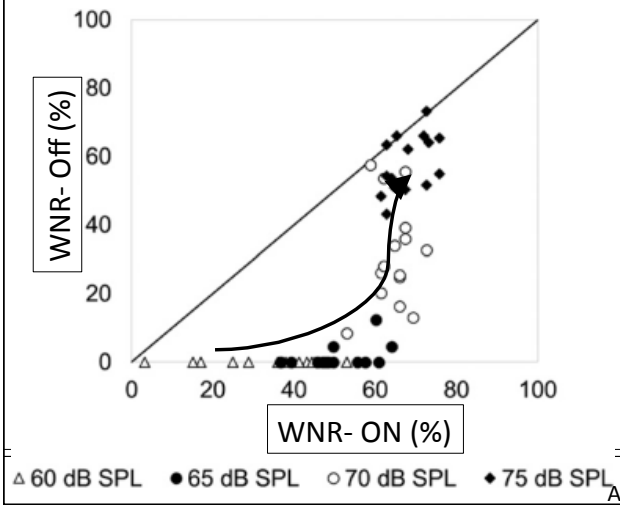
What they found (NST - adapted). . .



Speech presented from 0 degrees, wind 290 degrees only.

4 speech presentation levels.

Large average benefits up to nearly 50%

Adapted from Korhonen et al (2017)

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Limitations…

- Only evaluated speech recognition for one environment - The magnitude, or even presence of speech recognition benefits in other realistic environments are as yet unknown.
- Only evaluated subjective annoyance for two angles - The magnitude, or even presence of benefits in other realistic environments are as yet unknown.

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Why is this important? Clinical implications?

- Potential for reduced subjective wind annoyance and improved speech recognition in wind noise.
- One of at least two manufacturer techniques used in hearing aids that have been shown to deliver these benefits.
  - The other is signal sharing from the side with the better SNR (most benefit with speech to the side)
- Perhaps the more we can limit the negatives of hearing aid use the higher the acceptance and the more likely patients will be to use them.

Preferred Compression Speed for Speech and Music and Its Relationship to Sensitivity to Temporal Fine Structure

UNIVERSITY OF CAMBRIDGE

BRIAN C.J. MOORE AND ALEKSANDER SEK

(2016) *TRENDS IN HEARING, 20,* 1–15

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What they asked…

- Is reduced sensitivity to temporal fine structure (TFS) associated with preference for slow compression when listening to music and/or speech?

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A little background…

- People with cochlear hearing loss usually experience loudness recruitment and the associated reduced dynamic range, which is commonly counteracted to some extent using multichannel amplitude compression (low-level sounds are audible without high-level sounds being too loud).
- Controversy continues about the "best" way to implement compression - fast acting or slow acting.
- When considering a frequency band - Temporal information can be separated into rapid oscillations close to the center frequency (TFS) and slower amplitude modulations (temporal envelope).
  - Hearing impaired listeners generally have more limited ability to use TFS.

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Why it matters...

- Individualizing processing for individual differences is expected to lead to better clinical outcomes.
- Optimizing sound quality through hearing aids is one important factor affecting the usefulness and acceptability of hearing aids.
- Poor sound quality is a major reason for rejection of hearing aids (Kochkin, 1996, 2010).

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What they did...

- Twenty-two hearing-impaired subjects were tested (56-87 yo). A simulated hearing aid was fitted individually using the CAM2A method. On each trial, a given segment of speech or music was presented twice.
- Five channel simulated compression hearing aid - (CTs) 49, 41, 40, 34, and 28 dB SPL – presented through HDA 200 headphones.
- Attack and release times set to 10 and 100 ms (fast) or 50 and 3000 ms (slow).
- CR limited to 3:1 (fast) and 10:1 (slow).

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What they did…

- There were a total of six signal types (Classical music, Jazz, Male singing, Percussion, Female speech, and Male speech), presented at three signal levels (50, 65 and 80 dB SPL).
- For each signal type and level, paired comparisons of two segments (one fast compression and one slow compression) were made and the order was balanced across trials.
- All subjects indicated which segment was preferred and by how much (3 point scale).
- Compared to Difference Limens for Frequency (DLFs) and Interaural Phase Sensitivity (low frequency and adaptive TFS)

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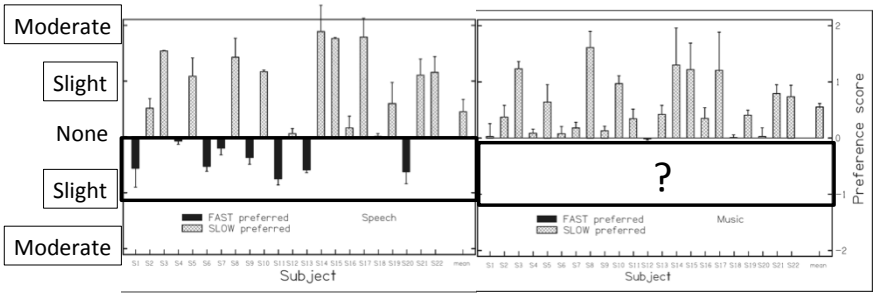
What they found…

SPEECH MUSIC



More preference for slow acting, but a lot of inter-subject variability

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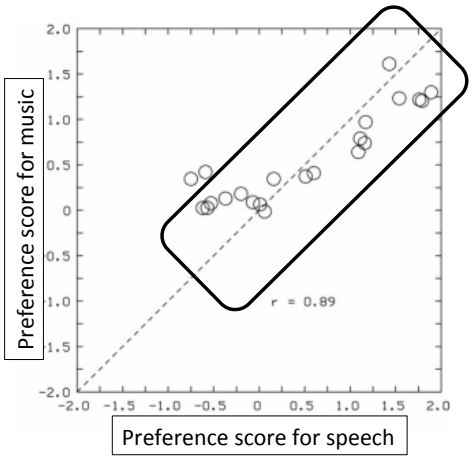
What they found…



Preference for slow compression was stronger for music, but similar preferences within subjects.

No significant main effect of presentation level.

Weak correlation between preference and one of the three TFS measures (Difference limens for frequency).

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Why is this important?

- Some evidence that TFS may be related to time constant preference, but not strong enough to warrant clinically testing with the measures used in this study.

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Does it matter clinically?

- Even though the TFS question was not clearly answered, there were some interesting findings related to preference. Specifically, slow time constants generally provided similar or better sound quality for music and speech for the majority of listeners.

- Although not 100% accurate, choosing slow time constants may therefore be the "safest" choice when considering sound quality for music.

Directional Processing and Noise Reduction in Hearing Aids: Individual and Situational Influences on Preferred Setting

TOBIAS NEHER, KIRSTEN C. WAGENER &

ROSA-LINDE FISCHER

(2016) JOURNAL OF THE AMERICAN ACADEMY OF AUDIOLOGY , 27, 628–646

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What they asked…

- Can PTA, self-reported noise sensitivity and personality factors predict preference for directional and Digital Noise Reduction (DNR) processing?
- Does the spatial target speech configuration interact with preference?

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A little background…

- In clinical practice, the only user factors routinely taken into account when fitting HAs are pure-tone audiometric hearing thresholds and patient complaints.
- Limited data suggest that more hearing loss is sometimes associated with preference for stronger DNR processing (Luts et al, 2010; Neher et al, 2014b). However, no relationship between audiometric factors and directional benefit/preference has been found (Ricketts and Mueller, 2000; Keidser et al, 2013).
- In general the data to date suggests that listeners with a larger working memory capacity are more likely to benefit from DNR, but not predictive of directional benefit.

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Why it matters…

- Individualizing processing for individual differences is expected to lead to better clinical outcomes.
- Optimizing noise management is one important factor affecting the usefulness and acceptability of hearing aids.
- Complaints about listening in noise is repeatedly cited as one of the top reasons patients pursue hearing aids.

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What they did…

- Sixty experienced HA users aged 60–82 yr with controlled variation in PTA and working memory capacity participated. All were (previously) evaluated on tasks of "executive control" (working memory, mental flexibility, and selective attention) and a Reading Span task (working memory capacity).
- In addition, two questionnaires targeting noise sensitivity and the "Big Five" personality traits (neuroticism, extraversion, openness to new experiences, agreeableness, and conscientiousness) were administered.
- Overall preference was assessed using a free-field simulation of a busy cafeteria situation (8 loudspeakers) with either a single frontal talker or two talkers at +/- 30 degrees (-4, 0, +4 – dB SNR – two above 50% performance).
- Two directional processing conditions (fixed directional and bilateral beamformer) combined with inactive, moderate, or strong single-microphone DNR (modulation based + Weiner Filtering) were programmed into a pair of behind-the-ear HAs together with individually prescribed amplification for a total of six conditions.

What they found (Group preference)…

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Single talker: Generally preferred bilateral beamformer over unilateral beamformers and moderate DNR over strong DNR.

Two talkers: Generally preferred unilateral beamformer over bilateral beamformers and moderate DNR over strong DNR.

Noise sensitivity and personality had no influence on DIR and NR outcome!

What they found (PTA and Executive Control)…

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Generally preferences didn't change as a function of PTA or executive control, strength of preference did!

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Why is this important? Clinical implications?

- Limited support that PTA and executive control modulate preferred DIR and NR setting; however, the effects vary as a function of specific technology. In addition, these factors only accounted for a limited potion of inter-individual variability in preferred HA setting.
- A number of research questions remain unanswered, but there is some potential for individualizing selection and adjustment of directional and DNR technologies. Importantly, when developing these techniques, situational influences such as target speech configuration that should also be considered.

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Hearing Aid Patient Education Materials: Is There Room for Improvement?

WAYNE STATE UNIVERSITY SCHOOL OF MEDICINE · RUTGERS New Jersey Medical School · NJNJ Neurological Institute of New Jersey · MEI Michigan Ear Institute

JOHN JOSEPH, PETER F. SVIDER, KEVIN SHAIGANY, JEAN ANDERSON ELOY, PAULETTE G. MCDONALD, ADAM J. FOLBE, & ROBERT S. HONG

(2016) *JOURNAL OF THE AMERICAN ACADEMY OF AUDIOLOGY, 27,* 354–359

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What they asked…

Do patient education materials meet guidelines recommended by public health agencies?

- Materials from hearing aid manufacturers
- Information obtained from Web sites

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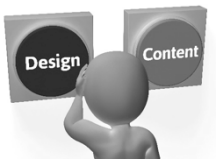
A little background…

- ❑ National Institutes of Health and US Department of Health and Human Services recommend reading materials have a 6th – 7th grade reading level
- ❑ Prevalence of hearing loss increases with age
- ❑ Elderly may need a lower reading level
- ❑ Adults are increasingly turning to the Internet to research health related concerns



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Why it matters…

- Millions of Americans have hearing loss, but adoption rates are low
- If patient education materials are too complicated, it may prohibit hearing aid adoption or successful use

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What they did…

User guides from hearing aid manufacturers

- English
- BTE instruments
- Big 6 hearing aid manufacturers
  - Willam Demant, GN Store Nord, Siemens, Sonova, Starkey Technologies, Widex

Information from popular Web sites

- Search for "hearing aid"
- Excluded news articles
- Health information services
  - Consumer Reports, Wikipedia, WebMD
- Professional organizations
  - Mayo Clinic, ASHA.org, BetterHearing.org, ENTnet, Medline/NIDCD
- Online retail information
  - Costco, Beltone, Miracle-Ear, EarQ

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What they did…

Readability analysis

- Flesch Reading Ease (FRE)
  - score of 0 to 100 (higher = more difficult)
- Gunning-Fog Index (GF)
  - number of sentences and ≥3 syllables
- New Fog Count (NFC)
  - number of complex words, easy words, sentences
- Raygor Estimate Graph (RE)
  - avg number of long words and sentences
- Simple Measure of Gobbledygook (SMOG)
  - sentence length and density of hard words with ≥3 syllables

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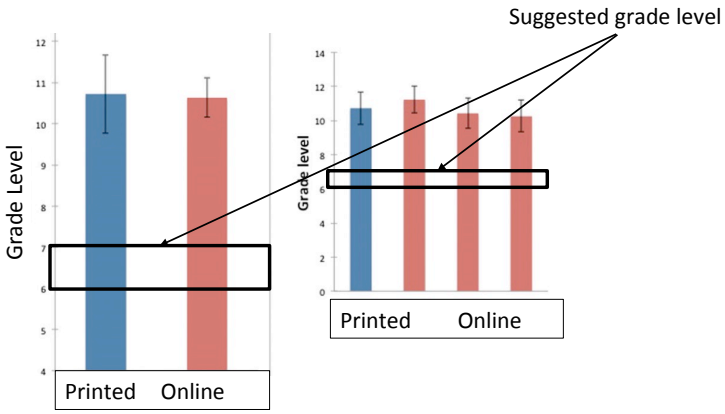
What they found…



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What they found…

Supplier

Professional

Printed

Retailer

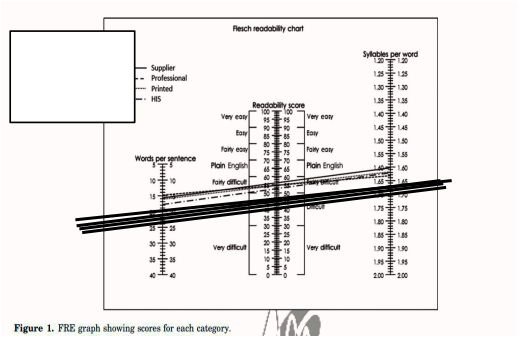

Figure 1. FRE graph showing scores for each category.

Adapted from Joseph et al (2016)

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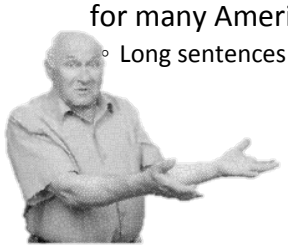
Why is this important?

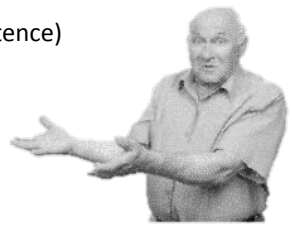
Patient-centered and family-centered practices seek to empower patients and family to take responsibility for healthcare

Critical to ensure accessibility of information

The information available is written at a level too difficult for many Americans

- Long sentences driving factor (16 words per sentence)





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Does it matter clinically?

- Poor comprehension leads to low compliance rates, increased number of visits and decreased quality of life
- Study only considered written text and did not evaluate comprehension
- Patient understanding of materials may be better than expected based on text readability

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Evaluation of a Modified User Guide for Hearing Aid Management

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

THE HEARING CRC

ANDREA CAPOSECCO, LOUISE HICKSON, CARLY MEYER & ASADUZZAMAN KHAN

(2016) *EAR AND HEARING*, *37*, 27–37

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What they asked…

- Can a modified hearing aid user guide improve hearing aid management, if the guide is modified according to health literacy best practices?

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A little background…

Experienced hearing aid users experience difficulties with hearing aid management

- Tasks that are easy
  - Removal
  - Battery
  - Insertion
  - Volume
- Tasks that are difficult
  - Cleaning
  - Telephone
  - Noise program

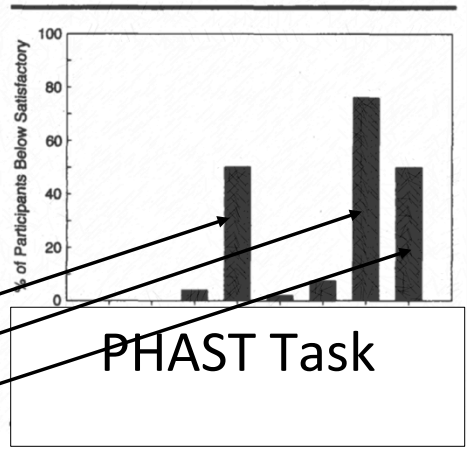

Figure modified from Desjardins & Doherty (2009) A*m J Audiol*, *18*, 69-77

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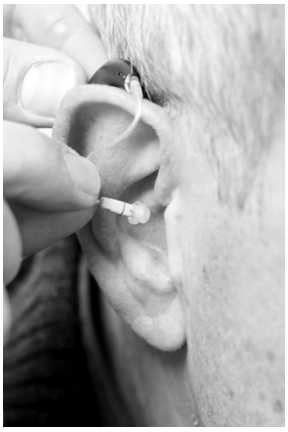
A little background…

Factors that affect hearing aid management

- Gender (female)
- Age (> 75 years)
- Finger dexterity (poor)
- Confidence (negative attitude and low self-efficacy)



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A little background…

Health literacy guidelines ***Davis et al (1996)***

- Active voice
- Common words
- 3rd to 6th grade reading level
- Simple line drawings
- Simple text caption with each figure
- Dark letters in 12 to 14 point font

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Why it matters…

High self-efficacy and accessible hearing aid information can lead to better hearing aid outcomes

- Higher adoption rate
- Lower return rate
- Higher satisfaction
- More benefit
- Reduced quality of life

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What they did…

Participants
- > 55 years old, fluent in English, new hearing aid users

Materials
- Demographic questionnaire – included hearing aid attitude and postcode
- Measure of Audiologic Rehabilitation Self-Efficacy for Hearing Aids (MARS-HA) – participant's predicted ability to perform basic and advanced HA skills
- Hearing Aid Management Test (HAM test) – based on the Profile of Hearing Aid Skills Test (PHAST) but allows participant to refer to a quick guide
  - Change the hearing aid battery
  - Turn the hearing aid on / off
  - Put the hearing aid in your ear
  - Hold the phone with the hearing aid
  - Turn up the volume of the hearing aid
  - Switch the hearing aid to program 2 – noise and sound program
  - Clean wax from the tube and put the hearing aid back together

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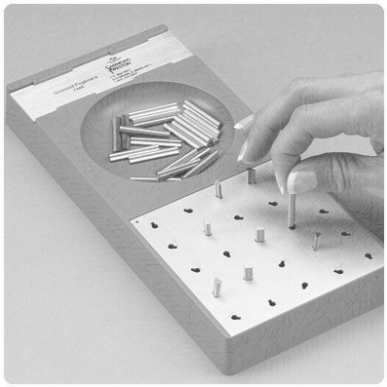
What they did…

Short Test of Functional Health Literacy in Adults (S-TOFHLA)
- timed reading comprehension test of two passages from a healthcare setting

Montreal Cognitive Assessment (MoCA)
- short cognitive screener

Grooved Pegboard Test (GPT)
- assess finger dexterity



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What they did…

	Original	Modified	Result
Size	14.5 x 9.8 cm	A4: 21 x 29.7 cm	BIGGER
Number of pages	56	32	SHORTER
Font Size	9 pt	20 pt	LARGER
Number of graphics	48	56	MORE PICTURES
Hearing aid models	3	1	SIMPLER
Grade level	10.5	4.2	SIMPLER
SAM Score	50%	90%	BETTER

Adapted from Caposecco et al (2016)

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What they did…

- 95 adults were enrolled and randomly assigned
  - 47 in modified user guide
  - 42 in original user guide
- Groups did not differ significantly on key demographic indicators or health literacy, hearing aid self-efficacy, cognitive function, finger dexterity, or hearing ability
- Participants did not know the study involved comparison of 2 user guides
- Demographic and MARS-HA were mailed to home, the remaining test battery items were completed at the time of the appointment

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What they found…

HAM test scores associated with:

- Modified user guide
- Adequate health literacy
- Better finger dexterity
- Younger age

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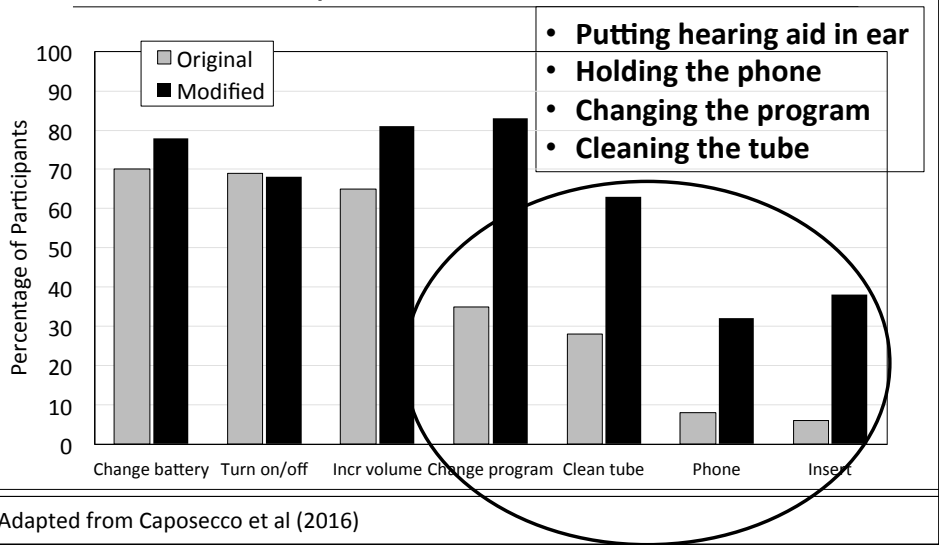
What they found…



- **Putting hearing aid in ear**
- **Holding the phone**
- **Changing the program**
- **Cleaning the tube**

Adapted from Caposecco et al (2016)

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Why is this important?

User guides that follow health literacy guidelines can result in better hearing handling skills

Caposecco et al (2011) provide recommendations for developing user guides based on health literacy principles

Trends in Amplification, 15, 184 – 195

Patients with more poor finger dexterity may require longer appointment times

Tasks where people have the most difficulty

- Inserting the hearing aid
- Cleaning the hearing aid
- Using the hearing aid with the telephone

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Does it matter clinically?

Results may have been even stronger in a different population

- Lower health literacy
- Lower SES

Study limitations

- Only print – not web-based
- Audiologist provided no verbal instruction

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Summary and Conclusions

Encouraging significant others to attend the hearing evaluation / selection may increase adoption rate

Singh & Launer (2016)

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Summary and Conclusions

With appropriate control (e.g. hearing evaluation and limited options) and support (e.g. video instruction) the time spent on professional services can be reduced while still providing significant hearing aid benefits.

By ReSound - ReSound, CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=12873875

Humes et al (2017)

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Summary and Conclusions

Newly introduced wind noise reduction algorithms can not only reduce wind noise annoyance, but also improve speech recognition in noise for specific environments.

Korhonen et al (2017)

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Summary and Conclusions

Although it will not be optimal for some listeners, choosing slow time constants may be the "safest" choice when considering sound quality for music

Moore & Sek (2016)

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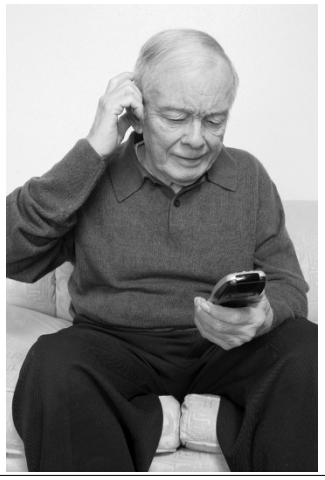
Summary and Conclusions

Predicting ***individual*** preference for noise reduction technologies (DNR and directional microphones) remains elusive

Neher, Wagener & Fischer (2016)

Summary and Conclusions

Hearing aid user guides available from manufacturers and the Internet are written at grade levels much higher than recommended by the health literacy field



Joseph et al (2016)

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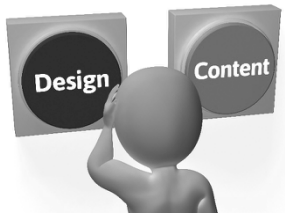
Summary and Conclusions

Modifying the user guide by following health literacy guidelines can improve hearing aid handling skills Recommendations include

- Standard paper size (21 cm x 2.97 cm)
- Fewer pages
- Larger font (20 point)
- Easy font to read (Arial)
- Dark text on light background
- Black and white line drawing
- Single, clear caption for each
- Simple language (active, common)



Caposecco et al *(2016)*


Thank You!
Questions?