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AN INVESTIGATION OF THE RELATIVE IMPACTS OF HEARING AID SELF-EFFICACY AND PERSONALITY ON ASPECTS OF HEARING AID SUCCESS

by

Lipika Sarangi

A Dissertation

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Doctor of Philosophy

Major: Communication Sciences and Disorders

The University of Memphis

December 2021

## **DEDICATION**

This dissertation is dedicated to my family, friends, professors, and mentors who have supported and challenged me throughout my journey, have patiently answered to my endless questions, and inspired me to pursue my dreams. A special dedication to my mother who has always encouraged me to do great things in life.

## **ACKNOWLEDGEMENTS**

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## **PREFACE**

Chapter 2 has been submitted as a manuscript in the *International Journal of Audiology* and is currently under review. Sarangi, L. & Johnson, J. (in review). An investigation of the associations between hearing aid self-efficacy and other measurable patient traits of naïve and experienced hearing aid users. *Int J Audiol*.

## ABSTRACT

It has been hypothesized that patient factors such as self-efficacy and personality impact aspects of hearing aid (HA) success. Thus, researchers have recommended that clinicians incorporate these factors while planning individualized audiologic rehabilitation. However, the different contributions of these factors have not been evaluated in tandem. Additionally, most of these factors are evaluated using generalized measures. It is unclear whether general measures reflect nuanced psychosocial impacts of listening in difficult environments. This dissertation evaluated the relative impacts of patient factors on aspects of HA success using a series of quantitative and qualitative studies.

First, we evaluated the associations between hearing aid self-efficacy (HASE) and other measurable patient characteristics in naïve and experienced HA users. Aspects of HASE were significantly associated with HA experience, with those having more experience also having higher confidence in handling HAs. Other measurable constructs, such as personality and cognition were distinct from HASE. In a follow-up qualitative study, we attempted to uncover the key ingredients of success in experienced HA users with high HASE. Our participants reported that self-reliance to make health care decisions, high intrapersonal motivation, openness and agreeableness towards accepting and using HAs, and a positive relationship with their audiologists were key to their success. Finally, we used mediation and moderation analyses to understand the interacting relationships between reported patient factors measured “in general” and in listening-specific situations in predicting readiness to pursue audiologic intervention. We found that participants reported having significantly different affective states in listening-specific situations compared to their affective states assessed in “General”. Individuals with greater perceived hearing handicap, high HASE, and high agreeableness showed increased readiness to pursue an intervention. However, HASE and agreeableness again were independent predictors

and, along with affective states or mood, did not impact the relationship between perceived hearing handicap and readiness.

Together, these results suggest that self-efficacy and personality impact aspects of HA success through mechanisms that are independent from each other; however, these specific mechanisms remain to be discovered. It is likely that patient factors impact success differently at different stages of an individual's hearing health journey. Future research should explore these relationships.

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## Chapter 1

### GENERAL INTRODUCTION

Individualized, patient-centered care is emerging as the most effective approach for the management of chronic health conditions (Michie et al., 2003). Patient-centered care has been widely used in health sectors such as medicine (Mead & Bower, 2000), physical therapy (Kidd et al., 2011), and occupational therapy (Law et al., 1995) due to its positive effect on health outcomes. Grenness et al. (2014) reported that individualized, patient-centered care can have a positive impact on hearing health outcomes such as greater satisfaction and adherence to treatment, increased willingness to self-manage, improved health status, and reduction in symptoms. Despite these results, implementation of these individualized protocols in many health sectors is sparsely investigated and implemented (Gzil et al., 2007). One such under-investigated area is audiological rehabilitation where individualized protocols have received much less attention. While one can argue that audiological rehabilitation is inherently individualized and patient-centered, how these approaches are implemented in practice vary. Evidence from the last decade has demonstrated that the nature of patient-audiologist interactions, as a component of patient-centered care, influence outcomes such as hearing aid (HA) adoption (Poost-Foroosh et al., 2011) and the decision-making process (Lapante-Levensque et al., 2010, 2012). However, the extent to which individualized approaches can be operationalized in audiology clinics is still unclear.

Available research on individualized approaches in audiological rehabilitation currently focuses on patient-audiologist relationships. Grenness et al. (2014) reported that along with practitioner-related factors, patient-related factors also contribute to outcomes from individualized, patient-centered hearing health care. Russo et al. (2019) performed a systematic review to understand the role of psychological constructs in general decision-making and

reported that patient factors such as self-efficacy and personality contribute to patients' engagement in the decision-making process and satisfaction with their decisions. These measurable patient factors have also been shown to influence other aspects of HA outcomes. Personality (Cox et al., 2005), HA self-efficacy (HASE; Kricos, 2006), cognition (Tahden et al., 2018), motivation (Ridgeway, 2017), and experiences with HAs (Amlani & Taylor, 2012) have all been demonstrated to impact on various aspects of success with HAs, such as HA adoption, use, and satisfaction. To develop an individualized patient-centered audiologic rehabilitation protocol, various researchers have recommended that clinicians evaluate each of these patient factors and incorporate the information into planning the treatment for each patient. However, the different contributions of these factors have not been considered in tandem. Thus, clinicians and hearing health researchers remain unsure how to utilize the information we have about these patient factors when planning individualized audiologic care.

One of the patient factors that has recently gained interest among researchers is HASE. HASE has been shown to impact various aspects of outcomes related to HAs (Hickson et al., 2014; Kelly-Campbell & McMillan, 2015; Dillion, 2018) and is one factor that can be directly modified using audiologic counseling techniques (West & Smith, 2006). Bosworth et al. (2016) suggested that improvements in self-efficacy can improve treatment adherence and can also act as a motivational factor to influence patient-centered care and decision-making process. This series of studies used quantitative and qualitative approaches to explore the relationships between HASE and other measurable patient factors (especially personality), and how they contribute to aspects of HA success.

The first study explored the associations between HASE and other measurable characteristics (working memory, personality, and HA experience) in both naïve and experienced

HA users (Chapter 2). To further understand the role of HASE in HA success, the second study employed qualitative approaches to understand the shared experiences of experienced HA users with high HASE. This study attempted to uncover the aspects of their hearing health journey that the participants believed to be facilitators of success with HAs (Chapter 3). The third study aimed to determine how individuals with hearing loss describe themselves in general and situations related to their hearing loss. We further attempted to identify significant predictors, mediators, and moderators of readiness to pursue audiologic intervention (Chapter 4).

## Chapter 2

### **AN EXPLORATION OF ASSOCIATIONS BETWEEN HEARING AID SELF-EFFICACY AND OTHER MEASURABLE CHARACTERISTICS OF NAÏVE AND EXPERIENCED HEARING AID USERS**

Research has shown that only a small percentage of adults with hearing loss who could obtain benefit from hearing aids (HAs) consult professionals for their hearing problems (Schneider et al., 2010) and use HAs (e. g., Smits et al., 2006). This has been attributed in part to differences in patient traits such as cognition (Tahden et al., 2018), personality (Cox et al., 2005), and HA self-efficacy (Kricos, 2006), and experiences with HAs (Amlani & Taylor, 2012). To improve outcomes for individual patients, researchers have recommended that hearing health practitioners evaluate each of these patient traits in a clinical encounter (e.g., West & Smith, 2006; Souza, 2019). However, these patient factors have not been evaluated in tandem in individuals with hearing loss. There are still some unanswered questions about the relative impacts of these patient traits and how their associations might affect outcomes related to HAs.

HA self-efficacy (HASE) is one patient trait that has been of some interest to audiologic researchers. Bandura (1994) described self-efficacy as an individual's beliefs about their capabilities to produce designated levels of performance. He suggested that self-efficacy is influenced by four major sources of information including mastery experiences, vicarious experiences, verbal persuasion, and physiological and emotional states. HASE refers to an individual's level of confidence in their ability to use a HA effectively (Smith & West, 2006b). Research has demonstrated that HASE influences individuals' decisions throughout their hearing health journey, including whether to consult about hearing loss (Kricos, 2006), purchase HAs (Dillion, 2018), regularly use or retain HAs (Smith & West, 2006b; Hickson et al., 2014), and to feel satisfied with HAs (Kelly-Campbell & McMillan, 2015).



Like HASE, aspects of cognition, specifically working memory, and personality have also been linked to aspects of HA success. For example, research has shown that individuals with high working memory tend to receive more benefit under certain HA processing conditions (Souza et al., 2015). Certain positive personality traits (such as high scores on measures of Openness and Agreeableness factors in the Big-Five model of personality) tend to have greater success with HAs (Cox et al., 2005). HA experience is another patient factor that affects aspects of HA success. Individuals with more experience with HAs tend to perceive greater benefit with their devices (Cox & Alexander, 1992).

Although researchers have recommended incorporating these factors into audiologic evaluations and interventions, there are notable costs associated with these changes to standard procedures. Some of these costs include additional time taken to complete these measures possibly adding additional costs and effort for the patient. Finally, it is not clear how clinicians should systematically utilize the information gained from these measures. Variables such as cognition and personality are comparatively difficult to modify directly and/or are beyond the scope of an audiologist. Therefore, although a patient might have cognitive and personality traits that have been shown to have a negative association with HA success, it is usually not considered within an audiologist's scope to attempt to modify these variables. In contrast, researchers have reported that HASE can be easily assessed in clinic and can also be directly modified by targeting aspects of self-efficacy principles in audiologic rehabilitation (Smith & West, 2006a; Gomez & Fergusson, 2020). Yet, it is not clear if HASE is a distinct variable, or if it is a trait that results from other, less adaptable, patient traits that also influence HA success.

It is evident that, regardless of the relative impacts of HASE with other measurable and more stable traits of a person, HASE based protocols could be implemented to have a more

effective audiologic rehabilitation. However, it is unclear whether HASE and HA success can be predicted based on more stable traits and abilities such as personality and working memory. It would be interesting to see if the association between HASE and HA success changes based on their associations with working memory or personality. The first step towards understanding these complex associations is to explore how these traits are associated with each other. Evidence from other fields suggest positive associations between self-efficacy and other patient factors such as education level, knowledge, cognition, and personality. Chen et al. (2009) reported a small but significant positive correlation for the association between cognitive ability and self-efficacy, and for the association between the personality trait of conscientiousness and self-efficacy. Judge et al. (2007) reported that once individual differences in cognition, personality, and experience were accounted for, the predictive usefulness of self-efficacy shrinks dramatically. If similar associations exist in individuals with hearing loss, we might be able to further test their relative influence on HA success. This might allow clinicians to incorporate the possible impacts of working memory and personality while designing self-efficacy based audiologic rehabilitation protocols. This warrants an investigation of the associations among these measurable patient traits in individuals with hearing loss.

Therefore, the primary aim of this study was to clarify the associations between HASE and measures of other more stable factors such as working memory, personality, and HA experience for adults with hearing loss. We hypothesized that HASE would be positively associated with working memory and personality traits of openness and it would be negatively associated with personality traits such as neuroticism. Also, we hypothesized that individuals with more experience with HAs would have greater HASE. Additionally, for a subset of current HA users who had used HAs for at least one year, we also explored how these patient traits were

associated with their actual level of ability to use and manipulate HAs. We hypothesized that working memory and certain personality traits would be positively associated with their actual HA skills.

## **MATERIALS & METHODS**

The present study was conducted at the Hearing Aid Research Laboratory (HARL) at the University of Memphis. Study procedures were reviewed and approved by the University of Memphis Institutional Review Board (IRB: PRO-FY2019-27). Participants were asked to give written consent at the beginning of the appointment.

### **Participants**

Fifty-four adults (26 females) with at least a mild acquired sensorineural hearing loss defined as a four-frequency pure tone average (.5, 1, 2, & 3 kHz) of > 25 dB HL in at least one ear; absence of any outer or middle ear pathologies (bilateral type A tympanogram); aged 45 years and older; with English as their primary language participated in this study. Figure 1 shows the mean hearing thresholds for these participants. The age range for participants was 46 to 89 years ( $M = 70.37$ ,  $SD = 10.64$ ). Eighteen participants were current HA users and had used HAs for at least one year. Participants were recruited through a database of willing participants maintained by the HARL ( $n = 29$ ), the Memphis Speech and Hearing Center ( $n = 12$ ), and via community-posted flyers and word-of-mouth referral ( $n = 13$ ).

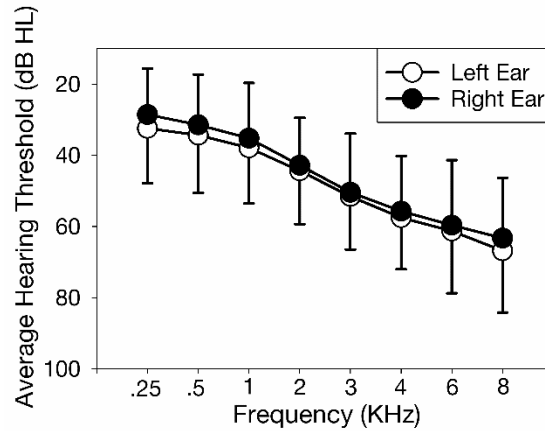


Figure 1. Average audiogram for all participants (n=54). Error bars show 1 SD.

## Materials

### *Hearing Aid Self-efficacy (HASE)*

HASE is an individual's confidence in their ability to perform the skills required for successful HA use. It has been shown to be an important factor in the decision-making process for hearing help-seeking and HA uptake (Meyer et al., 2014). We assessed HASE using the Measure of Audiologic Rehabilitation Self-efficacy for Hearing Aids (MARS-HA; West & Smith, 2007). This measure has been widely used in research related to HASE and is a highly reliable measure for both new (Cronbach's  $\alpha = .92$ ) and experienced (Cronbach's  $\alpha = .91$ ) HA users (West & Smith, 2007). For this measure, participants indicated how certain they were that they could perform specific tasks related to HA use. Possible scores ranged from 0 percent (I can't do this at all) to 100 percent (I am certain I can do this). This 24-item self-report questionnaire assesses self-efficacy in four areas: basic handling, advanced handling, adjustment, and aided listening. Scores were computed for each area by averaging the responses for items in each subscale. Total score was the average of all item responses. A total or subscale HASE score of 80% or more is the recommended self-efficacy level to target for patients and if lower,

then it is suggested to consider working with patients to increase their self-efficacy levels until the recommended level or higher (West & Smith, 2007).

### ***Personality***

The Big-five personality trait theory (Goldberg, 1992) is a commonly accepted method used to describe the fundamental factors of personality that contribute to human behavior. These factors are Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness. We used the International Mini Markers (IMM) questionnaire (Thompson, 2008) for this study. The 40-item IMM is based on the original 100-item “Big-Five” personality scale (Goldberg, 1992) but is less time consuming and still provides information with robustness almost equal to that of the original “Big-Five” scale (Saucier, 1994). The IMM consists of 40 descriptor words, such as talkative, shy, determined, and efficient. Participants rated each item on a scale according to how accurately each item described them. A summed score was calculated for each personality trait using the items dedicated to each of the five personality traits. For each trait, the scores can range from 1 to 5. An individual with high score on a trait is considered to have more prominent characteristics of that trait. These trait scores were included in the analysis.

### ***Working Memory***

Working memory has been shown to play a role in determining success with HAs. Working memory is one aspect of cognition that involves the ability to process and store information. We used the Reading Span Test (RST; Daneman & Carpenter, 1980) to assess working memory. This test was chosen because it has been shown to have good correlation with self-reported success with HAs. This test comprises 57 written sentences presented on a computer screen by one or two words at a time. Some of these sentences do not make sense. Participants read each sentence aloud as it appeared and indicated whether it made sense. After a

set of sentences were presented, participants were asked to repeat either the first or the last word for a group of sentences in the order that they were presented. The total number of first/last words correctly recalled was used as the final score. For this analysis, we calculated the percent correct score for each participant. These scores can range from 0% to 100%. An individual with high scores on the RST has high verbal working memory capacity.

### ***Hearing Aid Experience***

Our sample included both new and experienced HA users. We used a single-item question, “Do you wear HAs? If yes, for how long?” to assess participants’ experience with HAs in number of years.

### ***Hearing Aid Skills***

Practical HA skills were assessed for those participants with HA experience. Skills were documented with the Practical Hearing Aid Skills Test-Revised (PHAST-R; Doherty & Desjardins, 2012). This test requires the participant to complete 8 tasks: HA insertion, HA removal, opening the battery door, changing the HA battery, cleaning the aid, manipulating the volume control, using the telephone, and using programs in noisy situations. All tasks were performed with HAs. Therefore, it was only administered to the participants who were current HA users. We scored participants on a 3-point Likert scale ranging from 0 to 2 according to how well they accomplished each task. A score of 2 on this scale indicated that the task was performed without difficulty, a score of 1 indicated that the task was performed with some difficulty, and a score of 0 indicated that the participant could not perform the task at all. A final score was computed by summing scores on all the items. The final score ranges from 0 to 16, where an individual with high score would be considered to have better HA skill.

### ***Follow-up survey on Hearing Aid Experience***

To better understand the participants' HA experience, an informal follow-up survey was created. This survey asked the participant whether they consider themselves as experienced HA users and average hours of HA use per day. This survey also had 24 questions related to HA handling, adjustment, and aided listening in different listening situations. They were asked whether their audiologists trained them on these handling, adjustment, and aided listening skills at the time of HA purchase. Examples of the questions include: "Did your audiologist train you on how to insert/remove your hearing aids?" and "Did your audiologist train you on how to use the hearing aid in a noisy situation?". Yes/No responses were recorded for these questions. Eighteen participants with prior experience with HAs were contacted and asked to complete this survey.

### **Procedure**

This exploratory study was completed in a single appointment. Participants were given a brief overview of the study at the beginning of the appointment. In addition to collecting routine audiologic and demographic information to verify their eligibility, we assessed each participant's HASE, personality, working memory, and HA experience. Additionally, we assessed HA skills for a subset of experienced HA users. Participants were compensated for their time and participation. The 18 experienced hearing aid users were contacted through their preferred method and were asked if they would be willing to complete a quick follow-up survey. The follow-up survey was administered on those who could be contacted and agreed to complete it.

### **Data Analyses**

Visual inspection of the data via scatter plots of each variable and HASE were done to identify noteworthy associations. All statistical analyses were performed using the Statistical

Package for the Social Sciences (SPSS) Version 26 software. Regression analyses were conducted to assess the associations among patient traits. Post hoc sensitivity analyses computed using the software G\*Power version 3.1.7 (Faul et al., 2007), configured for linear multiple regression;  $\alpha = .05$ ; and  $r = .3$  demonstrated 78% power to detect a significant association among the tested variables with a sample of 54 participants. Although these did not quite reach the standard power of 80%, all correlations ( $r \geq .3$ ) were statistically significant in our primary analyses.

## RESULTS

Table 1 summarizes the distributions of the test variables. All participants reported having notable hearing difficulties for at least one year ( $n=54$ ). Although participants' working memories, personalities, HASE and HA skills varied substantially, mean scores were consistent with published normative data. To understand these associations across a broad patient population, both novice and experienced HA users were included as participants. Eighteen participants were HA users with experience varying from 1 to 36 years. Of these 18 participants, 10 could be contacted for the follow-up survey. They reported that they considered themselves experienced HA users and have been using their HAs for 6-12 hours per day. They were trained by their audiologists on how to handle, adjust to, and use the HAs in different listening situations. Based on these responses, they were considered as experienced HA users. To understand how HA experience systematically might have influenced or resulted from differences in other patient traits, individual independent  $t$  tests were used to compare average working memory scores and personality trait data for novice and experienced HA users. Results showed no significant differences on average for any of these variables (at  $\alpha = .05$ ). As there were no significant differences, corrections for multiple comparisons were not needed. Data from



all participants were used in the analyses to explore associations between these patient characteristics and HASE.

Table 1. Descriptive statistics for the test variables (MARS-HA total and subscale scores, % words correctly identified on the RST for working memory, personality trait scores on the IMM, and scores on the PHAST-R).

	Mean	Standard Deviation	Minimum	Maximum
<b>MARS-HA Total Score (n = 54)</b>	76.79	15.25	16.67	99.17
<b>MARS-HA Subscale Score (n = 54)</b>				
Basic Handling	81.93	19.59	15.71	100
Advanced Handling	58.81	24.49	8	100
Adjustment	84.19	19.88	23.33	100
Aided Listening	80.18	17.34	20	100
<b>Working Memory (RST % correct; n = 54)</b>	34.84	12.44	10	51.85
<b>Personality trait scores on IMM (n = 54)</b>				
Extroversion	3.50	.73	2	4.75
Openness	3.56	.79	1.63	5
Neuroticism	2.50	.57	1.31	3.56
Conscientiousness	3.76	.65	2.69	5
Agreeableness	4.11	.73	1.56	5
<b>PHAST-R score (n = 18)</b>	15.11	1.13	13	16
<b>HA Experience (yrs)</b>				
<b>Total Sample (n=54)</b>	3.19	7.07	0	36
Experienced HA users (n = 18)	9.56	9.56	1	36

MARS-HA, Measure of Audiologic Rehabilitation Self-efficacy for Hearing Aids; RST, Reading Span Test; IMM, International Mini Markers; PHAST-R, Practical Hearing Aid Skills Test-Revised.

### Associations between HASE and other patient characteristics

Associations between the 4 MARS-HA subscales and percent correct scores on the RST, personality trait scores for each of the 5 subscales on the IMM, and years of experience with HAs were tested. Examination of scatter plots suggested positive associations between HA experience and participants' HASE for basic and advanced HA handling. No other linear or non-linear associations were observed. Figures 2 and 3 display scatter plots for these two associations. For these plots, it is apparent that HASE for handling varied substantially for individuals with little or no HA experience, then improved with years of experience, especially

after using HAs for at least 10 years. This was particularly true for advanced handling abilities with HAs. Table 2 demonstrates correlations ( $r$ ) values between subscales of HASE measure and patient characteristics (working memory, personality, and HA experience). These associations supported our observation that only HA experience had notable ( $r \geq .3$ ) associations with participants' HASE (Basic handling:  $r = .31$ ; Advanced handling:  $r = .32$ ).

It was evident from the scatter plots that there was heterogeneity in the HASE handling data. Specifically, there was high variability in the data for individuals with little or no experience with HAs and low variability for individuals with more years of HA experience. Results of the Modified Breusch-Pagan test for Heteroskedasticity were also significant for self-efficacy for basic handling (Chi-Square = 6.884,  $p = .009$ ). An attempt to transform this data by using Log, Squared, and Square root transformation did not resolve issues of heterogeneity. Therefore, to clarify the associations between HA experience and self-efficacy for handling, we chose to categorize the HA experience variable into three groups: Group 1 - No HA experience, Group 2 - one to ten years of experience, and Group 3 - more than 10 years of experience. Regression analyses supported the observation that HA experience was the only variable that had significant association with self-efficacy for HA handling. Results demonstrated a significant difference between HA experience groups 1 and 3, where group 1, with no HA experience, had significantly lower self-efficacy for Basic ( $t = -2.542$ ,  $p = .015$ ) and Advanced ( $t = -2.197$ ,  $p = .033$ ) handling of HAs than group 3 with more than 10 years of experience. Results for group 2, 1 to 10 years of HA experience, were not significantly different for the other two groups. No significant associations were observed for other subscales of HASE measure. Further, the regression analysis did not demonstrate any significant association between HASE and other measurable patient traits.

Table 2. Associations between subscales of the MARS-HA and patient traits (working memory, personality traits, and HA experience). Values on the table represent correlation values from multiple regression analyses.

	Working Memory	Extro- version	Open- ness	Neuro- ticism	Conscient- iousness	Agreeable -ness	HA experience (Years)
MARS-HA Basic Handling	.17	.04	-.02	.22	.09	.11	<b>.31*</b>
MARS-HA Advanced Handling	-.09	.01	-.03	-.08	.15	.08	<b>.32*</b>
MARS-HA Adjustment	.25	.16	-.13	.09	.16	.11	.09
MARS-HA Aided Listening	.03	.11	-.24	.15	-.06	-.04	.06

\* $p < .05$  (two-tailed)

MARS-HA, Measure of Audiologic Rehabilitation Self-efficacy for Hearing Aids

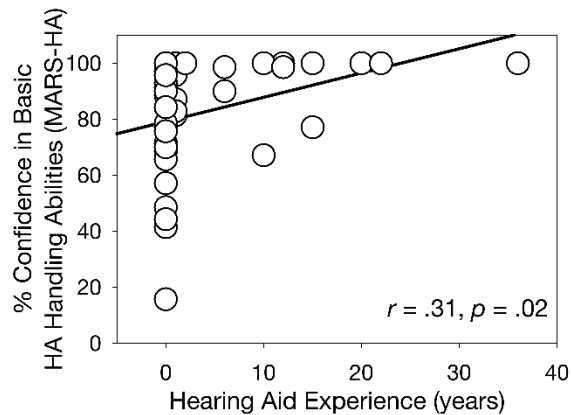
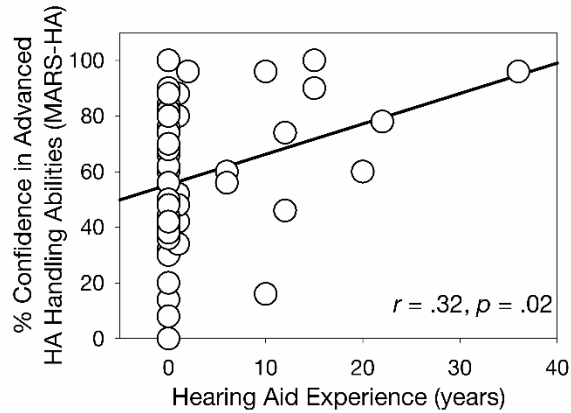


Figure 2. Scatter plot showing correlation between years of experience with HAs and % confidence in Basic HA handling abilities as assessed using the MARS-HA ( $n = 54$ ).  $p < 0.05$  was considered statistically significant.



*Figure 3.* Scatter plot showing correlation between years of experience with HAs and % confidence in Advanced HA Handling abilities as assessed using the MARS-HA ( $n = 54$ ).  $p < 0.05$  was considered statistically significant.

### **Associations between experienced HA users' skills and patient characteristics**

A subset of 18 participants who were using HAs were assessed for HA skills using the PHAST-R. Associations between HA skills and patient traits, including HASE, were analyzed. Examinations of scatter plots suggested a notable positive linear association between experienced users' HA skills and their working memories, as well as with their Openness score on the IMM. Figures 4 and 5 display scatter plots for these two associations. These plots demonstrate that HA skills tended to be better for individuals with better working memory abilities and higher scores on Openness. Table 3 displays the correlations ( $r$ ) between HA skills and patient characteristics. These correlation values supported our observations that these associations had noteworthy positive associations ( $r > .3$  for both). Multiple regression analyses demonstrated a statistically significant association between HA skills and the Openness personality trait ( $r = .54, p = 0.02$ ). The association between HA skills and working memory approached but did not achieve significance ( $r = .42, p = 0.08$ ) for this small subset of participants. No other notable linear or nonlinear associations were observed between patient

characteristics and HA skills. As the sample size was small, these results should be interpreted with caution.

Table 3. Associations between patient characteristics and experienced hearing aid users' hearing aid skills as assessed using the PHAST-R. These values in the table demonstrates correlation values from multiple regression analyses.

	Hearing Aid Skills (% PHAST-R Score)
<b>MARS-HA Subscale Score</b>	
Basic Handling	-.17
Advanced Handling	.05
Adjustment	-.04
Aided Listening	-.26
<b>% Correct on the RST</b>	<b>.42*</b>
<b>Personality trait scores on IMM</b>	
Extroversion	-.04
Openness	<b>.54*</b>
Neuroticism	-.07
Conscientiousness	.07
Agreeableness	.06

\* $p < .05$  (two-tailed)

MARS-HA, Measure of Audiologic Rehabilitation Self-efficacy for Hearing Aids; RST, Reading Span Test; IMM, International Mini Markers; PHAST-R, Practical Hearing Aid Skills Test-Revised

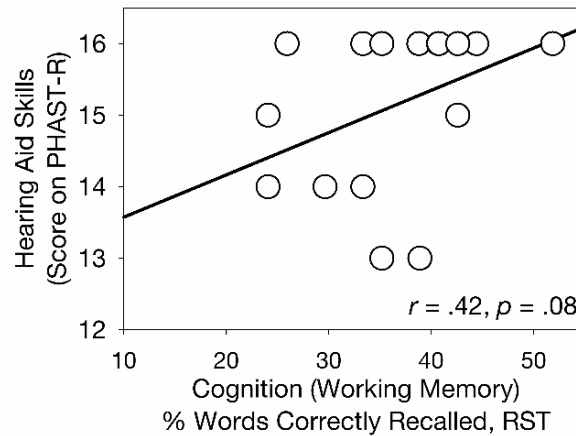


Figure 4. Scatter plot showing correlation between experienced users' HA skills and working memory. (n = 18).  $p < 0.05$  was considered statistically significant.

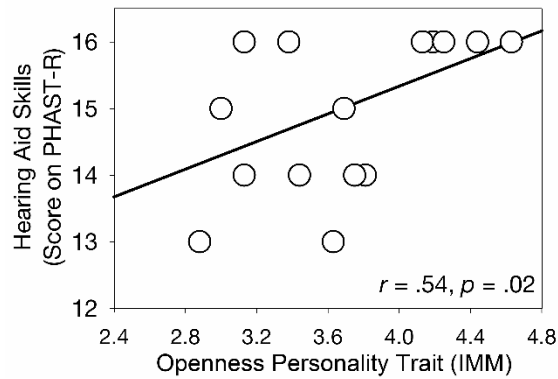


Figure 5. Scatter plot showing correlation between experienced users' HA skills Openness personality trait. (n = 18).  $p < 0.05$  was considered statistically significant.

## DISCUSSION

Self-efficacy has been widely researched in the psychological and health literature over the last several decades. This variable has consistently demonstrated significant associations with positive outcomes across a wide variety of domains, including job satisfaction and performance, creative and academic performance, and health behaviors and outcomes (e.g., Marks et al., 2005; Brockhus et al., 2014). More recently, this factor has gained popularity in the Audiological literature due to its positive associations with HA success and potential for improvement through clinical training and counseling techniques. At the same time, there are other predictors of HA success that seem likely to be associated with HASE. For example, it seems reasonable that individuals with better cognitive processing abilities and personality traits that are more positive would experience greater success and receive more positive feedback when handling activities of daily living, thus developing higher self-efficacy for novel or difficult tasks.

### Associations between HASE and other patient characteristics

Results from this study suggest that, on average, self-efficacy for handling of HAs tends to improve with years of experience using HAs. This result is not surprising given that, with regular practice, individuals develop mastery over tasks associated with daily HA use, increasing

confidence in their handling abilities over time. Although unsurprising, this finding provides support for Bandura's (1994) theory of self-efficacy which posits that self-efficacy is changeable through mastery experiences. For our participants, those with greater than 10 years of HA experience were most likely to achieve adequate HASE, especially for the more complex tasks required for advanced handling of HAs (e.g., troubleshooting a HA). When these participants were categorized to those with no HA experience, 1-10 years of experience, and > 10 years of experience, regression analyses further clarified that mean differences in self-efficacy for HA handling (for both basic and advanced HA handling skills) were only statistically higher for those individuals with more than 10 years of experience compared to new HA users or non-users. Our follow-up survey on some of the HA users also showed that they were trained to use the HAs effectively in different situations and they consider themselves experienced HA users. Although these trends support the idea that years of successful experiences with HA handling can improve participants' HASE for these areas, visual inspection of scatter plots (Figures 2 and 3) shows a great deal of variability among participants' reported HASE, particularly for those with less than 10 years of HA experience. For example, it can be seen in Figure 2 that although some of those with little or no experience indicated low HASE, more than half of these individuals demonstrated high confidence in their abilities to perform basic HA handling skills, and in some cases, had even more confidence than a few participants with > 10 years of experience. This could be explained by the fact that these basic skills tend to be quite straightforward (e.g., removing a HA). Thus, many of these participants might have expected that these tasks would be easy to complete, resulting in a majority of responses that were close to ceiling. It is also worth noting that even lengthy experiences using HAs did not correlate with HASE for the most complex areas of aided listening and adjustment to wearing hearing aids, and

there were many naïve users who reported high HASE in all areas without having any actual experience with HAs. These discrepancies suggest that multiple factors likely combine in complex ways to contribute to an individual's HASE. Previous research in Audiology has demonstrated that HASE can be modified through training (Gomez & Ferguson, 2020) as well as positive feedback during the HA orientation process (e.g., McMullan & Kelly-Campbell, 2018) and psychological researchers have shown that increasing self-efficacy through verbal encouragement can be independently related to improved performance on a given task. This suggests that as people start using HAs, their HASE can further be improved through orientation and training. Along with this, as their experience with HAs increases, they become more confident in using HAs effectively.

Contrary to our hypothesis, our findings suggested that an individual's confidence in using a HA effectively was not independently related to working memory or to any of the Big-5 personality traits. This suggests that in individuals with hearing loss, HASE is a factor that is distinct from working memory and personality. Additionally, self-efficacy is domain specific and personality as well as working memory are more general and stable. We only assessed these individuals' HASE. An assessment of their general self-efficacy might have been a more holistic measure to test the association with personality and working memory. Evidence from other fields have suggested a possible relationship between general self-efficacy and personality (Zakiei et al., 2020) as well as working memory (Hoffman & Schraw, 2009). Future research should explore whether a general measure of self-efficacy is associated with other patient traits in individuals with hearing loss.



### **Associations between experienced HA users' skills and patient characteristics**

For a subset of current HA users (18 participants), we explored the associations between ability to manipulate and use HAs and patient traits, including HASE. Although it seems reasonable that HASE and HA skills would be associated, they were not. These results are consistent with research by Dullard & Cienkowski (2014), who hypothesized that participants' personality traits might have influenced their responses to questionnaires and contributed to non-significant associations between HASE and HA skills. Our results suggest that clinicians should keep in mind that their patient's confidence in using the HAs effectively might not reflect their actual ability to use the HAs, and HA orientations and trainings should be designed accordingly.

For our HA users, the Openness personality trait did have a significant positive association with their abilities to use and manipulate HAs. Cox et al. (2005) postulated that individuals with higher scores for this trait are ready to try new things, and thus are more likely to have experienced greater success in learning skills and strategies related to amplification. An ad-hoc power analysis for this section reported that given the extremely small subsample for these comparisons, it is extremely underpowered (32% power to detect associations). Although this association makes sense considering the fact that these participants might be open to learning about hearing aids and thus believed that they could manage HAs, due to low power, we cannot provide decisive conclusions. Future studies with a larger sample size might confirm our associations and help us make interpretations.

It is also of interest to note that HA skills tended to be better for the experimental subset with better working memory as seen by a notable but nonsignificant correlation between the two. Individuals with better working memory can handle tasks that demand a higher cognitive load, which is difficult for individuals with poorer working memory. Similarly, skills related to HA

use and manipulation might be more difficult for individuals with poorer working memory. However, again, due to small sample size, we could not draw strong conclusions about these associations.

## **CONCLUSIONS**

In today's culture of individualized medicine, it is important to understand how patient traits contribute to, and might be modified for, optimized audiological outcomes. Self-efficacy is one modifiable factor that has been associated with HA success. We hypothesized that certain patient variables, like better working memory and positive personality traits, might be directly related to self-efficacy for using HAs. Such associations might partially explain the strong positive association between HASE and HA success. Our results did not support this hypothesis. Further, HASE was not directly related to experienced participants' abilities to use and manipulate HAs, but the Openness personality trait was. Our study suggests that HASE, working memory, and personality traits are independent factors. Although our study supported the theory that HASE for handling HAs might improve over time through mastery experiences using amplification, it remains unclear whether directly modifying HASE in a clinical setting would prove to be an effective intervention for improving outcomes related to HAs. Future research should clarify these complex interactions and evaluate the effectiveness of such an approach.

### Chapter 3

#### **SHARED EXPERIENCES AMONG SUCCESSFUL HEARING AID USERS WITH HIGH HEARING AID SELF-EFFICACY**

Hearing aids are the most common treatment for disabling hearing loss and have been shown to ameliorate quality of life problems (Chisholm et al., 2007; Manrique-Huarte et al., 2016). Although advancements in hearing aid (HA) technologies have improved satisfaction rates with HAs over the last several decades (Picou, 2020), fewer than half of those who could benefit from HAs wear them (Meister et al., 2008; McCormack & Fortnum, 2013). Over the last several decades, research has focused on advancing modern technologies to better meet users' expectations and improve HA success. The most recent MarkeTrak survey data demonstrated that modern HA wearers have relatively high satisfaction rates with their devices. Picou (2020) reported that 83% of device owners surveyed in 2018 indicated that they were satisfied with their HAs, and approximately the same percentage of those who purchased their devices kept them. These data also demonstrated that long-term HA users reported greater satisfaction with their current HAs compared to their previous models of devices, suggesting that modern technologies have positively impacted the end-user experience. Although these findings are encouraging, listening outcomes with hearing devices continue to vary considerably among HA users, as evidenced by the 20% of those surveyed who were not satisfied with their devices, and 20% who discontinued using their HAs. Picou further reported that half of those who returned their HAs indicated that they were not satisfied with their devices. Presumably, the other 50% who indicated that they were satisfied with their devices but discontinued using them did not find that the benefits with their devices outweighed their associated costs, including financial, time and effort, and social costs of using HAs.

Despite documented structural and societal barriers to hearing aid adoption, use, and satisfaction, many individuals with hearing impairment can experience long-term success with HAs. For decades, researchers have explored potential barriers to and facilitators of HA success (e.g., Lockett et al., 2010; Jenstand & Moon, 2011). An investigation by Lopez-Poveda et al. (2017) determined that demographic variables such as age, noise exposure, tinnitus, and previous HA use, and audiologic variables, such as degree of hearing loss and speech thresholds in quiet were poor predictors of reported HA benefit in daily listening. Working memory, one aspect of cognitive ability, has been shown to have a relationship with benefit from specific types of HA signal processing. Several researchers have found that individuals with poorer working memories perceive less improvement with more complex signal processing strategies than those with better working memories (Gatehouse, 2003, 2006; Lunner & Sundewall-Thoren, 2007; Xu & Cox, 2021). Tognola et al. (2019). also found a positive relationship between cognition and reported HA benefit. This study also determined that cognition was significant related to audiometric outcomes, and they speculated that this mediating variable was the driving factor for the relationship between cognition and aided benefit. Cox et al. (2005, 2007) demonstrated a significant association between HA outcomes and personality traits of Openness and Neuroticism.

An additional patient trait that has received recent attention for having strong positive associations with HA success is hearing aid self-efficacy (HASE). This trait encompasses a person's belief that they can successfully manage and wear HAs Higher HASE has been shown to influence individuals' decisions to purchase HAs (Dillon, 2018), regularly use HAs (Smith & West, 2006b), and be satisfied with their HAs (Kelly-Campbell & McMillan, 2015). Aspects of this trait can directly be improved with targeted audiologic rehabilitation (West & Smith, 2006a).

As a result, West and Smith (2006a) recommended that HASE be clinically evaluated and incorporated into standard audiologic rehabilitation protocols to improve long-term HA outcomes. To develop such a protocol would require a clear understanding of the salient aspects of HASE that might be driving the positive relationships with HA outcomes. In other words, it is important to understand the underlying “active ingredients” in HASE that play a role in HA success. Although research has demonstrated that HASE is distinct from other patient traits such as personality and cognition (Sarangi & Johnson, in review), it remains unclear how exactly HASE impacts outcomes, or whether modifications of HASE would directly translate to improved real-world outcomes. One step toward shedding some light on this issue is to seek out individuals that have high HASE and are successful HA users and explore their perceptions of their hearing health care journeys. The present study employed a qualitative research design to elicit such experiences and to uncover those aspects of the hearing health care journey that these individuals believed were important contributors to their success with HAs.

## **MATERIALS & METHODS**

This qualitative interview study was completed at the Hearing Aid Research Laboratory at the University of Memphis. All procedures involved in this study were reviewed and approved by the University of Memphis Institutional Review Board (IRB# PRO-FY2020-134).

### **Research Strategy**

We elected to use an interpretive phenomenological methodology for this study. Phenomenology is a qualitative school of thought that aims to provide a detailed understanding of individuals’ lived experiences of a phenomenon. As a result, it is an appropriate choice of research method when exploring the experience of illness or disability (e.g., Smith & Osborn, 2015; Benner, 1994; McGeehan et al., 2018; Mole et al., 2019), and is commonly used in behavioral and health sciences. The phenomenological approach is consistent with our objectives

because we sought to understand how successful HA users with high HASE experienced their hearing health journey, and how they perceived that these experiences contributed to their successes with amplification. Interpretive phenomenology is sub-type of phenomenology based on the philosophical writings of Heidegger (1927). There are several aspects of this approach that differentiate it from traditional descriptive approaches. For a comprehensive review of these differences see Lopez & Willis (2004) and Beck (2021). Several distinctive aspects of interpretive phenomenology (IP) were more congruous with the purposes of this study. For example, where the traditional descriptive approach to phenomenology attempts to set aside all researcher bias, the interpretive approach explicates the researchers' assumptions and preconceptions about the phenomenon under study and integrates them into the research findings (Cohen & Omery, 1994; Ray, 1994; Lopez & Willis, 2004). This philosophical choice was particularly relevant for this study because we sought to balance describing and representing patient embodied experiences in their own words with a desire to inform clinical audiologic practices and research. Similarly, unlike traditional methods, interpretive phenomenology embraces the use of a conceptual framework to explicate the study assumptions and researchers' frame of reference throughout interpretation. Consistent with this methodology, we used the transtheoretical model (TTM) of behavioral change (Prochaska & Velicer, 1997) as an orienting framework when generating interview questions and throughout data analysis and interpretation.

## **Participants**

A purposeful sample of successful HA users was recruited from a database of older adults who previously volunteered to be contacted for research conducted in our laboratory. Qualitative research grounded in constructionist epistemology implements purposeful sampling to recruit participants for whom the research topic is relevant (Creswell, 2002). For this study we were

interested in the shared experiences among successful HA users. Yet, successful HA use has not been consistently operationalized. Several outcome domains have been used in the audiology literature to characterize a successful intervention with HAs. Indicators of success include daily HA use (hours per day and days per week; e.g., Jilla et al., 2020; Bertolli et al., 2009; Nabelek et al., 2006), audibility (e.g., Folkeard et al., 2018; Mackersie et al., 2020), speech understanding benefit (e.g., Cox & Xu, 2010; Johnson et al., 2016), HA adoption (e.g., Jorgenson, 2020), and satisfaction with amplification in daily listening (e.g., Picou, 2020). Although each of these is a reasonable marker of success with HAs, we chose to define a successful user broadly as a person with noticeable hearing difficulties who effectively uses their HAs when needed in daily listening and is satisfied with the benefits that they receive from their devices in a variety of environments and domains relative to the costs of using their devices. Thus, we chose to include only experienced HA users, with at least a mild acquired sensorineural hearing impairment in one or both ears, who self-reported daily HA use, having high HASE, and satisfaction with their HAs in daily listening.

Traditionally, for IP data analyses the size of the sample is considered adequate when interpretations are clear and additional participants reveal no new findings (Benner, 1994). For IP analyses, 3-5 participants is a reasonable sample size for a group study (Reid et al., 2005; Pllio et al., 1997). We anticipated that a small sample size (between 3 and 8 participants) would be sufficient for this analysis. Ultimately, five English-speaking older adults that met the inclusion criteria were recruited for this study. All who were contacted agreed to participate. Demographic information including age, gender, and race/ethnicity were collected at the time of the interview. Table 4 summarizes these characteristics. For this study, data collection was terminated when

data from the fifth participant revealed no new or distinct categories not already identified in the first four participants' interview data.

Table 4. Demographic information and results of assessments (MARS-HA, SADL, IMM, GSE, and PPOS).

	<b>Participant 1 (Sue)</b>	<b>Participant 2 (Paul)</b>	<b>Participant 3 (Robert)</b>	<b>Participant 4 (Mike)</b>	<b>Participant 5 (Jane)</b>
<b>Age (yrs)</b>	66	83	75	70	78
<b>Gender</b>	Female	Male	Male	Male	Female
<b>Race/Ethnicity</b>	White or Caucasian (not Hispanic)	White or Caucasian (not Hispanic)	White or Caucasian (not Hispanic)	White or Caucasian (not Hispanic)	White or Caucasian (not Hispanic)
<b>HA Experience (yrs)</b>	36	15	3	4	24
<b>MARS-HA Scores (%)</b>					
<b>Total</b>	99.17	93.33	96.25	93.33	88.33
Basic Handling	100	100	100	100	100
Advanced Handling	96	100	88	96	78
Adjustment	100	96.67	100	100	100
Aided Listening	100	83.33	96.67	84.44	81.11
<b>SADL Scores</b>					
Global	5.9	6.5	6.1	5.7	5.9
Positive Effect	6.7	6.7	5.7	6.7	6.2
Service & Cost	5.7	7.0	7.0	4.7	6.3
Negative Features	4.0	6.0	6.0	6	5.7
Personal Image	6.7	6.0	6.3	4.7	5.3
<b>IMM Personality Traits</b>					
Extroversion	4.94	2.75	-	3.56	4.75
Openness	4.44	4	-	4.06	3.88
Neuroticism	2.63	1.81	-	2.13	1.56
Conscientiousness	4.5	4.31	-	3.94	3.81
Agreeableness	4.75	4.13	-	4.88	4.75
<b>GSE Total</b>	40	34	-	40	38
<b>PPOS Scores</b>					
PPOS Mean	4.33	4.56	-	4.5	3.33
PPOS Sharing	3.67	4.56	-	4.56	3.22
PPOS Caring	5	4.56	-	4.44	3.44

HA, Hearing Aid; MARS-HA, Measure of Audiologic Rehabilitation Self-efficacy for Hearing Aids; SADL, Satisfaction with Amplification in Daily Life; IMM, International Mini Markers; GSE, General Self-efficacy; PPOS, Patient-Practitioner Orientation Scale. Names used here are pseudo names.

## Materials

To confirm participants' eligibility for this study, we verified their ages and experience with HAs. We also assessed their HASE and satisfaction with HAs. In addition, participants completed measures of personality, general self-efficacy, and beliefs regarding patient-centeredness to triangulate evidence for emergent themes.



### ***Hearing Aid Self-efficacy (HASE)***

The Measure of Audiologic Rehabilitation Self-efficacy for Hearing Aids (MARS-HA; Smith & West, 2007) was used to assess HASE. It is a 24-item self-report questionnaire that assesses a person's ability to care for and use HAs in four areas: Basic handling, Advanced handling, Adjustment, and Aided listening. A score of 80% in each subscale is considered adequate for successful HA use (Smith & West, 2007). All our participants scored at least 80% for the MARS-HA for all the subscales, and mostly reported having HASE between 85 and 100% (See Table 4).

### ***Hearing Aid Satisfaction***

The Satisfaction with Amplification in Daily Living scale (SADL; Cox & Alexander, 1999) has been used in audiologic outcomes research to assess individuals' levels of satisfaction with HAs (e.g., Wan Ahmad, 2020; Jilla et al., 2020). This is a 15-item self-report questionnaire that evaluates satisfaction as a global score and in four subscales: Positive Effect, Service and Cost, Negative Features, and Personal Image. The global score has demonstrated good construct validity and reliability (Cronbach's alpha = .82; Cox & Alexander, 2001). We chose to use this measure to cross-validate that our participants were adequately satisfied with their hearing aids to be considered "successful" for our purposes. The mean normative global score reported by Cox and Alexander in 1999 was 4.9. Global SADL scores were also cross-validated against a single item measure of satisfaction (Cox & Alexander, 2001), demonstrating that a global SADL score of approximately 5.1 corresponded to a rating of "satisfied" on the single item measure, and a score of 5.9 corresponded to "very satisfied." We felt confident including those individuals who scored at least a 5 on the SADL global score for this study. Table 4 demonstrates the SADL scores for our participants. This confirms that our participants not only exceeded this threshold

but also that subscale scores were uniformly higher than the mean normative values reported by Cox and Alexander (1999). These values frequently exceeded the 80<sup>th</sup> percentile scores, confirming that these participants were satisfied with their current HAs at the time of data collection.

### ***Personality***

The International English Big-Five Mini Markers (IMM; Thompson, 2008) is a short personality measure that is based on the “Big-Five” personality traits developed by Goldberg (1992) and further described by Saucier (1994). It describes 5 factors of personality: Extraversion, Openness, Neuroticism, Conscientiousness, and Agreeableness and consists of 40 adjectives that describe these personality traits (eight adjectives per trait). Participants rate each adjective on a scale from 1 to 5 according to how accurately the adjective describes them. We chose to assess the Big Five personality factors as they are stable over time (Lucas & Donnellan, 2011) and have been widely used in behavioral research (e.g., Satchell et al., 2016; Neal, 2016). Evaluations of the IMM have demonstrated strong psychometric properties (Thompson, 2008).

### ***General Self-Efficacy***

The General Self-efficacy (GSE; Schwarzer & Jerusalem, 1995) scale was used to assess participants’ optimistic self-beliefs in their ability to cope with a variety of difficult life demands. This unidimensional scale was developed in 1981 and has been widely used internationally. It has been found to have high criterion-related validity with positive coefficients correlated with favorable emotions, optimism, and work satisfaction. Negative coefficients have been associated with depression, anxiety, stress, and health complaints. Cronbach’s alphas are consistently high (ranging from .76 to .90; Scholz et al., 2002). This psychometric scale presents 10 statements about general personal efficacy. For example, “When I am in trouble, I can usually think of a

solution.” Responses are a 4-point Likert scale ranging from 1 (Not at all true) to 4 (Exactly true). The total score is calculated by computing the sum of all the items. A higher score represents better general self-efficacy.

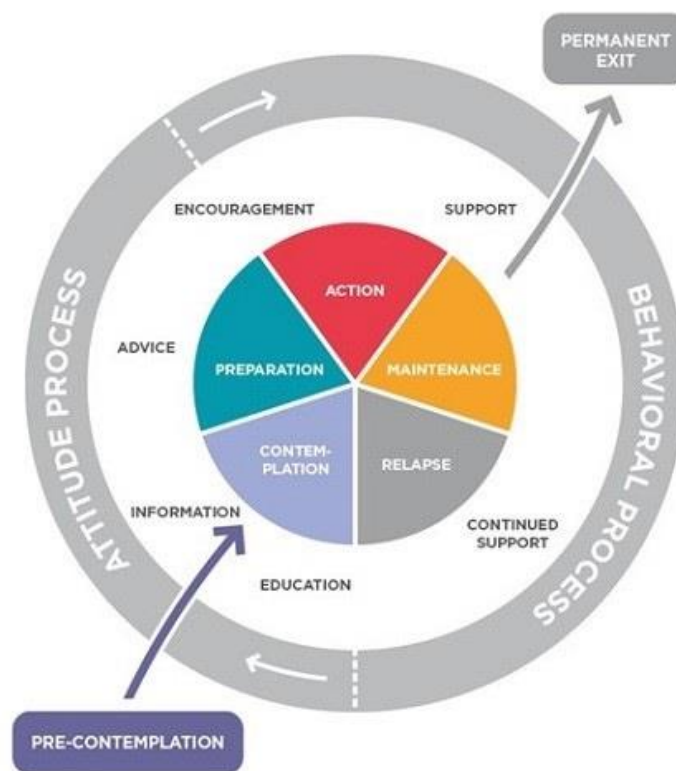
### ***Beliefs regarding patient-centeredness***

The Patient-Practitioner Orientation Scale (PPOS; Krupat et al., 2000) is an 18-item measure often used in health-communication research to assess health beliefs regarding patient-provider relationships. It consists of two dimensions of perceptions of patient-centeredness: Sharing and Caring. The Sharing dimension indicates a respondent’s perception of power sharing in a medical-care relationship. This is characterized along a continuum of high-power sharing (i.e., egalitarian) to low power sharing (i.e., paternalistic). The Caring dimension indicates a respondent’s perception that a provider cares for a patient’s feelings, beliefs, and interests. The 18-item version of the PPOS has demonstrated good construct validity (Krupat et al., 2000; Haidet et al., 2002; Street et al., 2003; Ross & Haidet, 2011; Beattie et al., 2012) and reliability estimates ranging from .73-.88 (Krupat et al., 2000, 2001; Haidet et al., 2001). Responses are scored on a 6-point Likert Scale (strongly disagree to strongly agree). We chose to use this measure to cross-validate participants’ orientations toward healthcare interactions.

### ***Semi-structured Interview***

Data were collected using one-on-one semi-structured, in-depth interviews. These interviews were based on a predetermined set of questions and themes to be explored; however, the semi-structured format allowed space for both the researcher and the participant to follow evolving directions that occurred naturally within the dialog. The interview guide was structured around the transtheoretical model of behavioral change (TTM; Prochaska & Velicer, 1997) as an orienting framework to understand participants’ lived experiences at salient stages of their

hearing health journey. This theory of health behavior and change, represented in Figure 6, has been used in audiology research to describe the hearing health journey (Babeu et al., 2004; Manchaiah, 2012; Manchaiah et al., 2018). It describes five stages of change in an individual's journey to achieve and maintain a successful health behavior. The five stages are: precontemplation (denial of problem), contemplation (considering a change in the problem behavior), preparation (seeking information for the change), action (making the change), and maintenance (maintaining the changed behavior) We chose to organize our interview around the TTM as it provides a structure for eliciting narratives about the hearing health care journey from the individual's point of view (Babeu et al., 2004) and delineates clear stages when HASE-based rehabilitative approaches might be incorporated into future clinical practices.



*Figure 6.* The Transtheoretical model (TTM) displaying the stages of changes as an individual achieves success in any health behavior. Figure reprinted with permission from the IDA Institute. [https://idainstitute.com/fileadmin/user\\_upload/Tools%20for%20Website%202011/The%20Circle%20with%20Instructions.pdf](https://idainstitute.com/fileadmin/user_upload/Tools%20for%20Website%202011/The%20Circle%20with%20Instructions.pdf). Accessed August 4, 2020.

Consistent with interpretive phenomenological tradition, the interview guide evolves throughout the iterative data collection and analysis process. The initial interview guide comprised six primary questions intended to elicit participants' perceptions of their experiences at each stage of the hearing health care journey according to the TTM. Secondary prompts and follow-up questions were used as needed to clarify responses. The initial 6 primary interview questions are numbered below with the targeted TTM stages presented in parentheses. In the second stage of data collection, we added specific prompts and a 7<sup>th</sup> interview question to further explore emergent themes observed from the first three participants' narratives. These added prompts and questions are presented in italics.

- 1) I am interested in knowing about your experiences when you first noticed that you had hearing problems. Tell me about that time. (Precontemplation/Contemplation).
  - a. What do you think might have delayed your recognition that your hearing had changed?*
  - b. What do you think were the most important factors that allowed you to realize that your hearing was a problem that needed attention?*
- 2) Think about the time when you went for your hearing tests. What was the tipping point that made you decide to go in? (Contemplation/Preparation).
  - a. Tell me more about that time of your life.*
- 3) Tell me about the time when you found out that you needed hearing aids. (Preparation).
  - a. Tell me what you were experiencing around that time that made you reluctant to get hearing aids.*
  - b. What were the most important factors that helped you decide to get hearing aids?*

4) Tell me about your experience when you wore the hearing aids for the first time.

(Action).

5) What was your experience with hearing aids during the first few weeks you wore them?

(Action/Maintenance).

*a. Not everyone chooses to keep wearing hearing aids after they get them. Tell me about any experiences that made you think about not using the hearing aids.*

*b. What helped you decide to keep using the hearing aids?*

6) Think about now. Tell me about the things that you think helped you the most in becoming a successful hearing aid user. (Maintenance).

*a. Tell me how your personality or attitude contributed to your success with hearing aids.*

*b. In your experience, what are the most important things that an audiologist should or could do to help people who wear hearing aids?*

Added question:

7) *How do you make decisions about what to do about your health when issues arise?*

*a. Walk me through the process of what you would do if you noticed a new health symptom today.*

*b. How do you gather information about a health symptom?*

*c. How do other people impact your health care decisions?*

Secondary data included relevant observations by the interviewers that could not be documented on the audio recording. These observations included descriptions of any meaningful body language and/or gestures that the participant made.

## **Procedure**

This research was completed in two face-to-face appointments in a living-room style sitting area within the premises of the Hearing Aid Research Laboratory, in the School of Communication Sciences and Disorders, at the University of Memphis. The second author conducted all interviews. Participants were given a brief overview of the study at the beginning of the appointment. After collecting demographic and routine audiologic information, participants completed the MARS-HA and SADL questionnaires to verify that their HASE and HA satisfaction were both high. This verified their eligibility to participate in the study. During the interview, participants were allowed as much time as they needed to respond to each of the primary questions. Each interview lasted between 25 and 35 minutes and was audio-recorded. After the interview was completed, the researcher verbally summarized the participant's responses to verify that their intended meaning was correctly interpreted. Participants were asked if there was additional information that they wanted to provide, and to help inform the researchers of ways that the interview process could be improved. (See Appendix A for verification questions). At the end of the interview, participants were allowed the opportunity to ask questions and to withdraw from the study. If they wished to continue, a code was assigned to their recording and their participant form. Immediately following each interview, the researcher expanded her field notes to describe more fully any observations that she had during the interview session. Expanded written notes were coded and saved as documents. All audio files saved in .wav format and were password protected. The research team then collaborated to generate an interpretive summary of each participants' interview data. At a second appointment participants were asked to verify the accuracy of the researchers' interpretation and add or clarify information as needed. At this appointment participants completed measures of personality

(IMM), general self-efficacy (GSE), and orientations to medical interactions (PPOS). One participant, P03, did not complete the second appointment due to health complications.

Participants were compensated for their time and participation.

### **Data Analyses**

Interpretation and analysis methods were consistent with recommendations for interpretive phenomenological analyses (Patton, 2002; Smith & Osborn, 1999; Starks & Brown Trinidad, 2007; Crist & Tanner, 2003). Audio-recorded files for each participant were transcribed verbatim. These transcripts and the researcher's field notes served as data for this study. When collecting data using an IP methodology, data collection and analyses are ongoing and iterative. Within this process, the narratives are analyzed while the investigator continues to interview and observe participants. Because the IP process is not linear, the data collection and analysis procedures described below overlapped in time.

Both holistic and thematic approaches were used for data analysis. Consistent with IP analysis (Patton, 2002; Smith et al., 1999; Starks & Brown Trinidad, 2007; Crist & Tanner, 2003), transcriptions were reviewed several times to obtain an overall impression of each participant's experiences. Electronic copies of the transcripts and field notes were uploaded to a computer assisted qualitative data analysis software program (N\*Vivo, [www.qsrinternational.com](http://www.qsrinternational.com)) to assist with organizing the interview data for interpretation.

Data analyses and interpretation were completed in several phases. In the initial phase, individual statements served as data units. Analysis of transcripts and field notes began with initial coding, in which each transcribed statement was denoted with a short label that summarized and described the participants' words. Using a technique recommended by Charmaz (2006), data were coded using language that reflected action in each statement rather than



language that reflected topics. These codes were then systematically compared for similarities and differences, and similar codes were clustered together to develop conceptual categories that reflected participants' experiences. After reviewing the transcripts and early codes and categories, participant narratives were summarized by the first author, restructured chronologically, and labeled using the TTM framework. For each summary, central concerns and salient excerpts were highlighted. Summaries were shared among the interpretive team to provide a vehicle for discussion, refinement, and interpretation. This method of interpretive writing is consistent with the IP approach (Crist & Tanner, 2003). When the interpretive team agreed that the summary was representative of the participant's narrative, that summary was shared with the participant to confirm that our interpretations of their experience were accurate from their perspective and to invite additional comment and clarification. These comments were included as an additional data source.

After the central concerns and common experiences of the first three participants were discussed and clarified, subsequent interviews and final interpretations were completed to clarify emerging themes. With the addition of the 4<sup>th</sup> and 5<sup>th</sup> participants' data, our existing themes were confirmed and no new salient categories emerged. This is called data "saturation," and data collection was discontinued (Saunders et al., 2018). Ongoing consultations between the researchers involved in this study throughout the data gathering, analyses, and interpretation phases of this study enhanced theoretical sensitivity and accountability (Noble & Smith, 2015) for this study. The final interpretations were discussed, and researchers agreed that these described the essence of these participants' experiences.

## **RESULTS**

When describing their hearing health experiences, all participants reported experiencing barriers to HA success at each stage of their hearing health journey and then told stories of how

they overcame these barriers to move forward towards success. We labeled those experiences and traits that motivated participants toward the next stage of their journey as “facilitators” of HA success. Barriers and facilitators were compared and organized, and then assembled into higher order categories according to the stages of change when they occurred based on the TTM framework. Figure 7 summarizes the common experiences of these participants at each stage of behavioral change. For this figure, each stage is represented by a solid shape. Our participants’ experiences exactly followed the hypothetical TTM sequence, and every stage was represented by our participants’ stories (although only one participant experienced “Relapse”). Some participants had short stays in various stages and others spent extended periods, including several years, suspended at one or more of these junctures in their journeys. We chose to represent the active stages of the hearing health journey as hexagons (like stop signs). The common barriers to progress experienced at each stage are included within these hexagons. Common facilitators of advancement in the hearing health journey are surrounded by dashed lines. In the section that follows, participants’ shared experiences are presented along with excerpts drawn from the interview transcripts. The excerpts presented in italics are representative of patterns observed across the interviews unless where noted. These are included to increase confirmability of our interpretations. Directly following each excerpt, the respondent is identified in parentheses using a participant-approved pseudonym. This method of representation was chosen to facilitate understanding of these data by readers with a variety of learning styles.

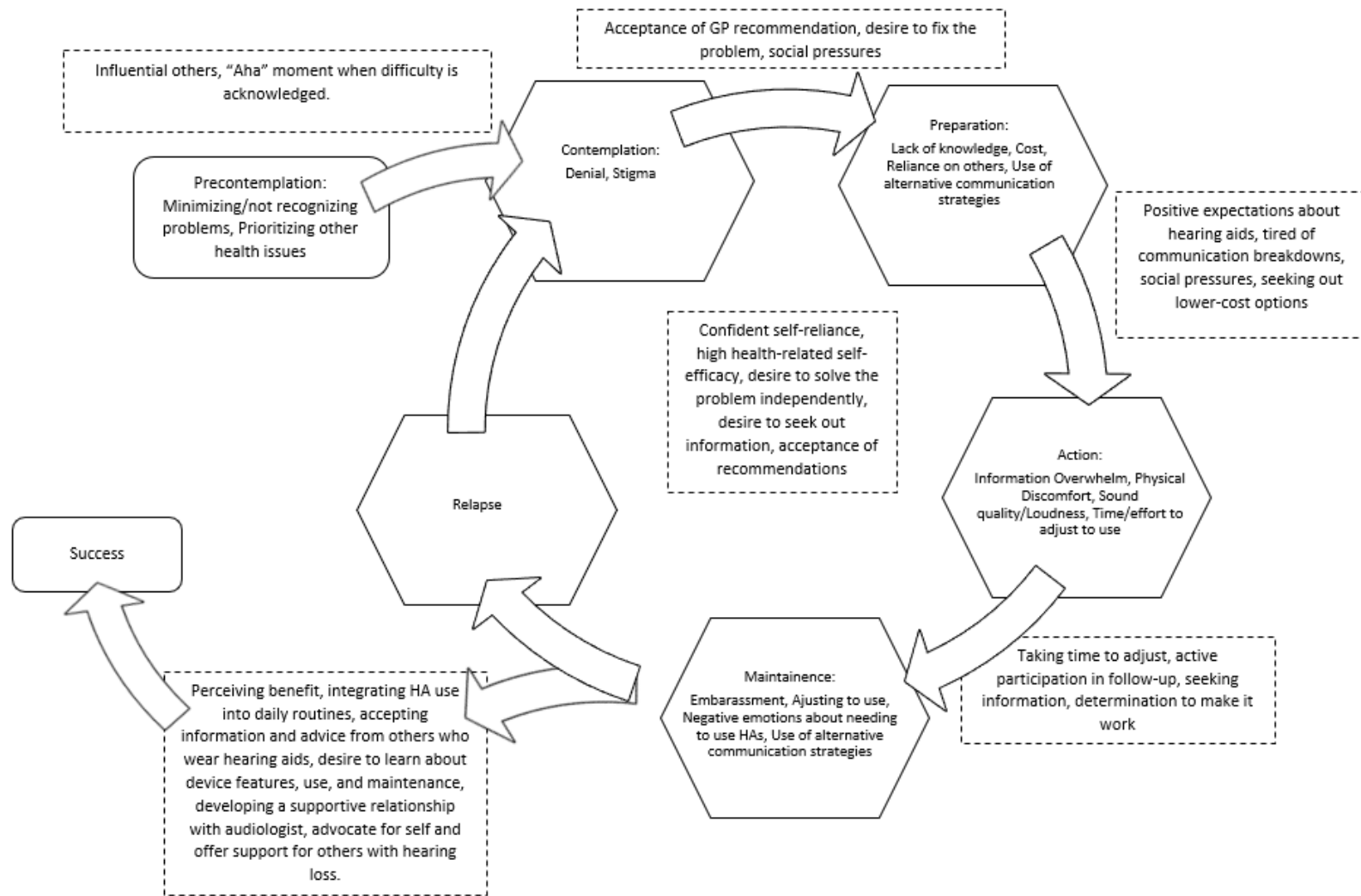


Figure 7. Summary of the common experiences of the participants at each stage of behavioral change

## **Barriers to HA success**

Although the barriers to HA success were not the primary focus of this analysis, a presentation of reported barriers here allows the reader to contextualize the experiences of these participants and determine whether their experiences are like or different from others' journeys.

### ***Precontemplation***

Initially, these participants were not aware of their hearing problems, attributed their difficulties to temporary or insignificant causes, or else did not prioritize their hearing health over other life problems. *"It took a couple of years. Well, because it wasn't symptomatic unless someone said something about it. To me, it was just going on about my day, you know?"* (Mike). *"Well, I think the initial reaction was, you know, 'You've got to be crazy! Of course, I don't have hearing loss!'"* (Paul). *"I was going 'What?' and I thought I just need to go to my ear doctor and get my ears cleaned out. That's all."* (Sue). *"I guess the older we get the more we find that we've got multiple problems. And that one was not expected at the time. I was not ... I had arthritis, bad legs. No, but hearing loss really didn't dawn on me."* (Robert).

### ***Contemplation***

Although all the participants eventually chose to have a hearing evaluation because of their problems, some were still surprised by their diagnosis. *"I knew I had some [hearing loss] but they said I had more than what I thought I had and it was a shock... 'Oh, wait a minute... Okay, let me digest this.'"* (Robert). One participant, Mike, emphasized that he knew he would eventually have hearing problems because of noise exposure from time served in the military. *"I knew that I was going to have a hearing problem, it was just a matter of when."* And yet, when his hearing test showed that he did have a loss and was a candidate for wearing hearing aids he

was disappointed. *“Well, I felt disappointed, you know, that I didn't know. I didn't want to wear hearing aids. So, yeah, I didn't, I didn't feel good about it.”*

Even those participants who had recognized their difficulties and weren't at all surprised by their hearing test results encountered barriers to considering HAs. These included social stigmas related to hearing loss and wearing HAs. *“I just feel like... you're getting older. Things are not working the way they used to. Well, it sets you apart from other people and from that perspective, yeah, it bothers you.”* (Paul). *“Hearing aids were for old people.”* (Sue). *“If I'm wearing hearing aids, people look at me and go, you know, ‘How did that happen?’ And, you know, ‘What is it, age? Is it injury or illness? And, so, it isn't a fix. You know how one feels about him or herself. So that was, that was the primary reason.”* (Mike).

### ***Preparation***

As these participants began to consider next steps toward remedying their hearing problems, several indicated that unknowns about the cost of the devices was a concern or barrier to progressing toward action. *“The other reason is that I did not know how, first of all, how much it would cost. I knew they were expensive. And so I knew that I would be looking at, you know, thousands of dollars to get a decent pair of hearing aids. And so that added expense was something that I was concerned about.”* (Mike).

These participants tended to be comfortable disclosing their hearing problems and using alternative communication strategies such as asking communication partners to facilitate clear conversation through repetitions, or by speaking louder or facing them to improve communication. In some cases, this approach extended the duration that participants were able to successfully cope with daily hearing difficulties, delaying their decision to take action toward purchasing HAs. *“Back then it, it didn't embarrass me to say ‘What?’ that much. I just said*

*'What?' and it did not embarrass me.*” (Sue). *“[Friends and family] were there for me. They understood. You've got to look at me, otherwise it's just this mumbling. They would catch themselves occasionally and they would turn or they'd speak up louder.”* (Robert).

### **Action**

After choosing to purchase HAs, the participants continued to experience barriers to successful use. Several participants mentioned feeling overwhelmed with information at their HA orientation. *“When you go in for your first set of hearing aids, it's probably more trauma than you're aware of. And so, when people give you explicit instructions, you don't [always] recall [what they said].”* (Paul). *“It was overwhelming at first because it was a lot of information to take in, and acceptance that I needed a hearing aid.”* (Sue). Participants also mentioned initial problems accepting the fit and sound of the HAs. *“They weren't completely how I was expecting them to be. I had to get a little bit used to them going behind my ear”* (Robert). *“I can remember when I picked [the hearing aids] up and we left, and I made it to [the highway, and said], 'I can't do this.' And I turned around and I went back and I said, 'Turn the volume down.”* (Jane). *“Well, [at first] it didn't work exactly the way they said it would work . So, I did go back two or three times. I do remember that. You know. It took a while for it to do it they said it would do. [It was frustrating because] you spend money and it's not what you expect.”* (Paul).

### **Maintenance**

Even after choosing to adopt HAs, these participants encountered barriers to long-term use and success. Several participants mentioned embarrassment and cosmetic concerns. *“The stares... some people, you know, they look like, you know, ... first it semi-bothered me”* (Robert). *“I think the vanity thing was the big part. I mean I didn't want them showing and so....They make*

*your ears stand out.*” (Jane). Participants also needed time to adjust to consistently using the HAs each day. *“I think the thing that most was to just put them in a place, remember to put them on it, to put them on, and then getting accustomed to the noises.”* (Mike).

Reliance on alternative coping strategies continued to be a barrier to consistent HA use for one of these participants. She realized that because her hearing difficulties were known to others, communication partners tended to be more patient and use better communication strategies with her. This coping strategy, as well as initially feeling angry about needing to wear the HA, caused this participant to “relapse”, before again committing to wearing the HAs consistently, and eventually becoming a successful HA user. *“I was embarrassed. I didn't want to wear a hearing aid...[After I went to the doctor] people were more sympathetic and would repeat things and you didn't feel like ...you got on their nerves for asking 'what' a lot... Days that I was rebellious I would sit to the front without the hearing aid, stand closer to the person, or at the front of the line.”* (Sue).

### **Facilitators of HA success**

Despite encountering the barriers presented above, these participants, who share having high HASE, were able to successfully navigate toward successful long-term HA use. Six additional shared factors that they believed contributed to their HA success emerged from the data. These were (1) intrinsic motivation to improve their hearing; (2) confident self-reliance when making health decisions, (3) willingness to act on considered advice, (4) positive personality traits, (5) positive expectations about outcomes with HAs, and (6) actively pursuing an optimal outcome with HAs. Although these factors varied in importance at different stages of the hearing healthcare journey, aspects of each were diffused throughout the process. For this section, results are presented in terms of each of these 6 themes.

***Participants were intrinsically motivated to improve their hearing***

Participants became aware of their hearing difficulties in a particular situation when they noticed a reduction in their hearing abilities, or else when one or more influential others mentioned it to them. “[My] wife would be saying something and I just didn't hear it. [If] she turned her head [away from me] ... she sounded like she's mumbling and I was like, wait a minute, ... something is not right.” (Robert). “When you hear enough times that you need to get a hearing aid, you think, ‘You know, how long can I put this off?’” (Paul). At that point, all participants were personally motivated to improve their hearing and did not require additional encouragement from others to seek help. Intrapersonal motivations included: a desire to resolve their own difficult listening experiences, improve quality of life for themselves and their families, and ameliorate communication breakdowns. “If I was going to hear people talk I needed to wear [a hearing aid].” (Sue).

*“I didn't want to become a hermit. I wanted to continue to go out and I wanted to continue to interact with people... I wanted to be able to sit with [my wife] and watch TV at an acceptable volume. And I wanted to be able to hear the ambulance horn when it's coming, the fire truck. And then, you know, I have grandchildren. I have a bunch of grandchildren. And so I wanted to be able to hear them as well without having to ask, you know, what did you say?” (Mike).*

*“By the time you say, ‘I'm sorry, could you repeat that?’ three times, you know that you need to go and get your hearing tested. I was aware that I was having to ask the guys to repeat, and that bothered me.” (Jane).*



### ***Participants had confident self-reliance when making health care decisions***

All these participants expressed confidence and self-reliance when making decisions related to their hearing. Most made a point to emphasize that they did not discuss their decisions to pursue hearing help with others and attended their initial appointments alone. “[My family was] not involved in the decision. I made my decision on that.” (Sue). “I make my decisions. I will tell my son what my decision is.” (Jane). “You have to resolve to do it and go ahead and do it.” (Paul). “If I have a symptom or sign, I feel very comfortable and then make an appointment to get that looked at.” (Mike). When we asked them how their friends and families reacted to their decisions, responses were mixed. Some participants suggested that others were supportive of their choices after they pursued hearing help. “[My wife] said, ‘Well good. Maybe you will start hearing me. [And my daughters said], ‘Oh, well good Daddy, we’re glad to see you did something’. So positive attitude was there.” (Robert). Others disregarded negative feedback from others about their decisions. “My mother was very upset and friends and family. Ah.. it didn’t bother me what they thought back then. It just didn’t bother me. That did not change my feelings about hearing aids. I had to have it.” (Sue). “[My wife took the news of my hearing results] more negative than me. [It made me feel] just down in the dumps so to speak. But, ‘Ok. You just, you’ve just got a negative attitude. I’m not going to discuss it more with you.” (Robert).

### ***Participants were open to acting on considered advice from others***

Participants indicated that they were willing to consider and act on advice from influential others when it was presented in a considered or empathetic manner. Influential others included family members and healthcare professionals. Paul’s family approached him “very nicely. They just said: Dad, I think you need to get a hearing aid. No one twisted [his] arm” to get HAs. However, this gentle recommendation prompted Paul to pursue hearing help.

Participants also were willing to accept recommendations from their healthcare professionals. *“I was young, I thought I was invincible. And so I didn't think I needed that [hearing aid] but I listened to the doctor because I knew he knew more than I did and I proceeded to do what he told me to do.”* (Sue). Participants also expressed trust in their audiologists’ recommendations. *“I tribute everything that I've learned to my audiologist ... I was a loyal customer of his for 36 years”* (Sue). Yet, these participants did not follow recommendations blindly. For example, Sue mentioned that she was receptive to advice from her ENT to see an audiologist because he explained why he was making his recommendation, and this built trust between them. *“The final decision was, I trusted that surgeon, and if it wasn't for that surgeon telling me and giving me a good explanation of why, and not just saying, ‘Go,’ but a good explanation why I should go. That's what put me there.”*

***Participants felt that their positive personality traits facilitated their success***

When we asked what helped our participants most in being successful, most mentioned their own positive personality traits, attitudes, and philosophies. These participants’ statements were generally consistent with having an internal locus of control, positive affect and personality traits, and prosocial behaviors. *“[What helped me?] Just me.”* (Paul). *“I don't tend to be negative about too many things either. I'm always going to try. And I'm always willing to help others try.”* (Jane). *“I knew that if the hearing aids helped me to hear better, I could continue what I like doing and talking to people, talking to patients, because at the time I was still seeing patients. And so I knew that that would help me to continue to do that, to be able to be a better communicator and a better listener.”* (Mike).

### ***Participants had positive expectations about outcomes with hearing aids***

Even when initial problems with the HAs were noted, participants realized the benefits that they received from their HAs. *“I knew that I heard better, and especially in the classroom or in a situation where I was going to have men. Conferences, that type of thing, I always wore them. It just wasn't worth taking the chance.”* (Jane). *“The first time I wore those [hearing aids], I was pleased because I remember driving back from the audiologist and my wife was with me, that I could hear her and I could hear the radio better when I got in the car with the hearing aids on. So I knew that, I knew for sure that they were going to make a difference, that, that I would be able to hear her, the noise, come outside, hear the television better.”* (Mike).

### ***Participants took an active role in pursuing optimal outcomes with their hearing***

These participants had realistic expectations about their HAs and committed to optimizing their HA experiences over an adjustment period. *“It's a huge adjustment. It did get better with time. You will learn how to deal with it.”* (Sue). *“It takes a little getting used to.”* (Paul). *“I had to get a little bit used to the going behind my ear. But that was a matter of a couple of days.”* (Robert). They also were not willing to settle for an “adequate” hearing aid fitting. They were willing to put in the work needed problem-solve and achieve an optimal fitting and integrate the hearing aids into their daily lives. *“[I said], ‘I'll make them work...Tell me how I can do it.’”* (Robert) *“Persistence. Not giving up in the beginning. I'm not a quitter, but these things are not going to get the best of me. I can do this.”* (Jane). *“I accepted [the hearing aid] and I learned how to clean it. I learned that it's my friend, you know, and I took good care of it.”* (Sue). *“It was a trying time [at first] because I would actually forget about it. ‘Oh, wait a minute, I have got a hearing aid. Let me put it in.’ [But now] I normally keep the hearing aid and the batteries and everything on the corner of my counter and when I sit out with my coffee I*

*reach up and pick it up or, actually, I go around, turn my coffee pot on, come back sit down on the chair and pick it up.” (Robert).*

## **DISCUSSION**

In an effort to understand the underlying “active ingredients” in HASE that might play a role in HA success we interviewed individuals who had high levels of HASE and were successful HA users. In these interviews we explored those aspects of their hearing health care journeys that they believed were important contributors to their long-term successes with HAs. To highlight the essential aspects of this phenomenon, we used inductive and holistic analyses of interview transcripts, consistent with an interpretivist phenomenological methodology, to elucidate the experiences shared by these participants. The interviews and interpretive results were framed in terms of a model of Health Behavior Change (HBC), a construct commonly used to explore behavior in healthcare. HBC is the process of facilitating change in habits and/or behaviors related to health (Manchaiah, 2018). There are several theories and models that can form structural frameworks to create positive changes in health-related behaviors. One of these models, the TTM, has been widely used in various health sectors to explain a person’s attitudes, beliefs, and behaviors associated with readiness to achieve healthy behaviors (Hall & Rossi, 2008; Hernandez, 2011; Prochaska et al., 2009). Research in other areas has shown that individuals who are in later stages of readiness for change tend to have greater success in terms of help-seeking, intervention uptake, adherence, and other health outcomes (Prochaska et al., 2009). More recently, the TTM has been applied in Audiology to describe hearing loss (Manchaiah et al., 2015; Ferguson et al., 2016) and readiness for audiologic rehabilitation (Noh et al., 1994; Manchaiah, 2012). Our analyses explored barriers and facilitators to readiness advancement that our participants experienced at each stage of change according to the TTM.

## **Barriers to HA success**

The barriers that these participants encountered were consistent with those described in previous research. For example, our participants reported that it often took time for them to realize that they had hearing difficulties severe enough to require intervention. Researchers have demonstrated that increasing severity of perceived hearing difficulties in daily life is related to improved outcomes across the hearing journey, including hearing help seeking (Gatehouse, 1990; Duijvestijn et al., 2003; Meyer & Hickson, 2012; Humes & Dubno, 2021), HA uptake (Humes et al., 2003; Simpson et al., 2019), use (Cox et al., 2007, Takahashi et al., 2007; Gallagher & Woodside, 2018), and satisfaction (Cox et al., 2007; Takahashi et al., 2007; Knudsen et al., 2010). In the Contemplation stage of their journeys, our participants mentioned having negative emotions about their hearing loss, mostly related to social stigmas related to hearing loss and HA use. The literature in this area is mixed, with some research demonstrating that negative attitudes toward HAs can be a significant barrier to HA uptake (van den Brink et al., 1996), and use (Hickson et al., 1986, 1999; Wilson & Stephens, 2003, Gatehouse, 1994), and other studies finding no such correlations (Duijvestijn et al., 2003; Jerran & Purdy, 2001). Researchers have also explored the relationship between attitudes toward one's own hearing loss, and HA outcomes. Collectively, these studies demonstrate that those individuals who found their hearing loss less stigmatizing had increased HA uptake (Southall et al., 2010, Wallhagen, 2010), and use (Brooks, 1989; Jerram & Purdy, 2001). In the preparation stage, cost of the devices was a significant barrier for some of our participants. This factor has been shown to be one of the primary issues preventing many HA candidates from taking action for HAs (Jenstand & Moon, 2011; Grundfast & Liu, 2017). Another factor that our participants presented as delaying their advancement toward taking action was successful use of and reliance on alternative

communication and coping strategies. This is consistent with research by Cox (2005), which demonstrated that HA seekers reported using fewer coping strategies than those who did not seek HAs. After our participants obtained HAs, they collectively reported feeling overwhelmed with information at their initial orientation to using HAs. This is consistent with medical literature that suggests that participants do not recall around 50% of what they are told in a clinical encounter, a statistic that is further reduced when patients are under stressed or receiving bad news (Luterman, 2001; Kessels, 2003). One of our participants mentioned that this event was “traumatic.” Even though he was expecting this news. Further, consistent with recent trends reported by Picou (2020), these participants also expressed a need to adjust to the physical fit, loudness, and sound quality of their newly fitted hearing devices. Simultaneously, participants dealt with overcoming ongoing negative emotions toward their HAs, including anger and feeling stigmatized by their hearing loss and wearing their HAs. Although some researchers also have demonstrated that negative feelings about one’s own hearing loss is related to reduced satisfaction with HAs (Wilson & Stephens, 2003; Gatehouse, 1994), other researchers have not found similar relationships (Hickson et al., 1999; Jerran & Purdy, 2001). Taken together, the experiences described by our research participants appear to be typical of many other participants in larger samples of the general population of adult HA candidates.

### **Facilitators of HA success**

Despite these similarities, a large proportion of HA candidates never become successful long-term HA users. Yet, our participants considered themselves highly successful. They regularly used their devices, had strong relationships with their audiologists, and were highly satisfied with their HAs. Examples of statements from these participants about their HAs included: *“I have heard people say: “I’ve got to get a hearing aid.” And I say: ‘Do it! Because*

*your world will change!” (Sue). “I don't have to worry nearly as much in conversation and in a gathering. I can hear the people behind me better and the people in front of me better. And if I'm in a group and there's talking around me, but I'm talking to one person, I can hear that individual much better than I could before I got hearing aids. So, it's made a difference, socially, for me, and professionally, because I can hear the patients better, much easier.” (Mike). “I leave the house. I have the hearing aids in.” (Jane). All these participants reported having high HASE, which, as we have stated, has been strongly related to HA success. But, what is special about this characteristic? Sarangi and Johnson (in review) found that HASE is significantly related to years of HA experience, particularly for those with greater than 10 years of experience; and years of HA experience has been linked to increased satisfaction with HAs (Hosford-Dunn & Halpern, 2001; Uriarte et al., 2005). One might presume that years of experience is the driving factor behind the relationship between HASE and HA satisfaction. However, our participants had experience ranging from only 3 to 36 years. Furthermore, in a study by Kelly-Campbell & McMillan (2015), HASE was a significant and independent predictor of HA satisfaction irrespective of participants' experience with HAs. Together, this suggests there is more to the impact of HASE on hearing aid success than can be explained by experience alone.*

These participants with high levels of HASE all reported factors that they believed impacted their success. We were particularly interested in exploring common experiences that we could build on to inform a best-practice rehabilitative approach. For example, we were curious whether these individuals shared experiences of having supportive others cheering them on toward success, or perhaps they all had super-star hearing healthcare professionals whose techniques we might share with others. Although a few of these participants had these kinds of

experiences, they were far from prevalent in this small sample. In fact, the actual experiences among the group were quite different from one another.

The factors that were most important from these participants' perspectives, and that were shared among the group, were inherent or learned personal characteristics and qualities that they relied on to overcome barriers to their long-term success. First, these participants expressed an intrinsic motivation to improve their hearing difficulties. In other words, they were self-motivated to seek help rather than motivated by others (extrinsic motivation). Several researchers have shown that the influence of others contributes to consultation for hearing healthcare services. Typically, these studies have demonstrated that social pressure from significant others (friends and family) to do something about the hearing problem is one of the primary influencing factors for individuals considering hearing healthcare services (Duijvestin et al., 2003, Kochkin, 1993; van den Brink et al., 1996). Hickson et al. (1986, 1999) and Wilson and Stephens (2003) investigated whether source of motivation (intrinsic or extrinsic) for seeking HAs impacted HA use. None of these studies demonstrated any differences in HA use based on source of motivation. Although Wilson and Stephens (2003) also found no differences between source of motivation and HA satisfaction, Hickson et al. (1999) did observe a significant association between source of motivation for seeking help and long-term satisfaction with HAs. In their study, self-motivated individuals were more satisfied than those who were motivated by others. Although these studies explored categorical differences in source of motivation, they did not address an individual's degree of self-motivation. Our participants indicated that they needed very little encouragement to seek services and were highly independent in terms of their decision-making and subsequent help-seeking. It is possible that a study examining source of



motivation along a continuum might provide additional insight into the impact of this trait on HA outcomes.

Like source of motivation, these participants expressed particularly strong tendencies to be confident and self-reliant when making health care decisions. As can be seen from the exemplar quotes, all these individuals indicated that they undertook their hearing healthcare decisions alone. Both women in the study found it particularly important that we understood that they made their own decisions without asking or consulting others beforehand. After observing this for the first three participants in the study, we asked ourselves whether the key ingredient of these participants' high levels of HASE was, in fact, high levels of general or general health-related self-efficacy. To cross-validate this theory we asked all participants to respond to a validated assessment of general self-efficacy (GSE; Schwarzer & Jerusalem, 1995). It should be noted that these closed-ended data are strictly intended to serve as an additional source of data to triangulate whether this observation could be supported for each of our participants. Because we did not intend to analyze mean numerical trends from these data in a sequential qualitative/quantitative analysis we have not referred to this as a mixed-methods study. The GSE assesses an individual's confidence in solving problems in their everyday life (in general). Possible scores on this scale range from 10 to 40. These participants scores ranged from 34-40 (See table 4), with an average score of 38, which is very high, confirming that these participants expressed high general self-efficacy. High general self-efficacy has been associated with high levels of motivation (Bandura, 1994), which could explain the intrinsic motivations expressed by these participants. GSE has been demonstrated to facilitate goal-oriented behaviors and assist in dealing with barriers and recovery from setbacks (Zielińska-Więczkowska, 2016). Sawyer et al. (2019) investigated the motivation level of individuals to use HAs and found that high self-

efficacy and high motivation combine to positively impact success. Self-efficacy is generally considered situation specific, however, there is research evidence that HASE and GSE are moderately related (Dullard et al., 2014). Although high HASE is associated with years of HA experience, it is likely that these participants' high GSE facilitated their successes in the stages of their hearing health journeys prior to HA adoption.

Although participants were highly independent once they decided to pursue hearing help, they generally were receptive to the advice of others, both family members and healthcare professionals, when advice was presented in a considered and empathetic manner. Preminger et al. (2015) conducted a qualitative study suggesting that individuals with hearing loss meet their healthcare service provider with a preconceived level of trust that later shapes their expectations from the service and the treatment. Thus, those with higher levels of initial trust in their providers are more likely to adhere to recommendations throughout the hearing healthcare process. Because our patients demonstrated openness to advice and willingness to develop a positive relationship with their audiologists, we asked them to complete the Patient-Practitioner Orientation Scale (PPOS; Krupat et al., 2000) questionnaire to understand their beliefs about the role of the provider in a clinical encounter. We wondered if these participants might be more inclined to accept a traditional, practitioner led clinical encounter rather than a patient-centered model. We calculated the mean PPOS score, and scores for the Sharing and Caring subscales. The possible range of scores is between 1 and 6. A high mean PPOS score indicates a belief that the provider is patient-centered, while lower scores indicate a belief that the provider is disease-oriented. The Sharing factor indicates a respondent's belief that the provider is oriented to share power in their medical-care relationship. The Caring factor indicates a respondent's belief that the provider is oriented to caring about the patient-provider relationship, the patient's emotions,

and has interest in the patient, rather than simply the disease. Our participants had PPOS scores ranging from 3.33 to 4.55 (See table 4), which is not particularly toward either direction, although they are slightly more toward a patient-centered orientation. Similarly, the Sharing factor scores ranged from 3.22 – 4.5, and the Caring factor scores ranged from 3.44 to 5. These scores are close to the norms reported by Krupat et al. (2000), although some participants were leaned toward patient-centered orientations. On the whole, these scores do not support the idea that provider orientation was a driving factor behind most of these participants' decisions to accept recommendations from their audiologists or healthcare providers. It was of particular interest to observe Sue's scores because she expressed acceptance of her ENT's recommendation for a HA even when she did not think she needed one. In the process, she experienced relapse before she eventually moved through the cycle again to become a successful user. Sue reported a moderate orientation to power sharing and a high orientation toward caring about the patient as a person. This acceptance of more a traditional practitioner-centered power dynamic, paired with the belief that the practitioner cared about her as a person, might partially explain Sue's willingness to accept her ENT's recommendation when it was carefully presented. However, a bidirectional and shared decision-making is generally considered a critical factor in the patient-provider relationship (Kennedy et al., 2017) and this unilateral relationship might have contributed to her initial relapse.

Another explanation for this theme might be that these participants were high in Agreeableness. People that are high in this personality trait tend to be trusting, willing to accept help, and more compliant than those who are lower in this trait (John & Srivastava, 1999). To cross-validate this theory we asked our participants to respond to the IMM personality survey

(Thompson, 2008). On a scale of 1 to 5 our participants scored between 4.13 and 4.5 (See table 4), or very high, on the Agreeableness trait, lending support to this hypothesis.

Participants generally attributed many of their successes to their positive personality traits. When examining their scores on the other 4 personality traits assessed by the IMM, it can be seen that these participants tended to report higher scores on positive personality traits, and lower scores on negative personality traits. Three of the participants expressed scores consistent with extraversion. Those who are high in extroversion enjoy socializing with others (John & Srivastava, 1999) and tend to have greater self-confidence (Cox et al., 2005; Soto, 2018). This is consistent with many of participants' desires to improve their hearing to relate to others. All our participants also were high in openness to experience. These individuals tend to enjoy learning (Soto, 2018), are intellectually curious, and ready to try new things (Cox et al., 2005). Several of our participants were excited to try HAs and enjoyed the fitting and adjustment process. This trait also might explain why these participants tended to have positive expectations about how their HAs would eventually perform, even when they initially encountered difficulties. These participants also scored low in neuroticism. Those who score low on this trait are more likely to be calm and confident. They are more likely to have high self-esteem and resilience. This trait is consistent with our participants' expressions of intrinsic motivation, high self-efficacy, and willingness to stick with the HAs, even when they had negative experiences with the devices or the fitting process. Participants also were high in conscientiousness. Those who score high on conscientiousness tend to be organized, disciplined, goal-oriented, work persistently to achieve their goals, and are determined to succeed (Cox et al., 2005; Soto, 2018). These traits are consistent with the final facilitating factor, that participants took an active role in pursuing optimal outcomes with their HAs. They developed strong relationships with their audiologists,

did not hesitate to return multiple times for follow ups to optimize their outcomes, and problem-solved to incorporate their devices into their daily lives.

Research in Audiology has not demonstrated consistent associations between personality traits and HA outcomes (Knudsen et al., 2010), and previous research from our laboratory has suggested that personality traits are distinct from HASE (Sarangi & Johnson, in review). However, the results of this research suggest that many of the facilitating factors experienced by these successful HAs users with high HASE might be explained by a combination of personality traits. This is consistent with existing research in other fields that demonstrate a strong relationship between self-efficacy and personality traits (Judge & Ilies, 2002), and positive traits with goal-oriented behaviors (Sanchez-Cardona et al., 2012).

## **CONCLUSIONS**

The successful HA users with high HASE that we interviewed for this study reported experiences that were typical of adults with acquired hearing loss as they consider hearing help-seeking, HA uptake and use, and move toward long-term satisfaction with their HAs. To understand the factor(s) driving the relationship between HASE and HA success, we explored the experiences that these participants shared that they believed contributed to their successes. Rather than reporting common external experiences that facilitated their successes, participants generally reported that they relied on inherent and learned personal characteristics and qualities to overcome barriers. The present study suggests that the relationship between HASE and long-term HA success might be related to factors like source of motivation, general-self efficacy, and personality traits. These possible moderating and mediating factors should be explored at varying stages of the hearing health journey. Understanding these relationships could inform clinical audiologists how to develop protocols that might facilitate change differently depending on a

patient's readiness. Future research will have to investigate whether such a protocol might ultimately facilitate long-term success with HAs in daily listening.

## Chapter 4

### GENERAL AND SITUATION-DEPENDENT PATIENT TRAITS IN PREDICTING READINESS TO PURSUE AUDIOLOGICAL INTERVENTION

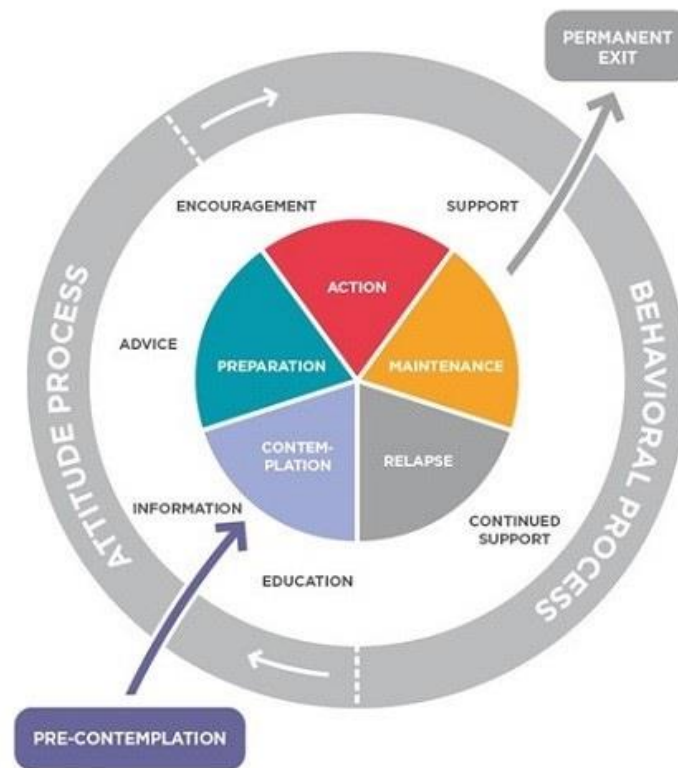
Hearing loss can have detrimental effects on communication, social- emotional wellbeing, earning power, and quality of life (e.g., Kochkin, 2007; Nachtegaal et al., 2009). Hearing aids (HAs) are the preferred treatment for hearing loss. Researchers have shown that quality of life problems can be ameliorated for adults using HAs (Acar et al., 2011; Kochkin, 2009). Yet only a small proportion of adults who could benefit from HAs choose to seek help for their hearing problems or use HAs (Schneider et al., 2010, Dillon et al., 1999). As the degree of daily hearing difficulties increases individuals are more likely to seek treatment for their hearing difficulties (Arnold et al., 2019). However, influences from additional patient factors such as cognition (Souza et al., 2015), personality (Cox et al., 2007), motivation (Ridgway, 2017), and hearing aid self-efficacy (HASE; Hickson et al., 2014) also impact aspects of HA success like HA uptake, use, and satisfaction. Thus, researchers have recommended considering these traits when designing individualized audiologic rehabilitation for HA wearers. Having said that, only a few of these traits, such as HASE and motivation, can be directly modified through established audiologic assessment and counseling techniques. Research on HASE has recently gained popularity in the field of Audiology; however, the salient attributes of HASE that impact HA success have not been investigated. This lack of clarity warrants exploration of how these traits interact to impact audiological outcomes for HA wearers. This study attempted to clarify some of these issues.

Although our preliminary research has demonstrated no direct relationships between HASE and general measures of patient traits such as measures of cognition and personality, our data do suggest that a complex interaction between these factors might impact patients' HA skills

(Sarangi & Johnson, in review). An additional qualitative investigation in our lab of the experiences of successful HA users who have high HASE suggested that these individuals believed that their open, agreeable, and other positive personality traits were important contributors to their success with HAs (Sarangi & Johnson, in preparation). One possible explanation for these somewhat conflicting findings regarding the relationship between HASE and personality is that self-efficacy is typically assessed using domain-specific measurement scales and personality is usually assessed using generalized measures. Yet it is unclear whether general measures of personality accurately characterize the aspects of personality that are salient to hearing health decisions and daily listening-related behaviors. Personality traits are usually considered to be stable over time (Lucas & Donnellan, 2011) and it is assumed that assessment results should not change based on a specific situation. However, research has suggested that the emotional state of a person at the time of assessment may impact the way they respond on self-report measures of personality and emotional state is situation dependent (Querengasser & Schindler, 2014). Researchers have found that personality traits such as Extraversion and Neuroticism are positively correlated with the manifestation of positive and negative affective states, respectively (Hiebler-Ragger et al., 2018; Magee & Biessanz, 2018). For a person with hearing impairment, difficult communication situations are often intertwined with negative emotions such as increased stress, annoyance, frustration, and self-stigma. Anecdotally, individuals in our laboratory who take personality inventories frequently complain that their answers depend on the situation that they are in, and they are not sure how to respond. This warrants an investigation of how individuals with hearing loss might differently report their personality traits and affective states when they are assessed “in general” and when they are assessed for situations that are specific to daily listening. We hypothesized that situation-



dependent measures of personality traits and affective states might provide greater insight into the traits and states that are most salient to HASE and aspects of success in an individual's hearing health journey, such as hearing help-seeking, HA uptake and use, and satisfaction with amplification in daily listening.



*Figure 8.* The Transtheoretical model (TTM) displaying the stages of changes as an individual achieves success in any health behavior. Figure reprinted with permission from the IDA Institute. [https://idainstitute.com/fileadmin/user\\_upload/Tools%20for%20Website%202011/The%20Circle%20with%20Instructions.pdf](https://idainstitute.com/fileadmin/user_upload/Tools%20for%20Website%202011/The%20Circle%20with%20Instructions.pdf). Accessed August 4, 2020.

### **Characterizing the hearing health journey**

There are several theories of health behavior and change that have been used in audiology research to describe a person's hearing health journey. The Transtheoretical model (TTM; Prochaska & Velicer, 1997) represented in Figure 8, is one such theory. The TTM explains a person's attitudes, beliefs, and behaviors that can lead to their readiness to achieve healthy behaviors (Hernandez, 2011). In the past few years, the TTM has been applied in various areas

of audiologic research, including research related to hearing loss (Manchaiah et al., 2015; Ferguson et al., 2016), tinnitus (Kaldo et al., 2006), and improving audiologic rehabilitation (Noh et al., 1994; Manchaiah, 2012). The TTM comprises five stages to describe a person's readiness to change. These five stages are: (1) precontemplation, during which individuals are in denial of their problem and cannot even consider making a change; (2) contemplation, during which individuals begin to think about changing their problem behavior; (3) preparation, during which individuals start seeking information and prepare themselves for the change; (4) action, during which individuals make actual changes in their behavior; and (5) maintenance, during which individuals try to maintain the changed behavior.

Although readiness for change is considered an important predictor of HA success, as of this writing it has not been used as an outcome measure. Previous studies have defined HA success in different ways, including HA uptake, regular usage, measured and self-reported benefit, and satisfaction in daily listening. These aspects of HA success can be measured for those individuals already in the action and maintenance stages of their hearing-health journeys. However, there are several prior stages of change that could be used as indicators of progress toward positive hearing health outcomes. As the TTM demonstrates stages of successful advancement toward a final goal, it is reasonable to consider readiness of change as a measure of relative success in the HA process. Although readiness to change has not been used as an outcome variable in Audiology, research studying other health behaviors such as reducing alcohol consumption has suggested that readiness for change is a valid and reliable outcome variable (DiClemente et al., 2009) and can also be used as the basis of individualized intervention programs (Morera et al., 1998).

## **Purpose**

In this study we examined how adult participants with perceived hearing problems, but who had not yet pursued audiologic intervention for their problems responded to surveys about their personality traits, affective states, and self-efficacy when they were assessed “in general” and in hearing related contexts and estimated the mediating and moderating effects of these traits on the relationship between perceived hearing difficulties and readiness to pursue intervention for hearing loss. We hypothesized that situation-dependent measures would demonstrate a larger effect on this relationship.

Specifically, we attempted to answer the following research questions.

- (1) Do adults with hearing loss demonstrate different personality states, affective states, and self-efficacy traits when assessed using situation-dependent measures and generalized measures?
- (2) a. Do these general and situation dependent measures of patient traits predict readiness to pursue audiologic intervention?
  - b. Does reported self-efficacy impact the relationship between perceived hearing difficulties and readiness to pursue hearing help?
  - c. Do reports about affective state impact the relationship between perceived hearing difficulties and readiness to pursue hearing help?

## **MATERIALS & METHODS**

The present study was a cross-sectional descriptive study. Due to the COVID-19 worldwide pandemic, data collection was completed remotely using a Qualtrics survey. All procedures related to the study were approved by the Institutional Review Board at the University of Memphis (PRO-FY2021-02). Participants were asked to provide their consent

(though Qualtrics) at the beginning of their participation and were reimbursed for their participation.

## **Participants**

Sixty-two adults (43 females) aged 20 – 80 years old; with self-reported adult-onset hearing loss and no previous experience with HAs; and adequate English literacy to provide consent and complete the survey participated in this study. Anyone not aware of their hearing difficulties or in denial were excluded from the study. Participants were recruited from existing secured databases of willing participants maintained by the Hearing Aid Research Laboratory and the Memphis Speech and Hearing Center, through flyers in the local communities and websites, and through word-of-mouth referral. A priori power analysis was completed for a regression analysis with an aim of achieving at least 80% power to detect a medium effect size. To the best of our knowledge, the primary outcome, readiness, has never been utilized in this manner in amplification research. Thus, we accepted a standard medium effect for this study. Power computation was done using SPSS version 26 with multiple regression,  $\alpha = 0.05$ , a medium estimated effect size, power = 80%, and with 12 variables. This analysis demonstrated that at least 56 participants were needed to obtain the required power. Data collection was completed for 62 participants to accommodate participant attrition.

## **Materials**

### ***Perceived Hearing-related Handicap***

Perceived hearing handicap has been strongly linked to hearing help-seeking and hearing aid uptake (Knudsen et al., 2010). The Hearing Handicap Inventory for Adults/Elderly-Screening version (HHIA/E-S; Ventry & Weinstein, 1982) was used to assess self-reported hearing handicap for these participants. It is a 10-item self-assessment tool designed to identify the

effects of hearing impairment on emotional and social adjustment. It contains 5 questions each to assess social (S) and emotional (E) problems. Two of the questions in the social domain are different for adults and elderly respondents. In the adult version (i.e., HHIA), these questions ask about their hearing difficulty while understanding people at work and while in the movies. The elderly version (i.e., HHIE) asks about hearing difficulty when someone speaks in a whisper and while attending religious activities. All the other questions in both the versions are same. Questions were merged for both of these versions and used for this study. Depending on the participant's age (adult/elderly) and their working status (working/retired), responses from those two items were selected for analysis. For each question, the HHIA/E-S had three response options (Yes, Sometimes, and No). The participants' task was to choose the response that best described their problem.

### *Self-efficacy*

Both general self-efficacy and HASE were assessed for our participants. The General Self-Efficacy (GSE; Schwarzer & Jerusalem, 1995) scale was used to assess participants' confidence in completing general tasks effectively. This is a 10 -item questionnaire where the response is rated in a 4-point Likert scale ranging from 1 (Not at all true) to 4 (Exactly true). Total score is calculated by computing sum of all the items and a higher score represents better general self-efficacy.

The Measure of Audiologic Rehabilitation Self-Efficacy for Hearing Aids (MARS-HA; West & Smith, 2007) was administered to assess hearing aid self-efficacy. This is a 24-item self-report measure that a person's confidence in completing tasks with hearing aids in four domains: Basic handling, Advanced handling, Adjustment, and Aided listening. This test was chosen as it

is a standardized test to measure HASE. It also has high internal consistency and test-retest reliability to identify self-efficacy beliefs in individuals with hearing loss.

### ***Personality Traits***

Personality was assessed using the International Mini Markers (IMM; Thompson, 2008). This is a 40-item questionnaire that identifies the Big five personality traits: Neuroticism, Extraversion, Openness, Conscientiousness, and Agreeableness. Participants rate each item on a scale from 1 to 5 according to how accurately the words describe them. Most of the available audiologic research has used a personality measure that identifies these 5 personality traits. Thus, we decided to include the IMM to assist with interpretation and comparison to previous research.

### ***Affective States***

Participants' affective state was assessed using the Positive and Negative Affect Schedule – Short Form (PANAS-SF; Watson et al., 1988). It is a 20-item self-report questionnaire that assesses both positive and negative states on a 5-point Likert scale ranging from 'very lightly or not at all' to 'extremely'. Participants were asked to read each item and indicate to what extent they feel that way over a certain period of time or in a particular situation. This measure is sensitive to fluctuations to mood in a particular situation and can also exhibit stable responses when used to describe general state over a longer period of time (Watson et al., 1988).

### ***Readiness to Change***

The modified University of Rhode Island Change Assessment (URICA; Laplante-Levesque et al., 2013) was used to assess readiness for change for our participants. Laplante-Levesque et al. modified the original 24-item URICA for individuals with hearing loss and reported that it has good internal consistency ( $\alpha = .76$  to  $.90$ ) and validity. This self-report measure asks questions based on the stages of changes (Precontemplation, Contemplation,

Preparation, and Action). Participants respond to each item on the URICA on a 5-point scale ranging from strongly disagree (1 point) to strongly agree (5 points). Points obtained on the items for each stage were summed and the readiness score was calculated by adding the contemplation, preparation, and action scores and subtracting these from the precontemplation score. This measure has been widely used as an independent variable to assess the impact of readiness to change on HA outcomes (e.g., Saunders et al., 2016), and has been recommended for use as an outcome variable for a variety of health behaviors (e.g., DiClemente & Hughes, 1990).

### **Procedure**

Individuals who met the inclusion criteria were contacted via telephone or email and if interested, were sent links to an eligibility survey and consenting documents, and to the questionnaires. Separate links were used to ensure participant confidentiality. Links were individualized and password protected. Participants used their home computer, tablet, or smart phone to complete the survey. Although we gave the participants written instructions for all the questionnaires, they also were given the option to schedule a video or telephone appointment with us to assist them in completing the survey. All participants elected to complete the surveys on their own.

The online survey was divided into four sections: Section 1 assessed demographics and self-reported hearing abilities (HHIE/A). Section 2 asked the participants to respond to the questionnaires based on their overall perception of themselves (general measures). They were instructed as follows: “Now you will complete three questionnaires to describe yourself and your behaviors. We are interested in how accurate these words and statements are for you based on your overall perception of yourself. There are no wrong answers.”. This section included the IMM, PANAS-SF, and the GSE. Section 3 asked the participants to complete the IMM and the

PANAS-SF again, as well as the MARS-HA. For this section, these measures were used as situation-dependent measures that allowed the participants to describe themselves in relation to their experiences related to hearing loss. For the situation-dependent measure of personality, participants were instructed as follows. “People have suggested that some personality traits might change in different situations. We are interested in how often these words are true for you when you are in situations related to your hearing and hearing health. How do you think, feel, and act in these situations? You have completed this questionnaire once before. Your responses might or might not be different this time. There are no wrong answers.” For the situation-dependent measures of affective states, participants had to listen to four vignettes that described different listening situations, and they were instructed as follows. “For this section of the study, you will hear a few descriptions of situations involving your hearing. Adjust your speakers so that you can hear each well. Close your eyes if you can understand without reading the captions. Try your best to picture yourself in each of these situations and think about how you would feel and what you might do. After each audio clip is over, you will respond to a short questionnaire where you will indicate how you would feel in each situation. You have completed this questionnaire once before. Your responses might or might not be different for these situations. There are no wrong answers.” Scripts for these audio clips are provided in appendix B. Instructions for the MARS-HA were provided as recommended by the authors. Finally, participants completed the modified URICA to indicate their readiness to pursue audiologic intervention. Participants who elected to share their email addresses were sent an Amazon gift card as compensation for their time and effort completing the survey.



## Data Analyses

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) Version 26 software. Descriptive statistics were used to look at the data distributions. A 2-step data transformation process described by Templeton (2011) was performed for variables where the normality test was significant. The first step transforms the variable into a percentile rank and the second step uses an inverse-normal transformation to compute a variable with normally distributed z-scores. Of all the variables, both self-efficacy, two of the personality traits, duration of hearing loss, two of the positive affective states, and all the negative affective states required transformation. Following transformation, all variables were normally distributed. Paired *t* tests were performed to explore mean differences between responses to the general and situation-dependent self-efficacy and personality measures. Repeated measures ANOVA and post hoc pairwise comparisons were performed to test differences between responses to the general and situation-dependent affective state measures. Holm Sidak corrections were performed to avoid familywise type 1 error after multiple comparisons. Moderation analysis was performed to understand how the relationship between self-reported hearing difficulties and readiness to pursue hearing help changed as a function of hearing aid self-efficacy. Mediation analysis was performed to test whether the relationship between self-reported hearing handicap and readiness to pursue audiologic intervention were partially explained by their relationship to these participants' reported affective states. As personality traits and duration of hearing loss are not directly modifiable, they were included as covariates in both moderation and mediation analyses. These analyses were performed in SPSS Version 26 using the PROCESS v4.0 package developed by Andrew F. Hayes. Post hoc sensitivity power analyses for the regression models within moderation and mediation analyses

demonstrated that with 62 participants, each of these models had at least 80% power to detect a medium effect size.

## **RESULTS**

The present research was a cross-sectional descriptive study. Survey links were emailed to a total of 87 interested participants. Of these, 66 started the survey and 62 participants completed the survey (29% attrition rate). All the participants had some degree of hearing difficulty, and more than half of the participants reported at least a mild - moderate degree of difficulty. Duration of noticeable loss was between 1 and 51 years. Table 5 summarizes the distributions of demographic, predictor, and outcome variables. Participants reported having mild to moderate hearing handicap on the HHIE/A ( $M = 21.90$ ,  $SD = 10.08$ ). On average, participants had low HASE (MARS-HA:  $M = 64.19$ ,  $SD = 26.79$ ), and low general self-efficacy (GSE:  $M = 63.33$ ,  $SD = 15.49$ ). They also reported having higher scores on positive personality traits (agreeableness, extraversion, openness, and conscientiousness) and lower scores for negative personality trait (neuroticism). When their stages of hearing health journey were assessed, 45.16% (28 of 62) were found to be Precontemplators (URICA score  $< 8$ ), 30.65% were Contemplators (URICA score 8 - 11), and 24.19% were Preparators/Action-takers (URICA score 11 - 14).

Table 5. Descriptive statistics for the demographic, predictors (General self-efficacy total score, Hearing aid self-efficacy in terms of MARS-HA total and subscale scores, personality trait scores on the IMM, Affective scores on the PANAS-SF), and outcome variable (Readiness of change and stages scores on the URICA).

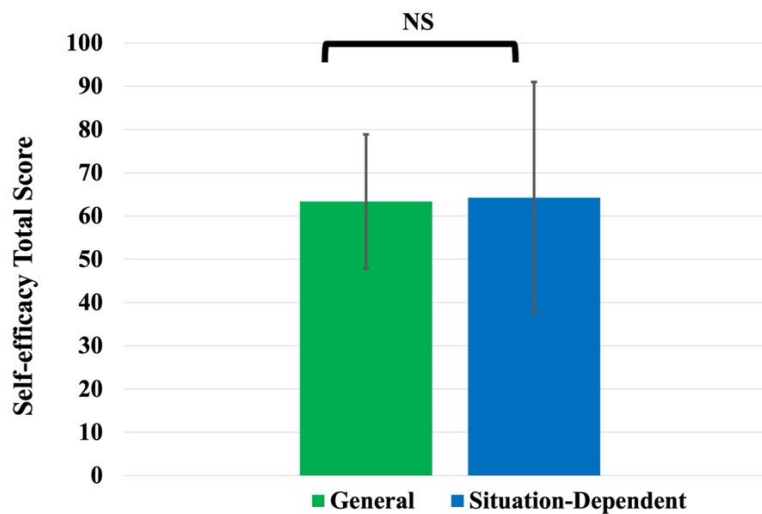
	<b>Mean</b>	<b>Standard Deviation</b>	<b>Minimum</b>	<b>Maximum</b>
<b>Age</b>	51.77	17.15	20	80
<b>Duration of Hearing Loss</b>	8.15	10.08	1	51
<b>Self-reported Hearing Handicap (HHIE/A Total)</b>	21.90	10.08	4	40
<b>GSE Total</b>	63.33	15.49	23.33	86.67
<b>MARS-HA Total Score</b>	64.19	26.79	9	100
<b>Personality trait scores on IMM</b>				
Extroversion	3.21	.86	1.5	5
Openness	3.79	.67	2.13	5
Neuroticism	2.81	.76	1	4.69
Conscientiousness	3.71	.75	1.94	5
Agreeableness	4.18	.61	2.75	5
<b>Affective States on PANAS-SF</b>				
<b>Positive Affective States</b>				
General	35.34	7.62	21	50
Situation: Social Event	30.27	8.22	10	46
Situation: Asking Directions	30.69	7.87	14	50
Situation: At Doctor's Appointment	29.60	8.99	10	49
Situation: At Home	24.53	8.90	10	40
<b>Negative Affective States</b>				
General	19.82	8.11	10	39
Situation: Social Event	23.37	8.97	10	48
Situation: Asking Directions	25.61	9.35	12	49
Situation: At Doctor's Appointment	24.56	8.97	11	50
Situation: At Home	24.60	9.97	10	50
<b>Modified URICA Stages Scores</b>				
Precontemplation	2.12	.80	1	3.63
Contemplation	3.75	.84	1.67	5
Preparation	3.94	.75	1.8	5
Action	3.17	1.07	1	5
<b>Modified URICA Readiness Score</b>	8.74	2.93	2.04	14

HHIE/A, Hearing Handicap Inventory for Elderly/Adults; GSE, General Self-Efficacy; MARS-HA, Measure of Audiologic Rehabilitation Self-efficacy for Hearing Aids; IMM, International Mini Markers; PANAS-SF, Positive and Negative Affect Schedule-Short Form; Modified URICA, Modified University of Rhode Island Change Assessment.

## Differences between General vs. Situation-dependent measures

### *Self-efficacy*

Both general self-efficacy (GSE) and HASE (MARS-HA) were assessed for our participants. As the rating scales are different for these measures, we rescaled the GSE scores to match the MARS-HA. Figure 9 displays the mean general and situation-dependent self-efficacy scores on a 100-point scale. There was no difference in the average scores on the GSE and MARS-HA ( $t = -.46, p = .65$ ).



*Figure 9.* Mean general self-efficacy (assessed using the GSE) and situation-dependent self-efficacy (assessed using the MARS-HA) scores on a 100-point scale. Error bars are 1 standard deviation. NS = not significant.

### *Personality Traits*

The International Mini Markers (IMM) survey was used to assess the “Big Five” personality traits: Extraversion, Openness, Neuroticism, Conscientiousness, and Agreeableness. Participants were asked to complete this measure twice; one as a general measure of personality and once while reflecting on how they perceive their personalities in situations related to their hearing. Figure 10 displays the means and standard deviations of average scores on the IMM. These data demonstrate no observable differences for any of the average trait scores on the IMM.

Paired  $t$  tests with Holm Sidak post hoc corrections supported these observations (Extroversion:  $t = 2.14, p = .17$ ; Openness:  $t = 2.13, p = .14$ ; Neuroticism:  $t = -2.03, p = .13$ ; Conscientiousness:  $t = 1.09, p = .28$ ; and Agreeableness:  $t = 1.19, p = .24$ ).

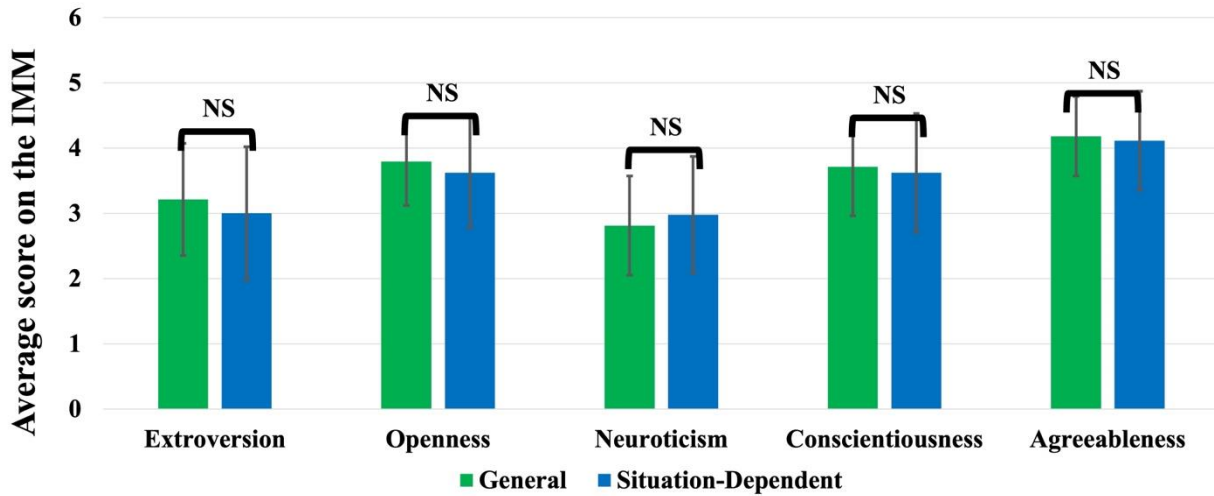


Figure 10. Mean general and situation-dependent personality trait (Extroversion, Openness, Neuroticism, Conscientiousness, and Agreeableness) scores on the IMM. Error bars are 1 standard deviation. NS = not significant.

### *Affective States*

The Positive and Negative Affect Schedule – Short Form (PANAS-SF) was used to assess participants’ affective states. Participants completed this measure five times (one general and four listening-specific situations). The four listening situations were social event, asking directions, at a doctor appointment, and listening at home. Figure 11 displays the means and standard deviations of average scores on the PANAS-SF. Figure 11a displays data for positive affective states in each condition. These data demonstrate greater positive affect in general compared to in listening-specific situations, and noticeably less positive affect when listening at home compared to listening situations that involved others. Repeated measures ANOVA demonstrated a significant main effect that at least one of the comparisons was statistically significant,  $F_{(4,58)} = 31.52, p < .001$ . Post hoc pairwise comparisons with Holm Sidak corrections

confirmed that these observed differences were not likely due to random chance. The measure of general positive affect was statistically different from each of the situation-dependent measures (General vs. “Social event”,  $t = 5.18, p < .001$ ; General vs. “Asking directions”,  $t = 4.71, p < .001$ ; General vs. “Doctor’s appointment”,  $t = 4.68, p < .001$ ; General vs. “Home”,  $t = 9.00, p < .001$ ). For the positive affective state, there was also a significant difference between listening at home and the other three listening situations (“Social event” vs. “Home”,  $t = 6.45, p < .001$ ; “Asking Directions” vs “Home”,  $t = 7.57, p < .001$ ; “Doctor’s appointment” vs “Home”,  $t = 6.39, p < .001$ ).

Figure 11b displays data for negative affective states in each condition. These data demonstrate less negative affect in general compared to in listening-specific situations, and noticeably slightly less negative affect when listening at a social event compared to when asking directions, at a doctor appointment, and listening at home. Repeated measures ANOVA demonstrated a significant main effect that at least one of the comparisons was statistically significant,  $F_{(4,58)} = 10.57, p < .001$ . Post hoc pairwise comparisons with Holm Sidak corrections confirmed that these observed differences were not likely due to random chance. The measure of general negative affect was statistically different from each of the situation-dependent measures (General vs. “Social event”,  $t = -3.86, p < .001$ ; General vs. “Asking directions”,  $t = -4.68, p < .001$ ; General vs. “Doctor’s appointment”,  $t = -4.22, p < .001$ ; General vs. “Home”,  $t = -4.48, p < .001$ ). There was also significantly greater negative affect when ‘Asking directions’ compared to at a “Social Event” ( $t = -2.71, p = .008$ ).

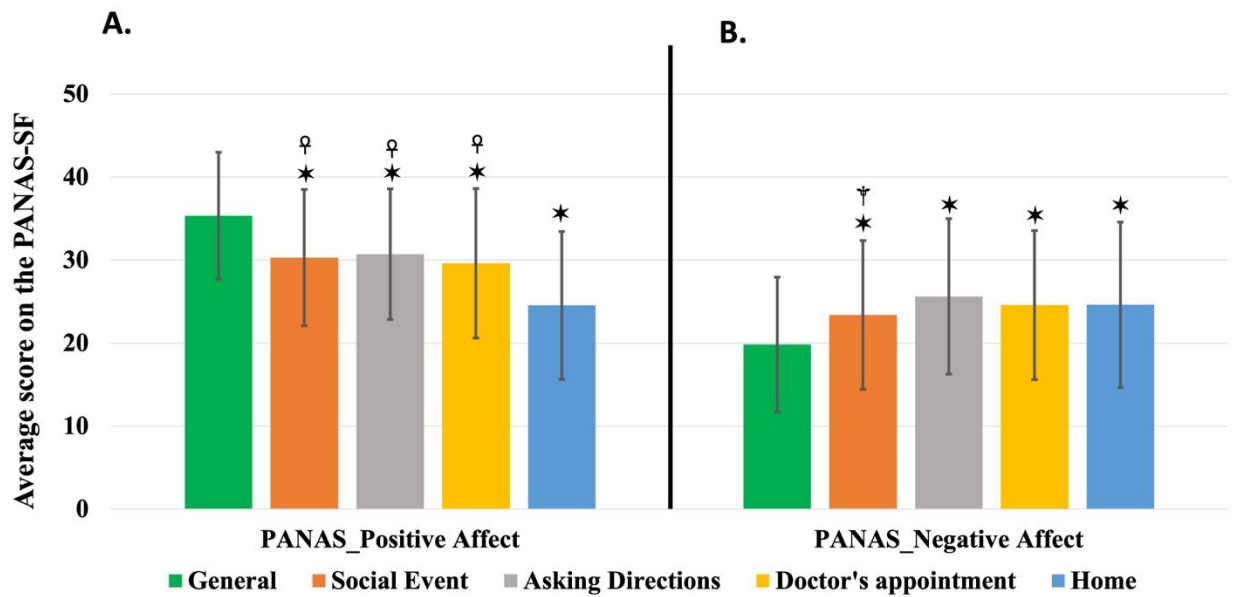


Figure 11. Mean positive and negative affective states scores in general and listening situations (Social event, Asking directions, Doctor’s appointment, and Home). Error bars are 1 standard deviation. \* = Significantly different from “General” affective states. † = Significantly different from “Home” affective states. ‡ = Significantly different from “Asking Directions” affective states.

### Impact of patient traits on readiness to pursue audiologic rehabilitation

Our second research aim was to disentangle the interrelationships between perceived hearing difficulty, patient traits, and readiness to pursue audiologic rehabilitation. It is generally accepted that increasing degree of hearing difficulty in daily listening prompts individuals to act toward seeking help for hearing loss (Laplante-Levesque, 2015; Sanders, 2016). To understand why some people take action toward improving their hearing ability by seeking hearing treatment and others do not, we wanted to explore whether modifiable variables such as HASE and affective states might impact the relationship between perceived hearing handicap and readiness to pursue audiologic rehabilitation.

Based on the results of the previous analyses and existing evidence, the following logical decisions were taken before finalizing our statistical models. We decided to combine the Positive

Affect data for Social Event, Asking Directions, and Doctor's Appointment situations as these were not statistically different. Similarly, we decided to combine the Negative Affect data for the Home and Doctor's Appointment situations. This step was taken to reduce the number of variables in the models and optimize statistical power. Also, as there were no significant differences between general and situation-dependent reported personality traits, we decided to include only the general personality trait scores in our models. Although personality has been related to hearing health outcomes, personality traits are not modifiable by clinical audiologists. So, we chose to account for their influences as covariates in our models. Duration of loss is also associated with likelihood to seek hearing help (Pronk et al., 2017). We included duration of hearing loss as a covariate as well.

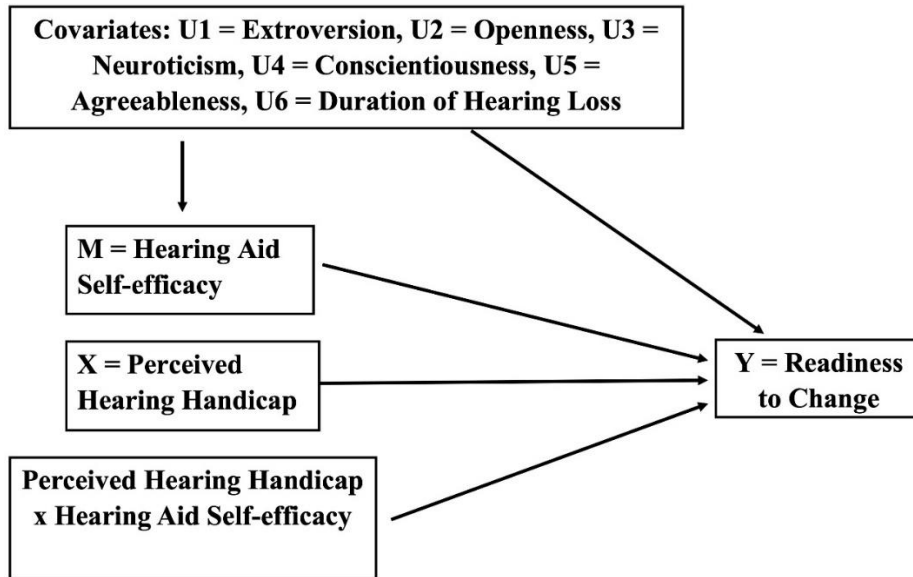
Ultimately, we developed two conceptual models to explore the impact of HASE and Affective State on the relationship between perceived hearing difficulties and readiness to pursue hearing help. Model A tested HASE as a moderator of this relationship. Moderation analysis focuses on determining if the relationship between two variables changes depending on the value of a third variable. Smith and West (2006) reported that individuals with greater degree of hearing loss have lower HASE. We hypothesized that perceived hearing handicap will significantly predict readiness to pursue audiologic intervention and this relationship will change as a function of their HASE level. Specifically, we envisioned that perceived hearing handicap would be less predictive of readiness to pursue help when participants had lower HASE. Model B tested affective states as mediators of the relationship between hearing handicap and readiness to pursue audiologic intervention. Mediation analysis tests whether the relationship between two variables can be explained by their relationships to a third variable. Because affective states vary as a result of hearing handicap and also might impact readiness, these states were classified as



mediators in the model. We hypothesized that the relationship between perceived hearing handicap and readiness will be mediated by their affective states. Specifically, we hypothesized that those with greater hearing handicap would likely have greater negative affective state ratings, and lower positive affective state ratings in listening-specific situations, and that these negative emotional experiences might motivate them toward readiness to pursue help for these difficulties.

***Predicting readiness from patient traits with HASE as a potential moderator***

Figure 12 displays the statistical diagram of the moderation analysis. In this model, we included self-reported hearing handicap (Total HHIE/A Score) as the independent variable (X) and readiness to change as the outcome variable (Y), and HASE as the moderator (M). The 5 general personality traits and duration of hearing loss were included as covariates (U).



*Figure 12.* Model A displaying the statistical diagram of moderation analysis. Perceived hearing handicap was the predictor variable, readiness to pursue audiologic intervention was the outcome variable, and HASE was the moderator variable. Personality traits and duration of hearing loss were covariates.

This model tested significant predictors of readiness to pursue audiologic intervention and also tested the interaction between perceived hearing handicap and HASE. This interaction effect tells us whether HASE is a significant moderator. Overall, the model was statistically significant,  $F_{(9,52)} = 7.83$ ,  $p < .0001$ , and explained 58% of the variance in readiness to change ( $R^2 = .58$ ). Results revealed that hearing handicap was the most significant predictor of readiness ( $b = .23$ , 95% CI [.16, .28],  $t = 7.24$ ,  $p < .0001$ ). HASE ( $b = .02$ , 95% CI [.01, .04],  $t = 2.30$ ,  $p = .03$ ), the Agreeableness personality trait ( $b = 1.36$ , 95% CI [.10, 2.62],  $t = 2.17$ ,  $p = .03$ ), and duration of hearing loss ( $b = -.07$ , 95% CI [-.13, -.01],  $t = -2.35$ ,  $p = .02$ ), were also found to be significant predictors of readiness. Based on these results, individuals with greater perceived hearing handicap, higher HASE, more agreeable personality trait, and who had hearing difficulty for a shorter duration tended to be more ready for audiologic intervention. No other tested variables were found to be significant predictors of readiness. The interaction between hearing handicap and HASE was not statistically significant ( $p = .81$ ) which indicated that HASE was not a significant moderator. The relationship between hearing handicap and readiness did not change as a function of HASE (the relationship remained same at different levels of HASE), when controlling for personality traits and duration of hearing loss.

***Predicting readiness from patient traits with affective states as potential mediators***

Figure 13 displays the statistical diagram of the mediation analysis. In this model, we included self-reported hearing handicap (Total HHIE/A Score) as the independent variable (X) and readiness to change as the outcome variable (Y), and affective states as mediators (M). The 5 general personality traits and duration of hearing loss were included as covariates (U).

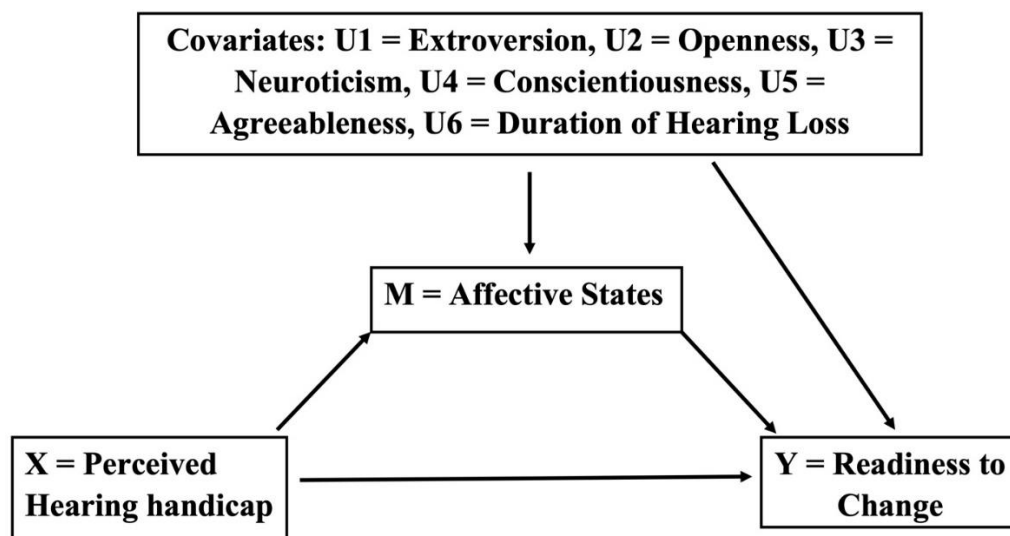


Figure 13. Model B displaying the statistical diagram of mediation analysis. Perceived hearing handicap as a predictor of readiness to pursue audiologic intervention, with affective states as mediators. Personality traits and duration of hearing loss were covariates for the affective states.

This model tested significant predictors of readiness to pursue audiologic intervention and also tested whether this prediction could be explained by their relationships with the affective states. This model tested a series of linear models reflecting different conditions to explore whether affective states were significant mediators. Condition 1 tested whether perceived hearing handicap and any of the covariates were predictors of the reported affective states. Perceived hearing handicap significantly predicted “general” negative affective State ( $b = .22$ , 95% CI [.06, .38],  $t = 2.75$ ,  $p = .008$ ) and the negative affective state in the “Social Event” situation ( $b = .29$ , 95% CI [.10, .49],  $t = 3.08$ ,  $p = .003$ ). Participants with greater hearing handicap reported more negative affective states under these conditions. Certain personality traits were also significant predictors of affective states. Having greater ratings of the Neurotic personality trait was positively related to negative affective state in all conditions (all  $p < .05$ ), except for “Asking directions” ( $t = 1.79$ ,  $p = .08$ ). Higher Extraversion ( $b = 2.75$ , 95% CI [1.13, 4.38],  $t = 3.39$ ,  $p = .001$ ) and Agreeable ( $b = 6.14$ , 95% CI [2.97, 9.31],  $t = 3.88$ ,  $p = .0003$ ) personality traits were positively related to positive affective state in the General condition.

Duration of hearing loss significantly predicted their positive affective state in the “Home” ( $t = -.21, p = .03$ ). Individuals who had hearing loss for longer duration had less positive affective state in this situation.

Condition 2 tested whether perceived hearing handicap, the affective states (mediators), and the covariates were predictors of readiness to pursue audiologic intervention. Overall, the model was statistically significant,  $F_{(14, 48)} = 6.79, p < .0001$ , and explained 67% of the variance in readiness to change ( $R^2 = .67$ ). Results revealed that hearing handicap was the most significant predictor of readiness ( $b = .25, 95\% \text{ CI } [.18, .31], t = 7.58, p < .0001$ ). Negative affective state in the situation “Asking Directions” ( $b = -.10, 95\% \text{ CI } [-.19, -.004], t = -2.10, p = .04$ ) and Conscientious personality trait ( $b = -.98, 95\% \text{ CI } [-1.76, -.19], t = -2.51, p = .02$ ) were the only other predictors of readiness. Based on these results, individuals with greater perceived hearing handicap, less negative affective state in a situation such as “Asking Directions”, and those who had less Conscientious personality trait were more ready for audiologic intervention. No other tested variables were found to be significant predictors of readiness when controlling for personality and duration of hearing loss.

Condition 3 tested whether perceived hearing handicap and the covariates were predictors of readiness to pursue audiologic intervention. The affective states were excluded from this test. This information was later used to verify whether the affective states were significant mediators. Overall, the model was statistically significant  $F_{(7,54)} = 8.69, p < .0001$ , and explained 53% of the variance in readiness to change ( $R^2 = .53$ ). Results revealed that hearing handicap was again the most significant predictor of readiness ( $b = .22, 95\% \text{ CI } [.16, .28], t = 7.14, p < .0001$ ). Agreeableness personality trait ( $b = 1.47, 95\% \text{ CI } [.18, 2.76], t = 2.28, p = .03$ ) and duration of hearing loss ( $b = -.08, 95\% \text{ CI } [-.14, -.02], t = -2.65, p = .01$ ) were also found to be significant

predictors of readiness to pursue audiologic intervention. Based on these results, individuals with greater perceived hearing handicap, more agreeable personality trait, and who had hearing difficulty for a shorter duration tended to be more ready for audiologic intervention. No other personality traits were found to be significant predictors of readiness.

The presence of mediation was tested in two steps. First, we checked whether adding the mediators in the model resulted in a weaker relationship between perceived hearing handicap and readiness to pursue audiologic intervention. To do this, the significance value of the model with mediators (Condition 2) was compared to the significance value of the model without predictors (Condition 3). Our results demonstrated no difference in the significance value of the model in these two conditions. Second, we checked the Bootstrapped confidence intervals (CI) for each mediator's indirect effects. All the Bootstrapped CIs contained zero, thus demonstrating that none of the reported affective states were significant mediators of this relationship.

## **DISCUSSION**

Health behavior change refers to the intentional and motivational changes a person makes to their health-compromising behaviors to improve the health condition. Several theories have been developed to describe changes in health behavior. The Transtheoretical model (TTM) is one such theory that includes knowledge, attitudes, beliefs and behaviors (Hernandez, 2011). The TTM has been widely used to describe intentional health behavior change and has been applied to a variety of health behaviors such as diet, depression and anxiety, drug and alcohol problems, etc. (Nidecker et al., 2008; Nakabayashi et al., 2020; Li et al., 2020; Marin-Farrona et al., 2020; Migneault et al., 2021). The TTM describes the health behavior change in terms of stages of change and an individual's readiness to change through these stages has been used to describe whether they have attained the targeted health behavior. This model has been shown to have high concurrent and productive validity in describing audiological intervention and outcomes

(Laplante-Levesque et al., 2012, 2013, 2015). In audiology research, readiness and stages of change has been used to predict help seeking and HA adoption (Babeu et al., 2004; Ingo et al., 2016). Researchers have also applied the TTM in Audiology to explain hearing loss (Manchiaiah et al., 2015; Fergusson, 2016), tinnitus (Kaldo et al., 2006), and delivery of audiological services (Babeu et al., 2004). In these research studies, readiness to change has been used as a predictor of other aspects of HA success. However, Ekberg et al. (2016) suggested that outcomes such as help seeking and HA adoption are different from their readiness to obtain and use HAs. Although a person with hearing loss might seek help, this does not mean they are ready for an intervention. Many adults with hearing loss do not purchase HAs even after visiting audiologists (Meyer et al., 2011) as they are still not ready for a HA (Claesen & Pryce, 2012). This suggests that we might want to consider the readiness continuum as another indicator of HA success. The current study included readiness to change as an outcome measure for individuals in the early stages of their hearing health journey.

### **Differences between General vs. Situation-dependent measures**

Various patient factors such as self-efficacy, personality, and affective state have been shown to impact readiness to change in health behaviors such as exercise (de Vries et al., 2016), online information health seeking for cancer (Myrick & Willoughby, 2017), and hand washing to avoid COVID-19 (Clemens et al., 2021). We were interested in identifying the potential impact of these factors on readiness to pursue audiological intervention. However, we wanted to be sure that we were using the most informative measures of these traits for our purposes. We first compared the differences between self-reports of self-efficacy, personality, and affective states when participants were reporting about these traits “in-general” and in hearing-related situations. We found that reports of self-efficacy and personality did not vary significantly for general and

situation-dependent measures. However, participants did report more negative and less positive affective states in hearing-related situations compared to “in-general”.

Initially, it was surprising to see that there was no meaningful difference between general and HA self-efficacy as self-efficacy is defined as a task-specific trait (Bandura 1997). However, some researchers have suggested that general and task-specific self-efficacy may be related to each other. For example, Agarwal et al. (2000) suggested that general and specific computer self-efficacy are related. In audiology, Dullard (2014) measured general self-efficacy and HASE in hearing aid users and reported that general and task-specific self-efficacy were moderately related. Rapley and Fruin (1999) suggested that general self-efficacy is more relevant at earlier stages of management and task-specific self-efficacy is more important at later stages of management. As our participants were at the earliest stages of their hearing health journey and had never used any HAs, perhaps it is not that surprising that their general self-efficacy was not much different from their HASE. Although we can evaluate a person’s HASE prior to HA adoption, HASE is expected to increase with mastery experiences with the devices (Sarangi & Johnson, in review). Further research with individuals in later stages of their hearing health journeys might demonstrate greater differences between general self-efficacy and HASE.

On the other hand, similarities between general and situation-dependent measures of personality traits were less surprising. Personality traits are considered universal and constant over time (Bouchard & Loehlin, 2001). Theoretically, personality assessments should not be influenced by the state of a person at a particular time (Querengasser & Schindler, 2014). Zuckerman (1977) suggested that the traditional trait tests like we used in our study cannot be used to assess responses to situations. Thus, despite anecdotal comments from some of our research participants that some personality descriptions might “depend on the situation”, our

study supports the assertion that personality traits remain constant, even when individuals with hearing impairment are in specific listening situations. It is possible that these individuals might be reflecting on changes in their affective states in given situations, rather than more constant personality traits.

Our results did support the assumption that self-reported affect differs when hearing impaired participants reflect on their states “in-general” and in listening-specific situations. In addition to assessing general affect, we provided participants with 4 different listening situations and asked them to report their affective states in each situation. The situations were: listening at a social event, asking directions, listening at a doctor appointment, and listening at home. Our results demonstrated that general reports of affective state were significantly less negative/more positive than reported affective states in all the listening situations. This was not surprising given that research has linked hearing difficulties in daily listening with negative psychosocial states such as self-stigma and depressive symptoms and increased negative emotional responses (Rutherford et al., 2018; Bigelow et al., 2020; Picou, 2016; Picou et al., 2018). Our results are in line with these findings as our participants reported less positive and more negative ratings on the affective state measure in situations related to their hearing loss, compared to their general state. As affective states assess behavior over a short period of time (Heller et al., 2007), the participants might have responded based on how their listening difficulties in that situation made them feel rather than reflecting their personality. An understanding of these nuanced relationships between affect and self-report measures might influence interpretation of such measures and facilitate accurate communication between patients and audiologists. Additionally, our participants also had a significant difference in the affective states for some of the listening situations tested. For example, being in a social event was less negative than some of the other



situations and being at home was less positive than the more social situations. On average our participants tended toward higher ratings of extraversion, which might explain some of these trends. This observation is a good reminder that an identical descriptive study might have very different results with a different sample of participants.

### **Impact of patient traits on readiness to pursue audiologic rehabilitation**

The second research question aimed to identify predictors of readiness to pursue intervention. We tested two models to test the relationship between perceived hearing handicap and readiness to pursue audiologic intervention, controlling for personality traits and duration of hearing loss. Perceived hearing handicap was found to be the most significant predictor of readiness in both the models. The first model (Model A) also explored how HASE might moderate this relationship and the second model (model B) explored how affective states might mediate this relationship.

### ***Predicting readiness from patient traits with HASE as a potential moderator***

As anticipated, self-reported hearing handicap was found to be the strongest predictor of readiness. Individuals with greater hearing handicap had the tendency to be more ready for hearing intervention. This result is in line with previous research where self-reported hearing disability was found to be significantly associated with readiness to change (Laplante-Levesque, 2015; Pronk et al., 2017; Saunders et al., 2016). Duration of hearing loss was also a significant predictor of readiness for hearing help. However, for our sample, individuals who had hearing loss for a longer duration were less ready to pursue intervention. This is not consistent with work by Saunders et al. (2016) that demonstrated that a longer duration of hearing loss was associated with readiness for hearing help. Unlike in our study, individuals participating in Saunders's study had sought hearing assessment, had higher readiness scores on average, and were mostly in the

action stage on the Modified-URICA. They also did not test this association while controlling for the participants' hearing loss. As hearing loss tends to increase over time, it seems likely that degree and duration of hearing loss might explain common variances in readiness. Our model explored the relationship between duration and readiness while controlling for degree of hearing difficulty. We postulate that those participants who had navigated their daily listening without hearing intervention for a greater amount of time are more likely to have successfully implemented alternative coping strategies in their lives, reducing their need or desire for formal audiologic treatment. This is consistent with results of our research that has highlighted the successful reliance on others and use of coping strategies as barriers to seek traditional hearing help in the form of HAs (Johnson & Sarangi, in preparation). However, this theory needs further exploration.

Our study also tested whether HASE is a predictor of readiness to change. Researchers have posited that an individual needs to believe in their abilities in order to make the necessary changes in health behavior (Bandura, 1986; Babeu et al., 2004). Our study extends this assertion to the hearing health field as HASE was a significant predictor of our participants' readiness to change their behaviors for improved hearing health. Self-efficacy is one of the most important social-cognitive variables that varies across the stages of change. In the early stages of a health journey, self-efficacy is usually low (West, 2005) and attitudinal processes are more important in making changes in health behavior. As our participants were all in the early stages of their hearing health journeys, all had relatively low HASE. However, HASE was higher for participants who were Preparators/Action-takers compared to those who were Precontemplators. Yet, HASE was not found to be a significant moderator of the relationship between perceived hearing handicap and readiness, when controlling for personality traits and duration of hearing

loss. These results indicate that HASE independently impacts aspects of HA success through mechanisms that are still not clearly understood.

Personality is another factor that has been shown to impact aspects of HA success and has also been found to predict readiness in other health behaviors. For example, De Vries et al. (2016) reported that individuals who are more extrovert and less neurotic were at later stages of change for exercise behaviors. In the current study, when HASE was included in the model as a moderator, the agreeable personality trait was a significant predictor of readiness. Individuals who were more agreeable tended to be more ready for an intervention. Individuals with high Agreeableness are the ones who trust others, are less assertive, and more tolerant. They like to help others and believe that they will receive help in return (Cox et al., 2005). When their HASE is considered, individuals with high HASE and high Agreeableness might be the ones who trust their audiologists and their recommendations. This might help them be ready to pursue audiologic rehabilitation. Individuals who are lower in Agreeableness and HASE might have more, or different barriers and they might be less willing to ask for help or less inclined to accept recommendations to achieve changes in hearing health. These people might need to be counseled differently and their counseling session should be more individualized to cater the barriers they might be facing. This finding suggests that if we assess patients' personality when they are in their early stages, we might be able to plan more effective, customized counseling strategies. However, more research is needed to validate these applications.

#### ***Predicting readiness from patient traits with affective states as potential mediators***

In model B, instead of Agreeableness, the Conscientiousness personality trait was a significant predictor of readiness. Both Agreeableness and Conscientiousness have been associated with different emotional expressions (Pease & Lewis, 2015). However,

Conscientiousness has been shown to co-occur more prominently with negative emotions such as guilt, anger, and irritation (Fayard et al., 2012; Mill et al., 2018). As our participants had more negative emotions in listening-specific situations, this might have resulted in Conscientiousness being the significant trait in the model that included affective states. In our study, individuals who are less conscientious were more ready to change their hearing health. Conscientiousness is usually considered to be a positive personality trait and likely to have a positive impact on behavior. Conscientious people are the ones who have self-control and are goal oriented. However, sometimes they face more challenges in dealing with negative feedback and have difficulty achieving their targeted goals (Cianci et al., 2010). When our participants had greater negative emotionality and were high in Conscientiousness, this combination appears to have acted as a disadvantage to move them to the next stage of their hearing health journey.

Researchers have also reported that affective states of a person can impact their readiness for health behaviors (Myrick & Willoughby, 2017; Clemens et al., 2021). In the current study, individuals' negative affective states in the "Asking Directions" situation significantly predicted readiness. Individuals who had less negative affective state in this situation tended to be more ready for change in their hearing health. The Appraisal theory of emotion proposes that emotion experienced in a given situation can be a driving motivator for change in a health behavior (Moors, 2020). Our results support this theory and our hypothesis that listening specific affective states might be better predictors of readiness to seek hearing healthcare compared to general descriptions of affect. The "Asking directions" situation was noisy, put them in a time pressure, and was probably the most difficult social situation presented. We also found that participants who were not ready were also less conscientious. This might be making them more anxious towards a change in their hearing health behavior. Together, these factors might have made it

challenging for these participants to be ready to pursue intervention. Identifying the most challenging listening situation and assessing their negative affective state in that situation in initial appointments might help the clinicians in recognizing more effective counseling strategies for their patients.

We also tested whether affective states were significant mediators of the relationship between perceived hearing handicap and readiness to pursue audiologic intervention. None of the affective states were significant mediators of readiness. This shows that the relationship between hearing handicap and readiness cannot be explained by their relationship to affective states, when controlling for personality traits and duration of hearing loss. To be a significant mediator, at least one affective state should be significantly associated to both hearing handicap and readiness. In our study, although negative affective states in general and “At a social event” situation were significantly associated with perceived hearing handicap, and negative state in the “Asking directions” situation was significantly associated with readiness, none of these affective states were related to both hearing handicap and readiness.

The mediation analyses in model B also provided information on how personality traits were related to affective states. Researchers have demonstrated that personality traits and affective states might be associated (Hiebler-Ragger et al., 2018). Specifically, extraversion and neurotic personality traits have been related to different positive and negative affective states (Magee & Biessanz, 2018). Our results were consistent with these findings. Neurotic personality trait significantly predicted general negative affective states and most of the situation-dependent positive as well as negative affective states. Individuals with higher Neuroticism reported more negative affective states and those with lower Neuroticism reported more positive affective states. Individuals who were more extroverted and agreeable had more positive general affective

state. These results suggest that a more stable factor such as personality can influence individuals' affective state in situations related to their hearing. An initial evaluation of the Neuroticism personality trait might inform the audiologists generally about a salient aspect of the patient's personality and might also serve as an indicator of probable affective state. This information can assist audiologists in deciding whether the patient needs additional time at the beginning of an appointment to assess readiness to pursue audiologic intervention and implement motivational interviewing techniques.

### **LIMITATIONS**

The current study was completed in a self-administered online format. Although effort was taken to ensure that the instructions were clear and the participants completed the questionnaires correctly, it is possible that some participants misinterpreted the questions and did not respond accurately. Further, as the study was completed remotely, we could not assess their hearing abilities through standardized audiometric tests. Due to the cross-sectional descriptive design of the study, we cannot make definite causal inferences about these results because of random sampling. For example, we cannot be sure that personality traits impacted reports about affective states, or if affective states at the time of responding impacted reports about personality. Future studies should control for these traits more stringently to make causal inferences.

### **CONCLUSION**

Hearing aid success is frequently assessed in terms of help seeking, adoption, use, benefit, and satisfaction. All these aspects of hearing aid success are only available for assessment in later stages of an individual's hearing health journey. Research has suggested that readiness to change might be the first step in defining success in any health behavior. In the current study, we explored the significant predictors of participants' readiness to pursue audiologic intervention. Perceived hearing handicap was the strongest predictor. Our results

demonstrated that when HASE was considered, individuals with high HASE and high Agreeableness were more ready for change. The relationship between hearing handicap and readiness did not change as a function of HASE when controlling for personality traits and duration of hearing loss. When affective states were considered, individuals with more negative affective states in difficult listening situations and who had lower Conscientiousness were more ready for change. The relationship between hearing handicap and readiness could not be explained based on their relationships with affective states, when controlling for personality traits and duration of hearing loss. We also found that personality traits can influence affective states, and affective states vary across difficult listening situations. This supports the recommendation that audiologists' early efforts should be geared towards understanding each patient's attitudes, feelings, and behaviors about changing their hearing health behaviors in their daily lives. Future research should focus on exploring the associations between personality traits and affective states in different stages of hearing health journey to decide whether an assessment of these factors is needed. Also, if audiologists could accurately identify their patient's readiness in initial appointments, it could help identify the specific needs of that patient and might facilitate the provision of a more individualized, client centered approach to audiologic rehabilitation.

## Chapter 5

### GENERAL CONCLUSION

Individualized patient-centered patient care is the most effective way to improve success in health behavior change, including success. It has been hypothesized that patient factors such as self-efficacy and personality impact aspects of hearing aid (HA) success. Using a series of quantitative and qualitative studies, this dissertation evaluated the relative impacts of patient factors on aspects of hearing aid success. These studies looked at the interrelationships between patient traits in individuals with hearing loss who are at different stages of their hearing health journey. The results can be explained through the stages of changes. When an individual is in early stages (precontemplation or contemplation) of hearing health journey, agreeableness and conscientiousness personality traits, hearing aid self-efficacy, and negative affective states in a difficult listening situation impact their readiness to move to later stages. Our first and third studies, together, demonstrated that personality and hearing aid self-efficacy were distinct traits and independently impact readiness. However, our second qualitative assessment suggested that these two traits might be interacting in a complex way to contribute to long term hearing aid success. Results from this study included individuals who are in later stages of their hearing health journey (in the Maintenance stage or have successfully exited the Circle).

Collectively, self-efficacy and personality do impact aspects of hearing aid success through mechanisms that are independent from each other; however, these specific mechanisms were not clarified in these studies. Although the second study did indicate that these traits might be related, the qualitative nature of the study did not allow us to test their relationship. It is likely that patient factors impact success differently at different stages of an individual's hearing health journey. Future studies should use mixed method approaches and aim to further explore the impact of these traits at different stages of hearing health journey. Studies including participants



systematically selected from different stages might uncover the relative impacts of these traits and help us in making causal inferences about their role in hearing aid success. Finally, future studies should also explore other measurable patient traits and their impacts in aspects of hearing aid success, including readiness to pursue intervention. These studies will enhance our understanding of these patient traits and help us in designing research to develop and validate individualized patient-centered rehabilitation approaches.

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**APPENDIX A**  
**VERIFICATION QUESTIONS FOR THE QUALITATIVE SEMI-STRUCTURED**  
**INTERVIEW**

- 1) I've finished asking the questions that I have, but I'm wondering if there is anything that I haven't asked that would seem important or would better help me understand your experiences and ideas.
  
- 2) How was this interview for you?
  - a) Do you have any suggestions for future interviews?
  
  - b) Is there anything about me or the way I asked questions that may have influenced your answers?
  
  - c) Is there anything about me that you do not feel comfortable with?
  
  - d) After this interview, do you have any theories you'd like to share?
  
  - e) Did you think of any new ideas during this interview?

**APPENDIX B**  
**SCRIPTS FOR AUDIO CLIPS OF HOUR LISTENING SITUATIONS USED FOR**  
**SITUATION-DEPENDENT PANAS-SF MEASURE**

**Audio Clip 1**

Imagine that you are going to a social event to meet-up with some friends. There will also be a few people there who you don't know very well, and you want to make a good impression. The event is at a restaurant that you have been to before, and you know that it can be pretty noisy. There will be more than 10 people in your group. As you enter the restaurant, you notice that the lighting has been turned down for the evening and sure enough, there is definitely a crowd. The restaurant is pretty loud with all of the other diners, and you can also hear noises like waiters moving around and calling out to each other, dishes are clattering, and there is music playing in the background. You see that your friends are already there, and they are talking with a few new people. They see you and wave to you to come over so that they can introduce you. They have been talking about something and they want your opinion about it. However, you are having some trouble following their conversation because of all of the background noise. Imagine how you would feel in this situation. Now, read each emotion item below and indicate the extent that you would feel each of these in this situation.

**Audio Clip 2**

Imagine yourself on a road-trip to a new city. You've gotten a bit turned around and, at a red light, you roll your window down to ask a local for directions. The person is happy to help you and starts explaining how to get there. The road is pretty noisy, and you are having a little difficulty hearing them clearly. Imagine how you would feel in this situation. Now, read each emotion item below and indicate the extent that you would feel each of these in this situation.

### **Audio Clip 3**

Imagine that you are out for a doctor's appointment, you have some questions for the doctor about a health concern. The room is very well-lit and quiet, but the doctor is soft-spoken and speaking kind of fast. You are having some trouble following his explanations about your health condition. Imagine how you would feel in this situation. Now, read each emotion item below and indicate the extent that you would feel each of these in this situation.

### **Audio Clip 4**

Imagine yourself sitting at home and watching television. The person that you speak with the most is also there, watching tv with you. Although the television volume is loud enough for you to hear, you do still have some trouble understanding everything that's being said. You would like to turn it up just a bit more, but your partner says that the tv is already way too loud. Earlier they were talking to you from the other room, and you didn't understand them. They tell you that they think you should look into getting hearing aids. Imagine how you would feel in this situation. Now, read each emotion item below and indicate the extent that you would feel each of these in this situation.

**APPENDIX C**  
**IRB APPROVAL: PRO-FY2019-27**



Institutional Review Board  
Office of Sponsored Programs  
University of Memphis  
315 Admin Bldg  
Memphis, TN 38152-3370

July 20, 2018

PI Name: Jani Johnson  
Co-Investigators:  
Advisor and/or Co-PI: Lipika Sarangi  
Submission Type: Initial  
Title: How do patient characteristics contribute to hearing aid self-efficacy?  
IRB ID : #PRO-FY2019-27

Expedited Approval: July 20, 2018  
Expiration: July 20, 2019

Approval of this project is given with the following obligations:

1. This IRB approval has an expiration date, an approved renewal must be in effect to continue the project prior to that date. If approval is not obtained, the human consent form(s) and recruiting material(s) are no longer valid and any research activities involving human subjects must stop.
2. When the project is finished or terminated, a completion form must be submitted.
3. No change may be made in the approved protocol without prior board approval.

Thank you,  
James P. Whelan, Ph.D.  
Institutional Review Board Chair  
The University of Memphis.

**APPENDIX D**  
**IRB APPROVAL: PRO-FY2020-134**



Institutional Review Board  
Division of Research and Innovation  
Office of Research Compliance  
University of Memphis  
315 Admin Bldg  
Memphis, TN 38152-3370

October 8, 2019

PI Name: Lipika Sarangi  
Co-Investigators:  
Advisor and/or Co-PI: Jani Johnson  
Submission Type: Initial  
Title: What experiences do individuals with high hearing aid self-efficacy share as they become successful hearing aid users?  
IRB ID : #PRO-FY2020-134

Expedited Approval: October 8, 2019

The University of Memphis Institutional Review Board, FWA00006815, has reviewed your submission in accordance with all applicable statuses and regulations as well as ethical principles.

Approval of this project is given with the following obligations:

1. When the project is finished a completion submission is required
2. Any changes to the approved protocol requires board approval prior to implementation
3. When necessary submit an incident/adverse events for board review
4. Human subjects training is required every 2 years and is to be kept current at [citiprogram.org](http://citiprogram.org).

For additional questions or concerns please contact us at [irb@memphis.edu](mailto:irb@memphis.edu) or 901.6783.2705

Thank you,  
James P. Whelan, Ph.D.  
Institutional Review Board Chair  
The University of Memphis.

**APPENDIX E**  
**IRB APPROVAL: PRO-FY2021-2**



Institutional Review Board  
Division of Research and Innovation  
Office of Research Compliance  
University of Memphis  
315 Admin Bldg  
Memphis, TN 38152-3370

July 27, 2020

PI Name: Lipika Sarangi  
Co-Investigators:  
Advisor and/or Co-PI: Jani Johnson  
Submission Type: Initial  
Title: Situational versus general patient traits in predicting readiness to pursue hearing treatment  
IRB ID: #PRO-FY2021-2

Expedited Approval: July 23, 2020

The University of Memphis Institutional Review Board, FWA00006815, has reviewed your submission in accordance with all applicable statuses and regulations as well as ethical principles.

Approval of this project is given with the following obligations:

1. When the project is finished a completion submission is required
2. Any changes to the approved protocol requires board approval prior to implementation
3. When necessary submit an incident/adverse events for board review
4. Human subjects training is required every 2 years and is to be kept current at [citiprogram.org](http://citiprogram.org).

For additional questions or concerns please contact us at [irb@memphis.edu](mailto:irb@memphis.edu) or 901.6783.2705

Thank you,  
James P. Whelan, Ph.D.  
Institutional Review Board Chair  
The University of Memphis.