



Use of Amplification for Normal Hearing Adults in Background Noise

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ABSTRACT

Many adults who have clinically normal hearing thresholds report difficulty hearing in background noise. Although these individuals self-report having a hearing handicap, little is recommended for them because they are not a typical hearing aid candidate. The purpose of the present study was to investigate if a mild gain hearing aid with an external microphone could improve these individuals' ability to hear in challenging listening situations. A control group of aged matched adults who did not self-report having difficulty hearing in background noise was included. Hearing handicap scores were significantly higher in the experimental group. All participants were fit with a mild high frequency gain aid and asked to wear the aid for two weeks. Aided and unaided working memory in noise, hearing handicap, attitudes towards hearing aids, speech in noise testing, and motivation were evaluated pre and post the two week hearing aid trial period.

METHODS

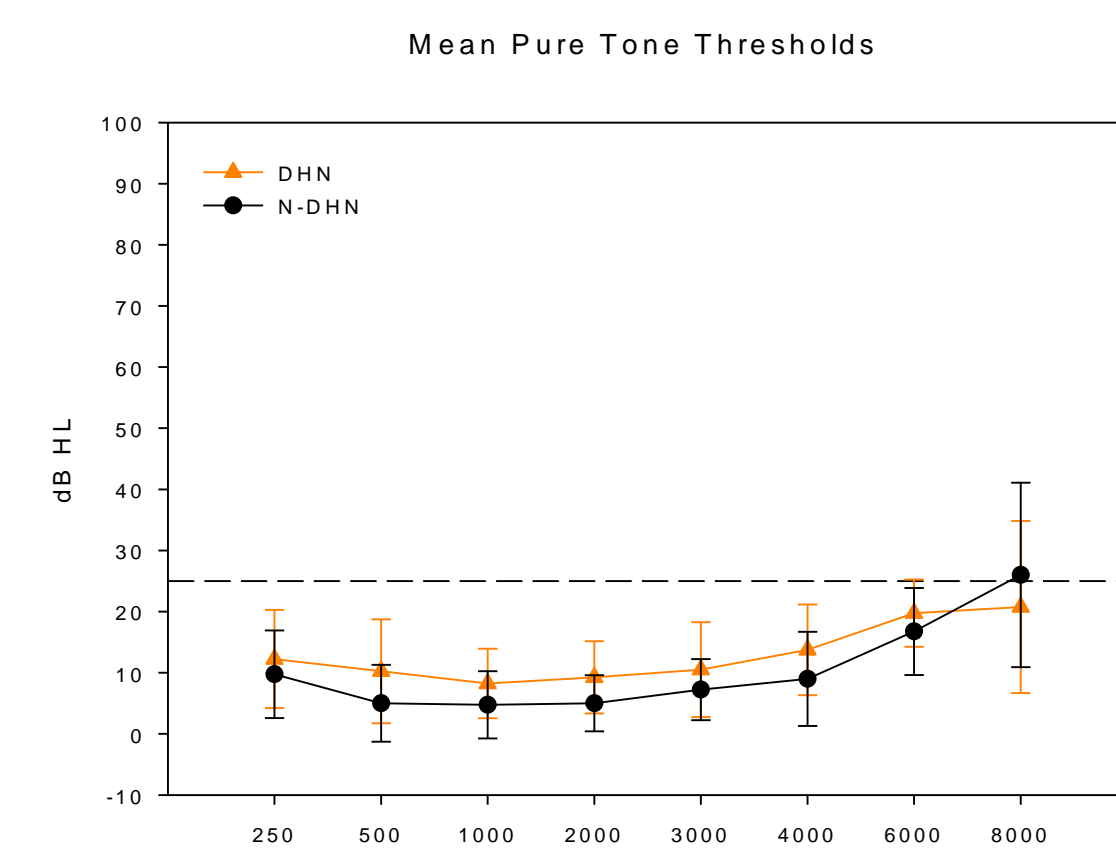
PARTICIPANTS

Normal Hearing (NH) Criteria:

- ≤ 25 dB HL at 250Hz through 6000Hz
- No air-bone gaps >10 dB HL at any test frequency

A total of 20 normal-hearing participants 45-69 years of age

- 10 individuals (mean age = 54.9, std= 4.98) with self-reported *difficulty hearing in background noise* (DHN)
- 10 individuals (mean age = 55.3, std= 3.02) with *no self-reported difficulty hearing in background noise* (N-DHN)



- There was no statistical differences in pure tone thresholds between the DHN and N-DHN groups

PROCEDURE

Week 0/Session 1

Objective Measures

1. *Extended High Frequency Thresholds*: 9 KHz to 14 KHz
2. *Speech in Noise (unaided)*: QuickSIN and IEEE Sentences in +5 and -5 dB SNR.
3. *Working Memory*: Listening SPAN (LSPAN) (unaided)
 - Participants repeated sentences and asked to recall the last word of each sentence after sets of 2, 4 and 6 sentences were presented.

Subjective Measures

1. *Hearing Handicap Questionnaire (HHQ)* (Gatehouse & Noble, 2004)
 - 12 item questionnaire- assesses the negative impact of an individual's hearing loss: "How often does your hearing difficulty restrict things you do?"
2. *University of Rhode Island Change Assessment (URICA)* (Laplante-Lévesque, Hickson, & Worrall, 2013)
 - 25 item questionnaire which measures "three stages of change":
 - Pre-contemplation: "As far as I'm concerned, I don't have any hearing problems that need changing."
 - Contemplation: "I think I might be ready for some self-improvement."
 - Action: "I am doing something about the hearing problems that have been bothering me"
 - Participants are to indicate what extent they agree with each statement on a scale of 1-5
3. *Hearing Attitudes in Rehabilitation Questionnaire (HARQ)* (Hallam & Brooks, 1996)
 - Questionnaire (40 items) with 7 subscales:
 - PDI= Personal Distress/Inadequacy: "My hearing loss makes me feel isolated from other people"
 - HLS= Hearing Loss Stigma: "When you have hearing difficulties other people ignore you."
 - MOL= Minimization of Loss: "Difficulty in hearing is not a major concern for me at the moment."
 - HAS= Hearing Aid Stigma: "It would embarrass me to have to wear a hearing aid."
 - ANW= Aid Not Wanted: "I don't really want a hearing aid."
 - PTA= Pressure to be Assessed: "I feel I have been pressured into having my hearing assessed."
 - PE= Positive Expectation: "I would expect to get used to a hearing aid in a matter of days."
4. *Question*: Would you consider purchasing hearing aids?

Hearing Aids

1. Bilaterally with *Resound Linx² 9 Receiver-in-Canal (RIC)* hearing aids (HA) using DSL v5.0 or minimum of 5 dB of gain at 2, 3, and 4KHz (verified with real ear)
2. *Practical Hearing Aid Skills Test- Revised (PHASTR)*- administered to ensure participants knew how to correctly use their hearing aids.

METHODS (cont'd)

Week 1/Session Two:

1. Working Memory: LSPAN aided and unaided
2. Hearing Aid Data log recorded
3. PHAST-R administered

Week 2/Session Three

1. Speech in Noise Tests: The QuickSIN and IEEE sentences in noise (unaided)
2. Subjective Measures: HHQ, URICA, HARQ and HA Purchasing Question
3. Data log recorded
4. Hearing Aid returned

RESULTS

Mean Extended High Frequency Pure Tone Thresholds

- No statistical differences in extended high frequency pure tone thresholds between DHN and N-DHN groups

L-SPAN: Working Memory

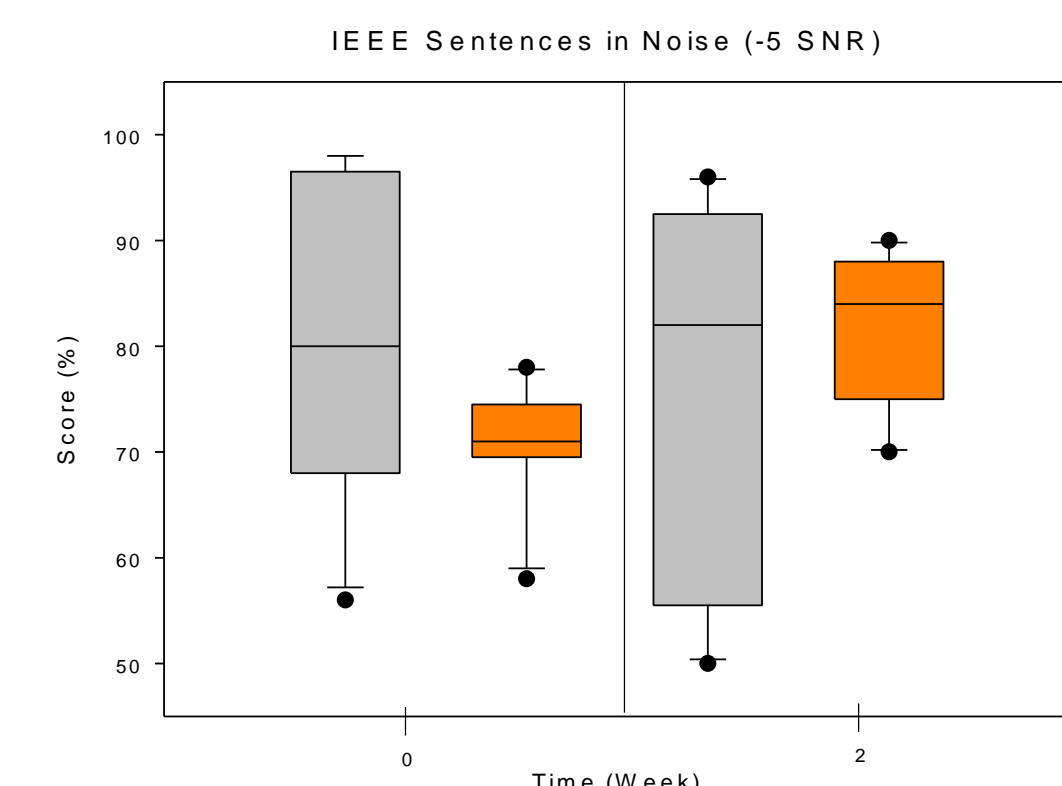
- DHN and N-DHN participants' aided and unaided L-SPAN scores were not statistically different at week 0 and 2, for all SPAN condition.

Would you Consider Purchasing Hearing Aids?

| | Participants who answered 'YES' | |
|-------|-----------------------------------|-----------------------------------|
| | Week 0 | Week 2 |
| DHN | 80% (8 out of 10 participants) | 20% (2 out of 10 participants) |
| N-DHN | 40% (4 out of 10 participants) | 40% (4 out of 10 participants) |

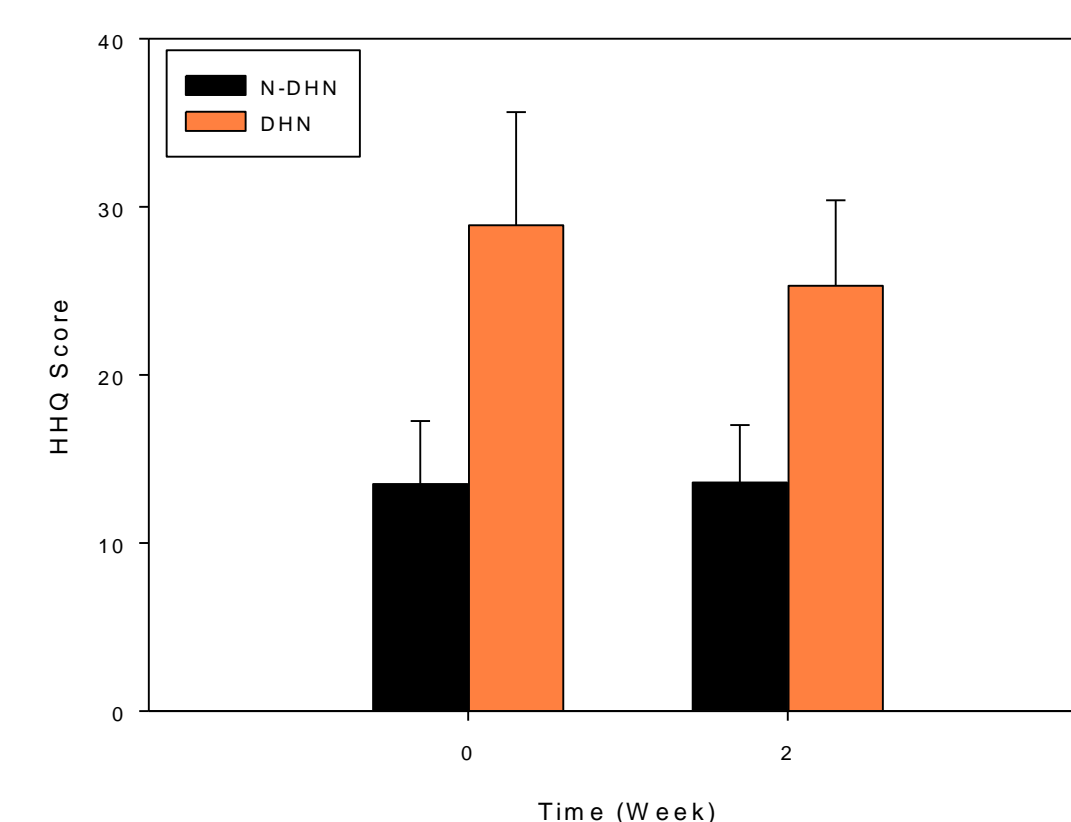
- After the two week trial period, 60% of DHN participants changed their answers to the question from 'Yes' to 'No'.
- N-DHN participants who would consider purchasing a hearing aid remained the same after the two week trial period.

Speech in Noise Tests



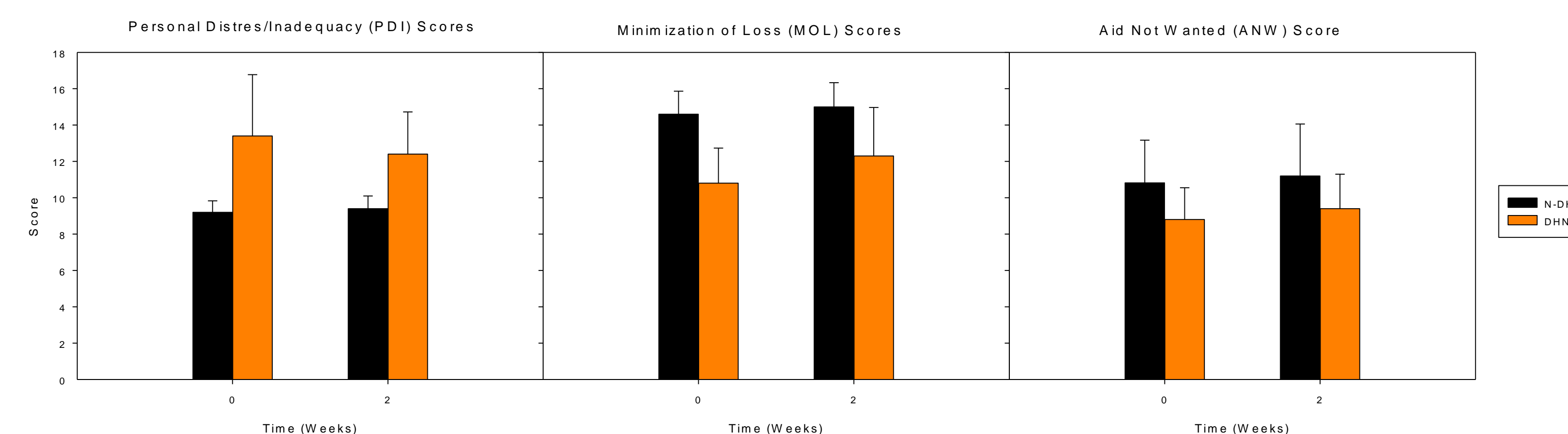
- No significant differences between DHN and N-DHN participants' IEEE sentences in noise (+5 SNR) and QuickSIN scores, at weeks 0 and 2.
- DHN participants' IEEE sentences in noise (-5 SNR) scores significantly increased from Week 0 (\bar{x} = 70.8, SD = 5.43) to Week 2 (\bar{x} = 82.2, SD = 7.02), but no significant changes were observed for the N-DHN participants between Week 0 (\bar{x} = 77.3, SD = 16.8) and Week 2 (\bar{x} = 65.3, SD = 15.1).

Hearing Handicap



- DHN participants had significantly higher HHQ scores than N-DHN participants ($p < 0.001$)
- DHN participants had significantly lower HHQ scores after wearing the hearing aid for two weeks ($p < 0.001$)
- N-DHN participants HHQ scores were *not* significantly different after wearing the hearing aid for two weeks ($p > 0.05$)

Attitudes Towards Hearing Aids and Hearing Loss

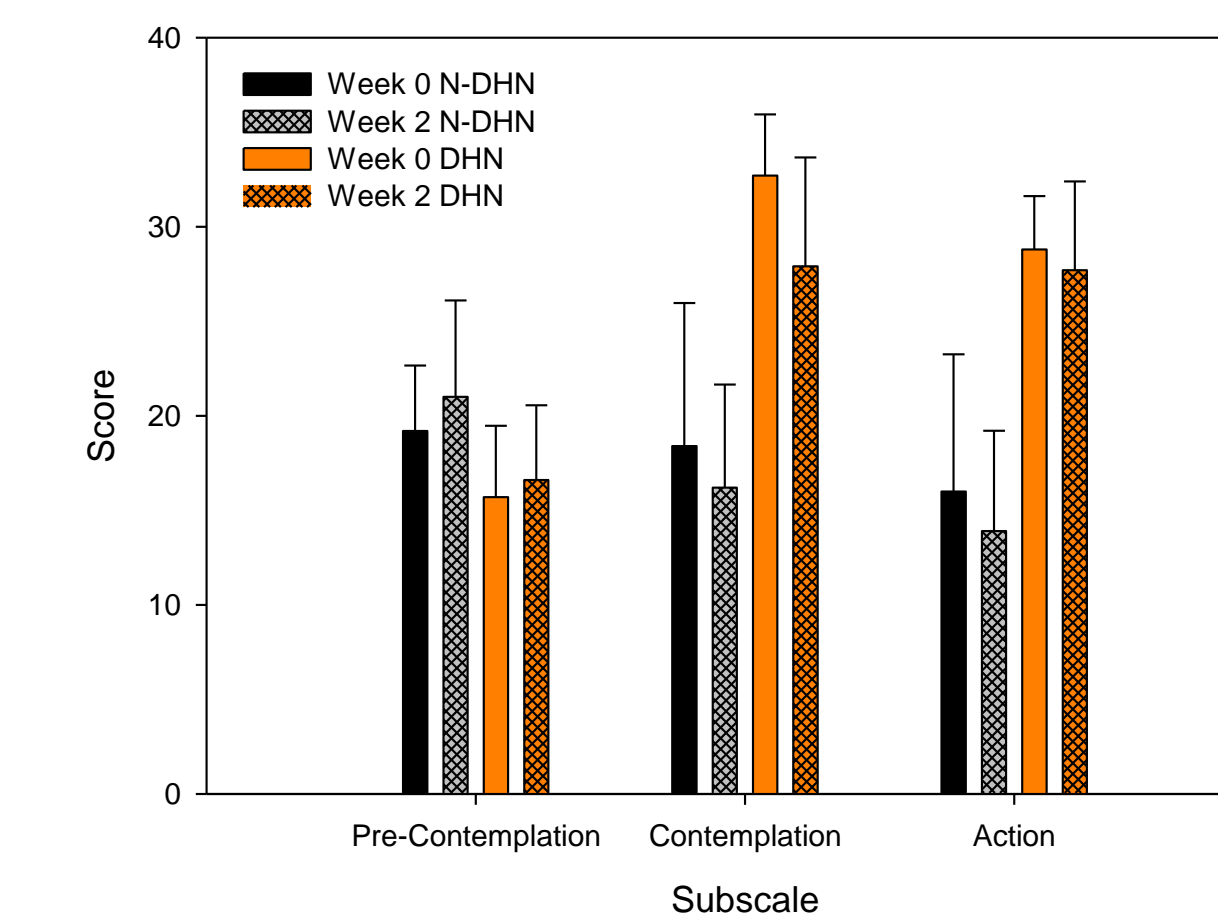


Only 3 of the 7 HARQ subscales significantly changed after wearing the HA for two weeks (Aided not wanted (ANW), Personal Distress/Inadequacy (PDI), and Minimization of loss (MOL)).

- PDI scores: DHN participants' scores were significantly higher than N-DHN participants' scores ($p < 0.05$) at weeks 0 and 2.
- MOL scores: N-DHN participants' scores were significantly higher than DHN participants' scores ($p < 0.05$) at weeks 0 and 2,
- ANW scores: N-DHN participant's scores were significantly higher than DHN participants' scores ($p < 0.05$), at weeks 0 and 2.
- No significant ($p > 0.05$) differences between scores at week 0 and 2 for any of the 7 subscales.

RESULTS (cont.)

Stages of Change



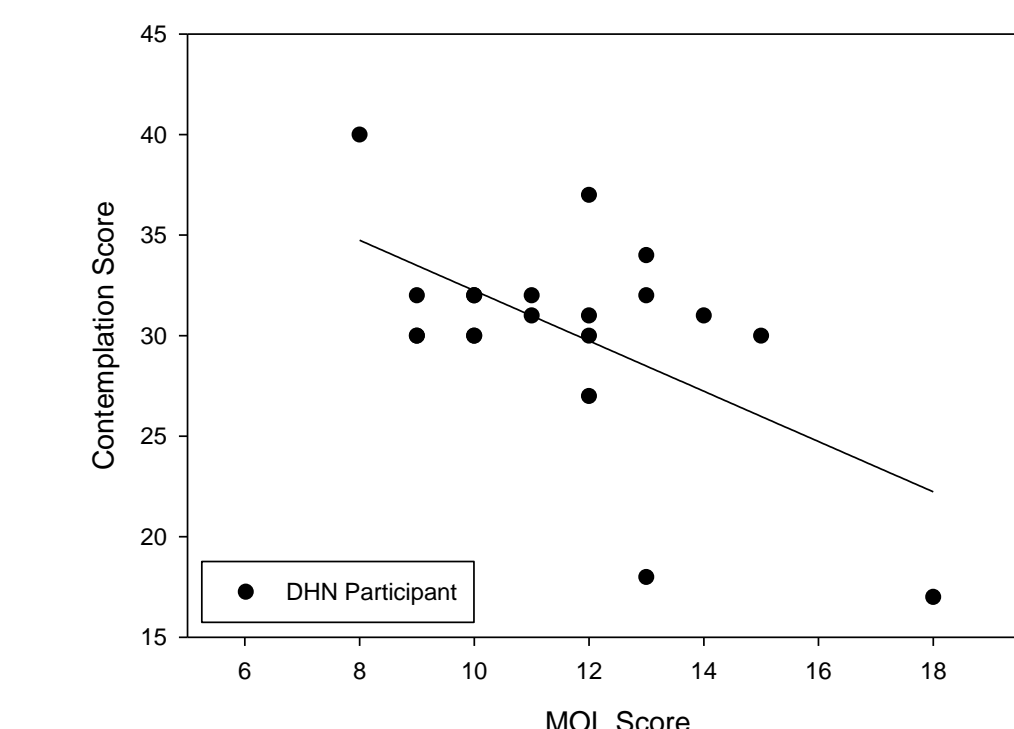
- DHN participants' contemplation and action scores were significantly higher than N-DHN participants' contemplation and action scores ($p < 0.05$)
- Based on highest overall score the N-DHN participants were in the pre-contemplation stage, and the DHN participants were in the contemplation stage. Stage of motivation, for both groups, didn't significantly change between weeks 0 and 2 ($p > 0.05$)

Relationship between Attitudes Towards Hearing Aids/Hearing Loss and Stages of Change

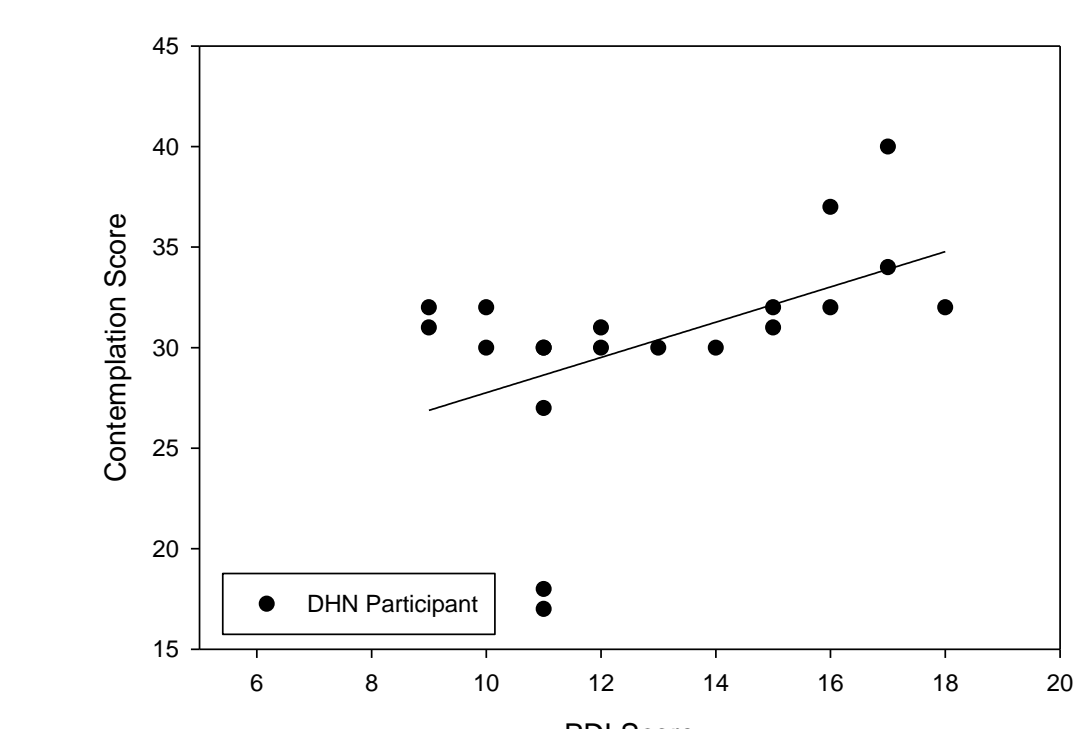
No significant changes were measured for the three stages of change at weeks 0 and 2 (p -value > 0.05). Thus, subscale scores from weeks 0 and 2 were analyzed together as displayed in the figures below.

- DHN participants who minimized their hearing loss more, had significantly lower contemplation scores ($p < 0.001$, $r = -0.579$). DHN participants who had higher personal distress/inadequacy scores, had significantly higher contemplation scores ($p < 0.05$, $r = 0.485$).

Minimization of Loss (DHN)

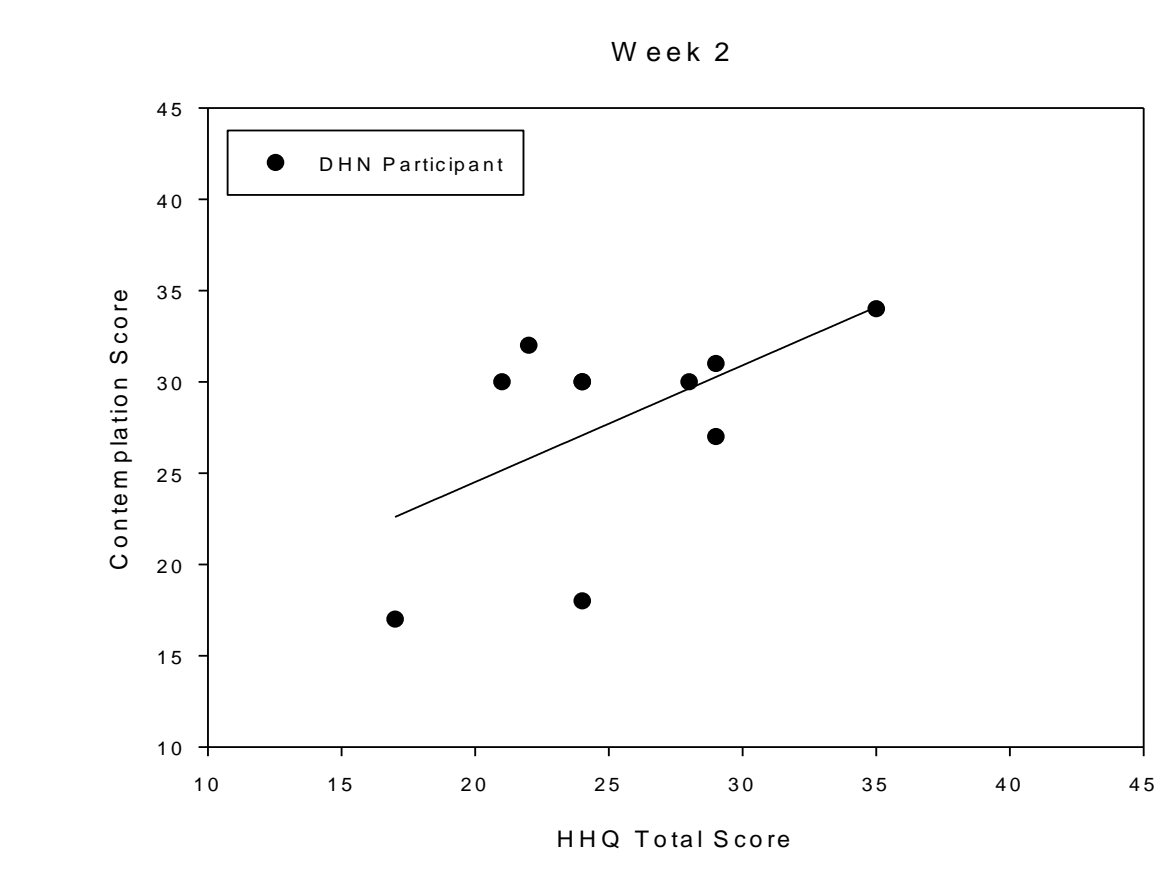
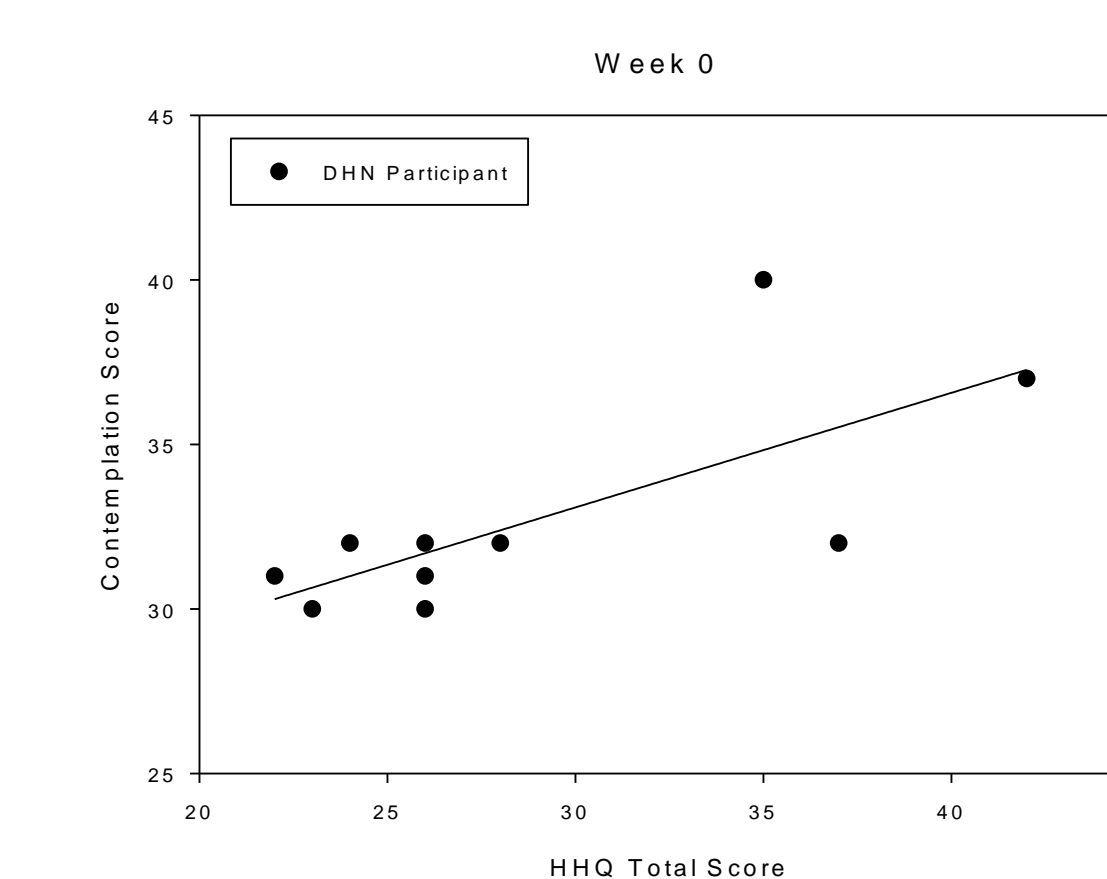


Personal Distress/Inadequacy (DHN)



Relationship between Hearing Handicap and Stages of Change

- Higher hearing handicap scores for DHN participants was significantly correlated with higher contemplation scores ($p < 0.05$, $r = 0.724$) at week 0, but no significant correlation was observed between hearing handicap and contemplation scores after wearing HAs for two weeks ($p > 0.05$).



CONCLUSIONS

- NH adults who self-report having difficulty hearing in noise have higher levels of personal distress and hearing handicap, and are more motivated to address their hearing problems than NH adults who do not self-report having difficulty hearing in noise.
- After using a mild gain HA for two weeks, hearing handicap level decreased for NH adults who self-report having hearing difficulty in noise.
- After using a mild gain aid for two weeks speech recognition scores increased for NH adults who self-report having difficulty hearing in noise.
- Most (80%) NH adults who self-report having difficulty hearing in noise stated they would consider wearing hearing aids, but after a two week HA trial only 20% of these adults stated they would consider wearing HAs.
- Extended high frequency thresholds and L-SPAN scores did not differentiate NH adults who self-report having difficulty hearing in noise from those who *do not* self-report having difficulty hearing in noise.

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