



Defining hearing aid success for adults: A comparison of three models



Casey Heidohrn¹, Christi Miller¹, Yu-Hsiang Wu², Ruth Bentler², Kelly Tremblay¹

¹Department of Speech and Hearing Sciences, University of Washington, Seattle ²Department of Communication Sciences and Disorders, University of Iowa, Iowa City

INTRODUCTION

Background: There are numerous available tools for measuring impact of amplification on the performance and function of an individual with a hearing impairment. A challenge facing audiologists and researchers is a lack of consensus on how to define successful hearing aid intervention.

Purpose: To explore and describe different ways of grouping adult hearing aid users into successful and unsuccessful users. This descriptive study compares three models of hearing aid success using an observational sample of 142 adults. Three different grouping methods were developed based on prior research identifying domains of hearing aid outcomes.

PARTICIPANTS

142 adult binaural HA users

- mean age=67.7, SD=9.329
- 87 female, 54 male

All have bilateral, symmetrical mild to moderately-severe SNHL

- average 4 frequency PTA=42.012dB, SD=9.53

Binaural HA user ≥ 6 months

- ≥7 hrs/week

• Average better ear speech intelligibility index (SI); %

@ 65 dB =64.044, SD=.29

Montreal Cognitive Assessment Screening score of >21/30 to ensure adequate cognitive function

OUTCOME MEASURES

Multilexical Sentence Test (MLST; Kirk et al. 2012) (Models #2 & #3)

- Participants were seated in a sound attenuated booth and were asked to repeat sentences in background noise (8 dB SNR, signal 65 dB SPL/Noise 57 dB SPL) while wearing their hearing aids.
 - o Two Noise types (Speech-shaped noise, International Speech Test Signal)
 - o Overall score was the average score of trials in two noises types

IOI-HA (Cox & Alexander, 2002) (Model #1)

- Questions #1 and #2 used to measure use (#1) and benefit #2)
 - #1 Think about how much you used your present hearing aid(s) over the past two weeks. On an average day, how many hours did you use the hearing aid(s)?
 - #2 Think about the situation where you most wanted to hear better, before you got your hearing aid(s). Over the past two weeks, how much has the hearing aid helped you in that situation?

APHAB (Cox & Alexander, 1995)

- Global Benefit score used as measure of benefit (Model #2)
- Aided Global score used as measure of activity limitation (Model #3)

SADL (Cox & Alexander, 1999)

- Global score measured satisfaction (Model #2)

HHIE/A (Ventry & Weinstein, 1982)

- Measured participation restriction (Model #3)

MODEL #1

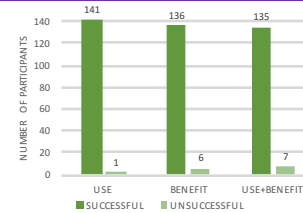
Model #1 is based on definition of HA success provided by Hickson (2014), which identified use and benefit as 2 categories to determine HA success.

Measures and Criteria for Success

- >1 hr of HA use/day (IOI-HA #1)
- Report at least moderate benefit (IOI-HA #2).

Results

- 95% of participants were classified as successful hearing aid users



MODEL #2

Model #2 was based on the work of Larry Humes (1999, 2003, 2004), which identified 4 domains of hearing aid outcome: use, benefit, satisfaction and speech perception.

Measures and Criteria for Success

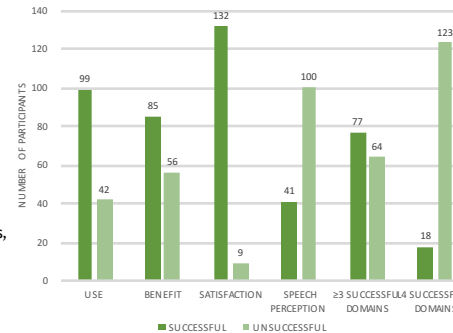
One measure was chosen to represent each of the 4 domains.

- Use: self-report wear time
 - >8 hrs/day considered full-time/successful
- Benefit: APHAB Global Benefit score
 - Success based on norms (score >22)
- Satisfaction: SADL
 - Success based on norms (score >4.25)
- Speech perception: Aided MLST
 - Score > 80% (Boothroyd, 2017)

- Participants successful in all 4 domains were considered successful overall

Results

- 54.61% of participants were successful in ≥3 domains, 12.77% were successful in all 4 domains, 2.12% in 0, 9.92% in 1, 33.33% in 2



MODEL #3

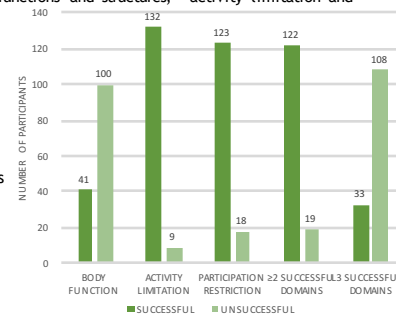
Model #3 is based of the WHO ICF framework of disability (ICF; World Health Organization, 2001). This model aims to create a broader view of disability by combining medical and social models to create a more encompassing bio-psycho-social model. Domains of the ICF model include body functions and structures, activity limitation and participation restriction.

Measures and Criteria for Success

- Body function: MLST, aided, +8 dB SNR
 - >80% considered successful
- Activity Limitation: APHAB Aided Global Score
 - Score <50 successful (norms)
- Participation restriction: HHIE/A
 - Score of <42 was considered successful (Ventry & Weinstein)
 - Overall success categorized by success in all 3 categories

Results

- 23.4% of participants were successful in all 3 categories 63.12% in 2, 12.77% in 1 and <1% in 0



COMPARISONS & DISCUSSION

More variability between successful and unsuccessful groups was observed in Methods #2 and #3 as compared to Method #1.

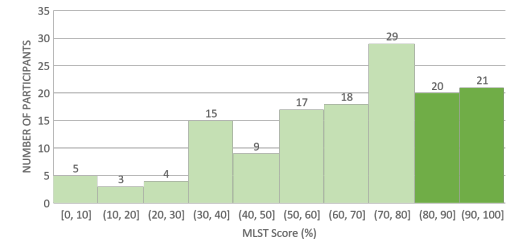
		MODEL #1	
		SUCCESSFUL	UNSUCCESSFUL
MODEL #2	SUCCESSFUL	18	0
	UNSUCCESSFUL	117	7

		MODEL #1	
		SUCCESSFUL	UNSUCCESSFUL
MODEL #3	SUCCESSFUL	31	2
	UNSUCCESSFUL	104	5

		MODEL #3	
		SUCCESSFUL	UNSUCCESSFUL
MODEL #2	SUCCESSFUL	13	5
	UNSUCCESSFUL	20	103

Speech Perception

- For models #2 & #3, the primary category that individuals were not successful in was speech perception.
- 70.92% of participants were not successful in aided speech perception (>80% understanding).



CONCLUSIONS

- A simplified definition of hearing aid success, such as use time, may not fully capture the variability between HA users
- Classification of an HA user as successful or unsuccessful can vary based on the definition and outcome measures used
- Despite struggling with speech perception in noise, HA users still are successful in other domains of HA outcome. So, speech perception alone should not be used as a measure of HA success

ACKNOWLEDGMENTS & REFERENCES

Funded by NIH grants R01 DC012769-04 and P30 DC004661. Presented at AudiologyNOW 2017. For more information, contact chstim@uw.edu.

Boothroyd, A. (2017) Lowest Acceptable Performance Level and Noise Tolerance Profile. Presented at the American Auditory Society, Scottsdale, Arizona.

Cox, R.M. & Alexander, G.C. (1999). Measuring satisfaction with amplification in daily life: The SADL Scale. *Ear and Hearing*, 20(4), 306-320.

Cox, R.M., Alexander, G.C. (2002) International Outcome Inventory for Hearing Aids (IOI-HA): psychometric properties of the English version. *International Journal of Audiology*, 41(1), 30-5.

Cox, R.M. & Alexander, G.C. (1995). The Abbreviated Profile of Hearing Aid Benefit. *Ear and Hearing*, 16(2), 176-186.

Hickson, L., Meyer, C., Lovelock, K., Lampert, M., Khan, A. (2014) Factors associated with success with hearing aids in older adults. *International Journal of Audiology* 53: S18-S27

Humes, Larry (2003). Modeling and Predicting Hearing Aid Outcome. *Trends in Amplification*, 7 (2).

Humes, Larry and Humes, Laura (2004). Factors Affecting Long-Term Hearing Aid Success. *Seminars in Hearing*, 25 (1), 63-73.

Larry Humes (1999). Dimensions of Hearing Aid Outcome. *Journal of the American Academy of Audiology*, 10: 26-39.

Ventry JM, Weinstein BE. (1982) The Hearing Handicap Inventory for the Elderly: A New Tool. *Ear and Hearing*, 3, 128-134.

World Health Organization. (2001). *International Classification of Functioning, Disability and Health*. Geneva, Switzerland.