Published in final edited form as:

Int J Audiol. 2019 May ; 58(5): 287–295. doi:10.1080/14992027.2018.1535720.

Development of a Hearing Help-Seeking Questionnaire based on the Theory of Planned Behavior

Michelle Arnold^a, Brent J. Small^b, Kathryn Hyer^b, Theresa Chisolm^a, Melissa Teahen Frederick^c, ShienPei C Silverman^c, and Gabrielle Helena Saunders^{c,d,e}

^a:University of South Florida, Sarasota-Manatee, College of Science & Mathematics

^b:University of South Florida, School of Aging Studies

^c:National Center for Rehabilitative Auditory Research, VA Portland Health Care System

^d:Oregon Health and Science University, Dept. Otolaryngology

^e:Eriksholm Research Centre

Abstract

Objective: To develop and assess a questionnaire measuring the constructs of the theory of planned behavior (TPB) regarding older adults' behaviors towards seeking a hearing test.

Design: Older adults who failed a hearing screening completed a newly developed Theory of Planned Behavior-Hearing Help Seeking (TPB-HHS) questionnaire. A principal components analysis (PCA) examined the factor structure of the questionnaire, and a reliability analysis determined the internal consistency of the factors. An examination of six-month follow-up data determined whether the questionnaire differentiated between individuals who did and did not seek out a hearing test by comparing their TPB-HHS scores.

Study Sample: Participants were 407 adults aged 50 to 89 recruited at community hearing screenings.

Results: PCA and reliability analyses resulted in a 4-factor, 18 item questionnaire. Three of four factors demonstrated acceptable internal consistency. The TPB-HHS explained 60.18% of the variance and factors were interpreted to be measuring the constructs of Intentions, Perceived Behavioral Control, Attitudes, and Subjective Norms. Individuals who sought a hearing test scored significantly higher on the Intentions, Perceived Behavioral Control, and Attitudes scales than those who did not.

Conclusions: The TPB-HHS provides insight into underlying psychological mechanisms that drive behaviors related to hearing help-seeking in older adults.

Correspondence concerning this article should be addressed to Michelle Arnold, College of Science & Mathematics, University of South Florida Sarasota-Manatee, 8350 N. Tamiami Trail, B322, Sarasota, FL 34243. mlarnold@sar.usf.edu.

Declaration of Interest

Research reported in this publication was supported by the National Institute on Deafness and Other Communication Disorders of the National Institutes of Health under award number R01DC013761.

Keywords

Adult or General Hearing Screening; Aging; Behavioral Measures; Psycho-social/Emotional

Hearing loss associated with aging is a growing problem, affecting nearly 30 million, or 1 in 3, older adults in the US (U.S. Department of Health and Human Services). Negative outcomes related to untreated hearing loss include increased risks for cognitive decline (Lin, 2011), falls (Lin & Ferrucci, 2012), and social isolation (Kramer et al., 2002). Although effective diagnostic and treatment options for hearing loss exist, help-seeking for hearing loss is low (Popelka et al., 1998; Nash et al., 2013; Bainbridge & Ramachandran, 2014), with over 20 factors being identified as influencing help-seeking for hearing loss (Knudsen et al., 2010). However, there remain many unknowns, such as how such factors should best be measured, to what the extent these factors are predictive of behaviors, and how the factors interact to influence hearing help-seeking.

To address this, a number of hearing health researchers have applied various health behavior frameworks in their work, in an attempt to parse out factors related to hearing help-seeking (van der Brink et al., 1996; Laplante-Lévesque et al., 2013; Saunders et al., 2013; Meyer & Hickson, 2014). These frameworks attempt to explain which decisional factors influence an individual's choice whether or not to address a chronic health issue, or engage in recommended treatment from a health care provider. Questionnaires to assess the constructs of a number of frameworks have been developed, including the Hearing Beliefs Questionnaire to assess the constructs of the health belief model (HBM; Saunders et al., 2013). Developed over several iterations in the 1950s and 60s, the HBM aims to predict one's likelihood of performing a health-promoting behavior by examining the influence of perceived benefits and barriers of the behavior, perceived threat of not engaging in the behavior (e.g., threat of the health condition if it goes untreated), self-efficacy (one's confidence in engaging in the behavior), and cues to action (e.g., bothersome symptoms) (Rosenstock, 1974). In terms of hearing loss, the HBQ differentiated between individuals who reported a hearing test, hearing aid owners, and regular hearing aid users; however, the HBM factors only explained 36% of the total variance and the "self-efficacy" construct did not emerge in a sample of adults with hearing loss. (Meyer & Hickson, 2014) used components of that questionnaire to further test the HBM as it relates to help seeking and hearing aid use, and found that significant communication partners played a large role in hearing aid adoption and success.

Another framework explored in the area of hearing loss is trans-theoretical model (Prochaska & DiClemente, 1983). Also known as the "stages of change" model, the transtheoretical model consists of a series of predictable, consecutive stages that individuals cycle through on the path to changing health behaviors. Like the HBM, the trans-theoretical model has been widely applied in the area of health and decision making, particularly in the area of substance abuse treatment (DiClemente & Prochaska, 1998). In contrast to the HBM, the trans-theoretical model does not specifically define factors related to health behavior change (e.g., "perceived benefits" or "self-efficacy"). Rather, proponents of the trans-theoretical model aim to facilitate behavioral change through understanding the current stage

an individual is in, and utilize counseling techniques designed to address that stage in an attempt to “move the person along” in the cycle (DiClemente & Prochaska, 1998; Malloy et al., 2017). In the area of hearing loss, (Laplanche-Lévesque, Hickson et al., 2013) adapted the University of Rhode Island Change Assessment (URICA) to assess the construct, concurrent, and predictive validity of the model among older adults with hearing loss. In terms of predictive validity, the adapted URICA demonstrated that individuals who were further along in the stages of change were more likely to report hearing aid use; however, the URICA was not able to determine who would adhere to long-term use of hearing intervention (Laplanche-Lévesque, Hickson et al., 2013).

Similar to both the HBM and the trans-theoretical Model, the theory of planned behavior (TPB) (Ajzen, 1991; Ajzen, 2002) is another iterative framework that seeks to explain and predict health-related behaviors. However, the theory has not been thoroughly tested or applied to behaviors around hearing loss. Therefore, the purpose of this study is to develop a questionnaire based on the TPB and to explore the relationships between the framework's factors and hearing help-seeking. The goal of this research is to build upon the work of Saunders et al. (2013), Laplanche-Lévesque, Hickson et al. (2013), and Meyer and Hickson (2014) in further exploring the validity of using such a model to identify barriers and facilitators to hearing help-seeking and treatment.

TPB: Constructs

The TPB uses four constructs to predict human: (1) intentions, (2) attitudes, (3) subjective norms, and (4) perceived behavioral control. The predictive value of each construct on a target behavior is expected to vary depending on individual circumstances, society, resources, and previous experience with the behavior (Ajzen, 1991; Ajzen, 2002). The model is illustrated in Figure 1.

Intentions

According to the TPB, intentions are the aggregate of: (1) beliefs regarding the likely products or consequences of a behavior; (2) beliefs regarding how one's social network perceives a behavior; and (3) beliefs about one's ability to perform a behavior. The aforementioned three factors are referred to as behavioral beliefs which drive attitudes, normative beliefs which drive subjective norms, and control beliefs which drive perceived behavioral control. The TPB proposes that the constructs of attitudes, subjective norms, and perceived behavioral control are the predictive factors leading to intention. The stronger the intention one has to perform a behavior, the more likely that person is to engage in that behavior. In sum, intentions are the precursors of behaviors and are mitigated by attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991; Ajzen, 2002; Ajzen, 2002).

Attitudes and Subjective Norms.

Attitudes are driven by behavioral beliefs and outcome evaluations. Behavioral beliefs are formulated based on the consequences of engaging in a behavior, and outcome evaluations are based on whether or not an individual views those outcomes favorably or unfavorably.

How an individual perceives a behavior may rely on personal experience or other assumed attributes of that behavior (Azjen, 1991; Azjen, 2002). Considering the behavior of seeking out a hearing test, a person might have positive attitudes if they feel having a hearing test will be easy or interesting. Conversely, a person might have negative attitudes if they feel like having a hearing test will be stressful or boring.

Outside influences, such as an individual's family, social network, or the media also impact attitudes (Sparks & Shepherd, 1992), perhaps to a greater degree than personal experience alone. Taking the same example of seeking out a hearing test, an individual may have negative attitudes based on unfavorable experiences reported by family members or friends, such as difficulty scheduling a test or physical discomfort during the test. Further, it is likely that normative beliefs contribute greatly to the assumed attributes held by a person regarding a behavior that they have yet to perform. Subjective norms are driven by normative beliefs, such as how culture, society, or significant others such as family members or friends view a target behavior. Normative beliefs are also driven by how influential others are in motivating an individual to engage in a target behavior. However, intentions cannot be fully explained by attitudes and normative beliefs if a person does not have confidence in performing the behavior, or if s/he feels the behavior is outside of their control.

Perceived Behavioral Control.

Perceived behavioral control is driven by control beliefs, or the degree to which an individual believes s/he can execute a target behavior. Perceived behavioral control is comprised of two components: (1) actual control and (2) self-efficacy. According to Azjen (2002), controllability reflects outside influences, and self-efficacy reflects volitional control or internal influences. Although controllability and self-efficacy are separate entities, they can be collapsed into the single construct of perceived behavioral control (Azjen, 2002). Perceived behavioral control can influence behavior directly; in other words, a person may have intentions to seek out a hearing test, but if their personal finances are limited or their insurance does not cover the test (controllability) or they are intimidated by the thought of being able to find the clinic (self-efficacy), then chances are that individual will not seek treatment.

In sum, the TPB proposes that if attitudes and normative beliefs are positive, and perceived behavioral or actual control is high, then intentions will subsequently be high and thus the person will engage in the target behavior (Azjen 1985; 1991; 2002). The theory also assumes that if the constructs are appropriately measured, then a person's behavior can be predicted with a great deal of accuracy. In contrast to the HBM and the trans-theoretical model, the TPB includes the factor of "controllability", which not only takes into account a person's self-efficacy, but also external influences on health behavior change, such as insurance coverage for a service, or transportation to an appointment.

The TPB has potential for use in the area of hearing help seeking, as it has demonstrated predictive value for health-related decision-making in other areas, such as exercise, diet, and assistive device use. A systematic review and meta-analysis of TPB and exercise behaviors resulted in medium to large effect sizes for the relationships between attitudes and intentions, perceived behavioral control and intentions, and intentions and behaviors (Hagger

et al., 2002). Further, Kim et al. (2003) demonstrated significant positive correlations between intentions to eat dairy products and actual dairy product consumption, with the TPB constructs explaining over 42% of the variance in participants. Regarding assistive device use, Aminzadeh and Edwards (2000) found that the TPB correctly classified 91% of individuals and explained 67% of the variance associated with cane use, revealing that subjective norms and attitudes were significant predictors of whether or not an older adult would use a walking cane. In addition to health-related decisions such as diet, exercise, and assistive device use, the TPB has shown value in explaining help-seeking behaviors for various health conditions. Several studies demonstrate that a significant, moderate proportion of variance in behaviors related to seeking psychological help is explained by one of more constructs of the TPB (Smith et al., 2008; Schomerus et al., 2009), and TPB constructs explained a small yet significant proportion of women's intentions to seek help for breast cancer symptoms (Hunter et al., 2003). In sum, the TPB's demonstrated ability to both predict and explain behaviors related to assistive device use and help-seeking for health conditions suggests that the theory would also apply to help-seeking behaviors for hearing loss, such as seeking out a hearing test or using hearing aids.

Meister et al. (2014) developed a questionnaire to assess how the constructs of the TPB impacted the decision to use hearing aids. They examined four groups of German adults: current hearing aid users, individuals interested in hearing aids, individuals who obtained a hearing test, and individuals who did not obtain a hearing test). They determined that the predictive value of the TPB was dependent on group; those who did not obtain a hearing test were more influenced by subjective norms than the other constructs. Path modeling conducted by the authors revealed that participants who obtained a hearing test and those who were interested in hearing aids were influenced by all of the constructs, and those who were current hearing aid users were influenced by attitudes about hearing aids. Similarly, a study by Cobelli et al. (2014) found that Italian adults' intentions to use hearing aids were significantly related to positive attitudes. However, the questionnaires created by Meister et al. (2014) and Cobelli et al. (2014) were targeted specifically towards the decision to use hearing aids. As a hearing assessment is generally considered the first step in help-seeking for hearing loss, the purpose of the current study was to develop and psychometrically validate a TPB questionnaire to determine which constructs are associated with the behavior of obtaining a hearing test.

Method

Participants

Prior to the start of the study, the Institutional Review Boards at each study site (VA Portland Health Care System and University of South Florida) granted approval for all research procedures, participant recruitment, and informed consent procedures. Participants were adults 50 years of age or older who were taking part in a multi-site (Tampa, FL and Portland, OR) longitudinal study designed to investigate the hearing help-seeking behaviors of older adults. Recruitment took place during hearing screenings held at a variety of Tampa, FL and Portland, OR area community settings, including senior centers, places of worship, gyms, recreation centers, health fairs, and farmers' markets. Inclusion criteria were (i) a pure-tone

hearing screen fail (i.e., no response at 25 dB HL) in either ear at any of three tested frequencies (1, 2, and 4 kHz) and/or a score of 10 or greater on the Hearing Handicap Inventory for the Elderly – Screening (HHIE-S) version (Ventry & Weinstein, 1982), (ii) a passing score on the Mini-Cog dementia screening tool (Borson et al., 2003), and (iii) the ability to read and complete questionnaires in English. Exclusion criteria were reported current participation in research related to hearing loss and/or current or previous hearing aid use.

Test measures

Hearing Screening.—Pure-tone screening was conducted to determine eligibility at 25 dB HL for 1, 2, and 4 kHz using a Grason Stradler Instruments 18 audiometer and either TDH-39 supra-aural earphones (Tampa site) or Sennheiser HDA 200 headphones (Portland site). At each screening, periodic measurement of background noise levels occurred using an Extech 407732 type II sound level meter using a slow setting and dB A weighting. Mean background noise levels during the community screenings was 48.0 dB A ($SD = 8.8$).

HHIE-S. (Ventry & Weinstein, 1982).—The HHIE-S is a 10-item, three-response alternative choice questionnaire that measures self-perceived hearing difficulties in older adults. For each item, participants report “no” (zero points), “sometimes” (two points) or “yes” (four points). Points are added to yield a total score. Scores can range from 0 to 40 with higher scores indicating greater self-perceived handicap. A score of 10 or greater is the recommended cutoff for referral for full audiometric testing (American Speech-Language-Hearing Association, 1997). The HHIE-S was administered in a pencil-paper format.

Mini-Cog. (Borson, Scanlan et al., 2003).—The Mini-Cog is a brief screening tool for cognitive impairment. It consists of a three-item word recall measure and a clock drawing test. Participants first hear and repeat a list of three unrelated words and then are asked to draw the numbers and hands on a clock face to read ‘ten minutes after eleven’. They are then asked to recall the three words. A passing score is either successful recall of all three words, or recall of one or two words and a correct clock face. The Mini-Cog has 76–99% and 86–95% ranges for sensitivity and specificity, respectively (Borson, Scanlan et al., 2003).

TPB-Hearing Help-Seeking Questionnaire (TPB-HHS).—The TPB-HHS questionnaire was developed for this study using a TPB questionnaire construction guide (Francis et al. (2004) and input from Dr. Azjen, who created and refined the TPB model. Six items were created to address each of the four constructs (intentions, attitudes, subjective norms, and perceived behavioral control) for a total of 24 items. Clear wording (e.g. avoidance of double negatives and sub-clauses), and ease of understanding were primary considerations when constructing the individual items. Each question was assessed for readability using the Flesh-Kincaid scale, with the mean grade level for the TPB-HHS being 4.8 ($SD = 1.5$; range 2.8 – 8.5) and the questions were circulated among an expert panel of audiologists and hearing scientists who made suggestions for refinement of the items and wording. Participants responded to each item using a visual analog scale (VAS). For each item, there was a horizontal line with “anchoring” words on opposing ends. Participants were instructed to mark an “X” along the line at a point that best described their opinion.

VAS scoring was selected for use because it is a preferred method for measuring psychological constructs that occur on a continuum (Wewers & Lowe, 1990). For scoring, the position of the X along the length of the line was measured using a ruler. From this, the value was transformed onto a scale of 0 – 100, such that an X at the far left of the line had a score of 0, an X at the far right of the line had a score of 100, and an X exactly half way along the line had a score of 50.

Demographic Questionnaire.—Participants' demographic information was collected using an 11-item questionnaire that included information on sex, race, age, self-reported duration of hearing loss, and socioeconomic status, such as insurance coverage or ability to pay for hearing aids if needed. The demographic questionnaire was administered in pencil and paper format.

Procedures

Hearing screenings were conducted at various community locations and included pure-tone screening and administration of the HHIE-S as part of a larger longitudinal study (NIH NIDCD R01 DC013761.) Any individual who failed either one or both screening measures was invited to participate in the study. If interested, individuals completed a written informed consent form followed by the Mini-Cog. Participants who passed the Mini-Cog were enrolled in the study. Detailed results from the hearing screening phase of this study have been reported elsewhere (Saunders et al., 2018). In brief, a total of 1954 (OR $n = 1219$; FL $n = 735$) adults with full screening data were screened at 191 different events. Ambient noise levels were measured prior to each individual screened, and ranged from < 30 dBA to > 70 dBA, with mean ambient noise levels for pure-tone screen passes at 47.0 dBA ($SD 7.1$) and screen fails at 48.6 dBA ($SD 9.7$). Of the individuals screened, 1434 were eligible for the current study. Of the eligible participants, 796 (40.7%) failed the HHIE-S, 1238 (63.4%) failed the pure-tone screening, and 600 (30.7%) failed both. Of those who were invited, 567 (OR $n = 311$; FL $n = 256$) agreed to participate. Two weeks after the screening, participants were sent the demographic questionnaire and the TPB-HHS. The mailing also included written instructions for completion and a pre-addressed, postage-paid envelope for return mailing of the questionnaires.

Upon receipt of the completed questionnaires, responses were entered into the Oregon Clinical and Translational Research Institute's online database, REDCap. Six months after questionnaires were returned, participants were contacted with a brief, scripted follow-up phone call and were asked: (i) if they remembered having a hearing screening, (ii) if they remembered the results of the hearing screening, and (iii) if they followed up with a hearing test. Participants who reported having a hearing test were also asked what the results of the hearing test were, what recommendations were given by the audiologist and whether they had followed those recommendations. Their response to this question classified individuals into two groups for analysis: those who sought a hearing test, and those who did not.

Statistical Analysis

Statistical analyses were performed using the Statistical Package for Social Sciences software, version 22.0 (SPSS Inc., Chicago, IL). The analyses included principal

components analysis (PCA) using Varimax rotation with Kaiser normalization to extract TPB constructs, and a subsequent reliability analysis using Cronbach's α to determine the internal consistency of the measured constructs. Correlations were calculated to examine the relationships between the four latent factors and demographic variables. Finally, independent samples t -tests were performed with six-month follow-up data to compare TPB-HHS results between participants who sought out a hearing test versus participants who did not.

Results

Participants.

At the time of analysis, a total of 515 questionnaires had been returned, 428 of which had complete TPB-HHS data, however, as described below, data from 407 individuals were used in the analyses (see Figure 1 in the online supplemental materials for details). The mean age of these 407 participants was 68.3 years ($SD = 8.2$). The majority of the sample was female, White, and reported having experienced hearing loss for 1 year or more (Table 1).

TPB-HHS.

Prior to performing the PCA, the data were checked for suitability. The analytic sample size was good to excellent (Comrey & Lee, 1992). Bartlett's test of sphericity ($p < .001$) demonstrated that inter-correlations among the TPB-HHS items were low, and the Kaiser-Meyer-Olkin measure (.91) demonstrated excellent sampling adequacy (Dziuban & Shirkey, 1974). The skewness and kurtosis of individual questionnaire items were examined to assess the response distribution for each item. Using criteria for sample sizes > 300 defined by Kim (2013), two items were not normally distributed ("*It is entirely up to me whether I get a hearing test in the next six months.*" and "*I have complete control over getting a hearing test in the next six months*" with anchor points "*Definitely false*" and "*Definitely true*"), demonstrating absolute skewness values > 2 . Subsequent square root and reflect transformations normalized the distribution of these item scores and both were included in the final analysis. Individual item responses were assessed for outliers, and cases with standardized scores > 3.29 were eliminated ($n = 21$), leaving data from 407 adults for the remaining analyses.

Following the individual item analysis, a PCA using Varimax rotation was conducted. Using the theoretical framework as a guide as well as inspection of the eigenvalues and scree plot (see online supplementary materials), a four-factor solution was extracted. Items with loadings of greater than .45 (Comrey & Lee, 1992) were considered for inclusion on any factor. Factors were then interpreted and assigned labels. The factors corresponded to: Intentions ($k = 13$), Perceived Behavioral Control ($k = 6$), Attitudes ($k = 4$), and Subjective Norms ($k = 3$).

Reliability analyses using Cronbach's α determined the internal consistency of the included items for each of the four factors. In an effort to reduce the length of the questionnaire, items that did not alter the internal consistency of the factor ($k = 8$) were identified and omitted from the final questionnaire, leaving a total of 18 items. One item did not load on any factor, and was removed. Three items loaded on two factors; two were assigned to the Perceived

Behavioral Control scale, as removal of the items significantly reduced the internal consistency of this scale, and one was removed, as its inclusion did not significantly alter the internal consistency of either scale. Using criteria outlined by George and Mallery (2003), three of the four factors (Intentions, Perceived Behavioral Control, and Attitudes) resulted in acceptable internal consistency ($\alpha = .91, .70$ and $.78$, respectively). The fourth factor, Subjective Norms, resulted in questionable internal consistency ($\alpha = .60$), but was retained due to the individual items' coherence with the overall theoretical construct. Table 2 displays items categorized by TPB constructs, factor loadings, and Cronbach's α values. Asterisks notate which items were included in the reliability analysis that make up the final version of the questionnaire.

Transformation of factor millimeter scores to VAS scores from 0 to 100 occurred following the PCA and reliability analysis. Transformed mean responses were 61.44 (range: 12.0 – 99.4, $SD = 22.0$), 85.07 (range: 48.1 – 100.0, $SD = 11.7$), 60.9 (range: 14.4 – 100.0, $SD = 15.5$), and 46.4 (range: 0 – 100, $SD = 19.4$) for the Intentions, Perceived Behavioral Control, Attitudes and Subjective Norms scales, respectively. Total scale scores were calculated as the mean of the transformed mean responses for all questionnaire items loading on a particular scale. Figure 2 shows the distribution of responses on each scale. For the Intentions scale, response distribution is multimodal, with the majority of responses clustering around 0 – 10%, 50 – 60%, and 90% points along the VAS. Both the Attitudes and Subjective Norms scales demonstrate an overall normal distribution, with the majority of responses concentrated between 40% and 70% along the VAS, with the exception of a cluster of scores between 0 – 10% in the Subjective Norms scale. The Perceived Behavioral Control scale resulted in a negatively-skewed distribution, with the majority of responses concentrated between 80% and 100% of the VAS. However, it should be noted that there is a subset of approximately 60 individuals who reported very low perceived control over receiving a hearing test.

Correlations were calculated to examine the relationships between participants' age (Pearson), duration of reported hearing difficulty (Pearson), sex (point-biserial) and mean TPB-HHS component scores (Table 3). For the Intentions scale, significant correlations were seen for duration of hearing difficulty and age in years. Participants who reported a longer duration of hearing difficulty and younger participants had stronger intentions to seek out a hearing test. For the Attitudes factor, a significant correlation was seen for sex, with women being more likely than men to report positive attitudes about receiving a hearing test. For the Subjective Norms factor, a significant correlation was seen for age in years, with older participants being more likely to report knowing individuals who had a hearing test. No significant correlations were seen between any of the demographic variables and the Perceived Behavioral Control factor.

Six-month follow-up.

At the time of analysis, 362 of 407 participants with complete data had responded to a six-month follow-up call to determine whether or not they reported seeking a hearing test. Of the 362 participants who were contacted, 98 (27.1%) reported having had a hearing test versus 264 (72.9%) who had not. Table 4 shows means and standard deviations on each

TPB-HHS factor for participants who did and did not report receiving a hearing test. Independent samples *t*-tests were used to compare TTP-HHS scores of individuals who did and did not report seeking a hearing test. Results indicated that participants who reported having a hearing test within six months had significantly higher Intentions, Perceived Behavioral Control, and Attitudes scores than those who did not (Table 4).

Discussion

In this study, we developed a questionnaire to assess the constructs of the TPB as they pertain to the hearing help-seeking behavior of seeking a hearing test. Using a four-factor solution, the constructs of the TPB were found to explain 60% of the variance in older adults' intentions to seek out a hearing test. Response distributions of the various scales provide insight into the TPB constructs as they relate to seeking hearing help. As noted, the Intentions scale demonstrated a bimodal distribution, suggesting that the study sample consists of two types of individuals: those who plan to seek out a hearing test versus those who don't. Responses for the Subjective Norms and Attitudes scales were normally distributed, suggesting that the participants had neutral attitudes and subjective norm beliefs towards seeking out a hearing test. Negatively-distributed responses on the Perceived Behavioral Control scale suggest that participants felt highly in control of whether or not they could seek out a hearing test. While these results may seem apparent, to our knowledge this is the first validated questionnaire for older adults related to hearing loss that measure these constructs as they relate to seeking a hearing test. Information gained from the TPB-HHS could give insight to health care providers regarding how to counsel patients who may need hearing assessment and subsequent intervention. The finding that the TPB-HHS Intentions, Perceived Behavioral Control, and Attitudes scales distinguished participants who reported seeking a hearing test from those who did not illustrates the potential value of this questionnaire.

While the TPB is used throughout health care disciplines to explain behaviors, very little research in the area of hearing health care using the theory has been conducted. A measure examining the TPB in a group of hearing aid users exists (Meister, Grugel et al., 2014), but the questionnaire is specific to the management of hearing loss in the German healthcare system, and therefore is not applicable to our study population (older people living in the US). Further, the questionnaire designed by Meister, Grugel et al. (2014) retrospectively assessed individuals who had already obtained hearing aids. The current study prospectively collected data from participants who had not yet sought help for their hearing loss. A strength in this approach is that decisional mechanisms explained by the theory may be uncovered in those that ultimately do not seek any help for their hearing loss. Future research will follow these individuals over the course of three years to determine what action, if any, was taken to address their hearing loss. Understanding the influential factors of those who do not seek help could lead to development of patient education approaches or interventions designed to increase help-seeking behaviors for those living with hearing loss.

Not surprisingly, a weak yet significant correlation was seen between duration of self-reported hearing loss and the Intentions factor as measured by the TPB-HHS. This is consistent with previous research that demonstrates that adults generally wait 10+ years

between diagnosis with a hearing loss and pursuing further hearing health care, such as the use of hearing aids (Kochkin, 2009; Fischer et al., 2011). Additionally, younger participants were more likely to report stronger intentions to seek out a hearing test, which is at odds with literature demonstrating positive correlations between hearing loss, hearing aid use, and age. This interesting result might be explained by the data of Kamil et al. (2015) and Saunders et al. (2018) who showed that younger participants tended to overestimate and older participants underestimate their hearing impairment relative to perceived difficulties. Further, it has been noted that relative to older individuals, younger individuals do not expect their hearing to decline and thus have less tolerance of hearing difficulties. They may also have greater demands to communicate in difficult listening environments, and/or greater reliance on hearing than older individuals (Saunders et al., 2004). This perhaps partially explains why younger participants in the current study reported stronger intentions to seek out a hearing test versus older participants. Indeed, perceived hearing loss is consistently a strong predictor of help seeking for hearing loss (Knudsen, Öberg et al., 2010; Gopinath et al., 2011; Meyer & Hickson, 2012).

The Intentions, Perceived Behavioral Control, and Attitudes scales as measured by the TPB-HHS distinguished participants who reported seeking a hearing test from those who did not, although the subjective norms construct did not. This is in contrast to the results reported by Meister, Grugel et al. (2014) who found that individuals who had not yet consulted an ENT or hearing professional were significantly influenced by the subjective norms construct. This may be because the decision to adopt a hearing aid is often impacted by perceptions of stigma related to hearing aid use (Knudsen, Öberg et al., 2010) which is largely driven by social norms and experiences, while having a hearing test may not.

This study has both strengths and limitations. Besides being conducted in a prospective manner, the study includes a large sample of older adults who were recruited using the MiniCog as a screener to rule out cognitive decline. Individuals were identified in a variety of community settings, which reduces sampling bias by including those who may not seek out opportunities to engage in research and increases sample diversity, and thus the validity of the findings. Also, the community hearing screenings were intentionally not advertised in advance, in order to recruit individuals who were not actively seeking help for their hearing loss, further reducing sampling bias and lending better generalizability to the target population.

Limitations of the study include the scope of the questionnaire items, analytic constraints, and inherent issues with self-report data. While three of the four scales characterized those who received a hearing test from those who did not, receiving a hearing test is only a single step in hearing help-seeking. Therefore, the TPB-HHS may not be an appropriate tool for explaining hearing help-seeking behaviors of older adults with hearing loss. It is possible that specific constructs from the theory in combination with other health behavior frameworks may be useful in predicting actual behaviors. This is being addressed in our larger ongoing longitudinal study.

The current study did not assess the test/retest reliability of the TPB-HHS. Future studies will examine test/retest reliability and construct validity. The larger ongoing study will also

enable us to compare results with HHIE to determine the suitability of the TPB-HHS for widespread clinical use. Further, for clinical applicability, analyses are planned to determine whether using only a single item from each TPB-HHS scale can identify those who will seek out help for hearing loss compared to the current 18-item questionnaire. The inherent problems of using self-report to measure intentions to engage in behaviors is also considered a limitation of the study. For health-related surveys, response biases such as social desirability and acquiescence bias pose a particular threat, as many individuals tend to respond in ways that reflect what they believe is acceptable or agreeable, regardless of the truth. (Ross & Mirowsky, 1984; van de Mortel, 2008).

In the US, treatment uptake in the form of hearing aids for those who could benefit from them remains stagnant at around 25 –30% since the 1980s (Kochkin, 2009; Abrams & Kihm, 2015). Previous research suggests a variety of factors are responsible for low uptake rates, such as socioeconomic variables, stigma, and perception of hearing loss (Garstecki & Erler, 1998; Kochkin, 2009; Gopinath, Schneider et al., 2011; Meyer & Hickson, 2012). However, few measures exist in the field of audiology and hearing science that measure these factors using a robust behavioral theory as a framework. This study appropriately addresses this longstanding problem by attempting to measure the underlying psychological mechanisms that drive decision making related to hearing help-seeking in older adults. Assessment tools that provide insight into decisional mechanisms of older adults with hearing loss could point to important areas of future research related to assessment, intervention, and treatment.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements

This article was previously presented at the Gerontological Society of America Annual Scientific Meeting held in New Orleans, LA, on Friday, November 18, 2016, as a poster entitled: “Application of the theory of planned behavior for explaining hearing help-seeking behaviors of older adults”. The authors would like to thank Dr. Icek Azjen for his consultation while developing the initial questionnaire, and Celia Escabi, Laura Westermann, Preyanca Oree, and Charissa Hicks for their assistance in conducting this study.

Glossary

CFA	Confirmatory factor analysis
dB	Decibels
HHIE-S	Hearing Handicap Inventory for the Elderly – Screening
Hz	Hertz
PCA	Principal components analysis
SPSS	Statistical Package for the Social Sciences
TPB	Theory of planned behavior

TPB-HHS	Theory of Planned Behavior Hearing Help-Seeking questionnaire
VAS	Visual analogue scale

References

- Abrams H & Kihm J 2015 An introduction to MarkeTrak IX: A new baseline for the hearing aid market. *Hearing Review*, 22, 16.
- American Speech-Language-Hearing Association 1997 Guidelines for audiologic screening.
- Aminzadeh F & Edwards N 2000 Factors associated with cane use among community dwelling older adults. *Public Health Nurs*, 17, 474–483. [PubMed: 11115146]
- Azjen I 1991 The theory of planned behavior. *Organ. Behav. Hum. Decis. Process*, 50, 179–211.
- Azjen I 2002 Constructing a TPB questionnaire: Conceptual and methodological considerations.
- Azjen I 2002 Perceived behavioral control, self efficacy, locus of control, and the theory of planned behavior. *J. Appl. Soc. Psychol*, 34, 665–683.
- Bainbridge KE & Ramachandran V 2014 Hearing aid use among older U.S. adults: The National Health and Nutrition Examination Survey, 2005–2006 and 2009–2010. *Ear Hear.*, 35, 289–294. [PubMed: 24521924]
- Borson S, Scanlan JM & Chen PJ 2003 The Mini-Cog as a screen for dementia: Validation in a population-based sample. *J. Am. Geriatr. Soc*, 51, 1451–1454. [PubMed: 14511167]
- Cobelli N, Dip LG, Cassia F & Ugolini M 2014 Factors that influence intent to adopt a hearing aid among older people in Italy. *Health and Social Care in the Community*, 22, 612–622. [PubMed: 25251979]
- Comrey AL & Lee HB 1992 A first course in factor analysis. Hillsdale, NJ: Erlbaum.
- DiClemente CC & Prochaska JO 1998 Toward a comprehensive, trans-theoretical model of change: Stages of change and addictive behaviors In: Miller WR & Heather N (eds.) *Applied Clinical Psychology: Treating Addictive Behaviors*. New York, NY: Plenum Press, pp. 3–24.
- Dziuban CD & Shirkey EC 1974 When is a correlation matrix appropriate for factor analysis? *Psychol. Bull*, 81, 358–361.
- Fischer ME, Cruickshanks KJ, Wiley TL, Klein BEK, Klein R, et al. 2011 Determinants of hearing aid acquisition in older adults. *Am. J. Public Health Nations Health*, 101.
- Francis J, Eccles MP, Johnston M, Walker AE, Grimshaw JM, et al. 2004 Constructing questionnaires based on the theory of planned behaviour: A manual for health services researchers Center for Health Services Research, University of Newcastle upon Tyne: Newcastle upon Tyne.
- Garstecki DS & Erler SF 1998 Hearing loss, control, and demographic factors influencing hearing aid use among older adults. *J. Speech. Lang. Hear. Res*, 41, 527–237. [PubMed: 9638919]
- George D & Mallery P 2003 SPSS for Windows step-by-step: A simple guide and reference. Boston: Allyn & Bacon.
- Gopinath B, Schneider J, Hartley D, Teber E, McMahon CM, et al. 2011 Incidence and predictors of hearing aid use and ownership among older adults with hearing loss. *Ann. Epidemiol*, 21, 497–506. [PubMed: 21514179]
- Hagger MS, Chatzisarantis NLD & Biddle SJH 2002 A meta-analytic review of the theories of reasoned action and planned behavior in physical activity: Predictive validity and contribution of additional variables. *J. Sport Exerc. Psychol*, 24, 3–32.
- Hunter MS, Grunfeld EA & Ramirez AJ 2003 Help-seeking intentions for breast-cancer symptoms: A comparison of the self-regulation model and the theory of planned behaviour. *Br. J. Health Psychol*, 8, 319–333. [PubMed: 14606976]
- Kamil RJ, Genther DJ & Lin FR 2015 Factors associated with the accuracy of subjective assessments of hearing impairment. *Ear Hear*, 36, 164–167. [PubMed: 25158982]
- Kim H-Y 2013 Statistical notes for clinical researchers: Assessing normal distribution (2) using skewness and kurtosis. *Restorative Dent*, 38, 52–54.
- Kim K, Reicks M & Sjöberg S 2003 Applying the theory of planned behavior to predict dairy product consumption in older adults. *J. Nutr. Educ. Behav*, 35, 294–301. [PubMed: 14642214]

- Knudsen LV, Öberg M, Nielsen K, Naylor G & Kramer SE 2010 Factors influencing help-seeking, hearing aid uptake, hearing aid use and satisfaction with hearing aids: A review of the literature. *Trends in Amplification*, 14, 127–154. [PubMed: 21109549]
- Kochkin S 2009 MarkeTrak VIII: 25-year trends in the hearing health market. *Hearing Review*, 16, 12–31.
- Kramer SE, Kapteyn TS, Kuik DJ & Deeg DJH 2002 The association of hearing impairment and chronic diseases with psychosocial health status in older age. *J. Aging Health*, 14, 122–137. [PubMed: 11892756]
- Laplante-Lévesque A, Hickson L & Worrall L 2013 Stages of change in adults with acquired hearing impairment seeking help for the first time: Application of the trans-theoretical model in audiology rehabilitation. *Ear Hear*, 34, 447–457. [PubMed: 23364333]
- Lin FR 2011 Hearing loss and cognition among older adults in the United States. *J. Gerontol. A Biol. Sci. Med. Sci.*, 66A, 1131–1136.
- Lin FR & Ferrucci L 2012 Hearing loss and falls among older adults in the United States. *Arch. Intern. Med. (Chic.)*, 172, 369–371.
- Malloy K, Proj A, Battles H, Juster T, Ortega-Peluso C, et al. 2017 Smoking cessation benefit utilization: Comparing methodologies for measurement using New York state's Medicaid data. *Nicotine & Tobacco Research*, ntx250.
- Meister H, Grugel L & Meis M 2014 Intention to use hearing aids: A survey based on the theory of planned behavior. *Patient Preference and Adherence*, 8, 1265–1275. [PubMed: 25258520]
- Meyer C & Hickson L 2012 What factors influence help-seeking for hearing impairment and hearing aid adoption in older adults? *Int. J. Audiol*, 51, 66–74. [PubMed: 22256793]
- Meyer C & Hickson L 2014 Factors associated with success with hearing aids in older adults. *Int. J. Audiol*, 53, S18–S27. [PubMed: 24447233]
- Nash SD, Cruickshanks KJ, Huang G, Klein BEK, Klein R, et al. 2013 Unmet hearing health care needs: The Beaver Dam offspring study. *Am. J. Public Health Nations Health*, 103, 1134–1139.
- Popelka MM, Cruickshanks KJ, Wiley TL, Tweed TS, Klein BEK, et al. 1998 Low prevalence of hearing aid use among older adults: The Epidemiology of Hearing Loss Study. *J. Am. Geriatr. Soc.*, 46, 1075–1078. [PubMed: 9736098]
- Prochaska JO & DiClemente CC 1983 Stages and processes of self-change of smoking: toward an integrative model of change. *J. Consult. Clin. Psychol*, 51, 390–395. [PubMed: 6863699]
- Rosenstock IM 1974 Historical origins of the health belief model. *Health Educ. Monogr*, 2, 328–335.
- Ross CE & Mirowsky J 1984 Socially-desirable response and acquiescence in a cross-cultural survey of mental health. *J. Health Soc. Behav*, 25, 189–197. [PubMed: 6470459]
- Saunders GH, Forsline A & Fausti SA 2004 The Performance-Perceptual Test and its relationship to unaided reported handicap. *Ear Hear*, 25, 117–126. [PubMed: 15064656]
- Saunders GH, Frederick MT, Silverman S & Papesch M 2013 Application of the health belief model: Development of the hearing beliefs questionnaire (HBQ) and its associations with hearing health behaviors. *Int. J. Audiol*, 52, 558–567. [PubMed: 23682849]
- Saunders GH, Frederick MT, Silverman S, Penman T, Gardner A, et al. 2018 Hearing screening in the community. *J. Am. Acad. Audiol*,
- Schomerus G, Matschinger H & M.C. A 2009 Attitudes that determine willingness to seek psychiatric help for depression: a representative population survey applying the Theory of Planned Behaviour. *Psychol. Med*, 39, 1855–1865. [PubMed: 19379538]
- Smith JP, Tran GQ & Thompson RD 2008 Can the theory of planned behavior help explain men's psychological help-seeking? Evidence for a mediation effect and clinical implications. *Psychol. Men Masc*, 9, 179–192.
- Sparks P & Shepherd S 1992 Self-identity and the theory of planned behavior: Assessing the role of Identification with "Green Consumerism". *Soc. Psychol. Q*, 55, 388–399.
- U.S. Department of Health and Human Services Hearing and Other Sensory or Communication Disorders.
- van de Mortel TF 2008 Faking it: Social desirability response bias in self-report research. *Aust. J. Adv. Nurs*, 25, 40–48.

- van der Brink RHS, Wit HP, Kempen GJIM & Heuvelen MJG 1996 Attitude and help-seeking for hearing impairment. *Br. J. Audiol.*, 30, 312–324.
- Ventry IM & Weinstein BE 1982 The Hearing Handicap Inventory for the Elderly: A new tool. *Ear Hear.*, 3, 128–134. [PubMed: 7095321]
- Wewers ME & Lowe NK 1990 A critical review of visual analogue scales in the measurement of clinical phenomena. *Res. Nurs. Health*, 13, 227–236. [PubMed: 2197679]

Figure 1. A Simple Model of the Theory of Planned Behavior (Ajzen, 1991)

Figure 1 depicts a simple model of the TPB. According to the model, attitudes are driven by behavioral beliefs and outcome evaluations. Behavioral beliefs are based on the outcomes of behaviors, and outcome evaluations are based on how a person views outcomes. Subjective norms are driven by normative beliefs, such as how culture, society, or significant others view a behavior. Normative beliefs are also driven by how influential others are in motivating a person to engage in a behavior. Perceived behavioral control is composed of actual control beliefs and self-efficacy. Control beliefs are the degree a person believes s/he can execute a certain behavior. Intentions are ultimately influenced by attitudes, subjective norms, and perceived behavioral control. The stronger the intention one has to perform a behavior, the more likely that person is to perform the behavior.

Figure 2. Range and Distribution of TPB-HHS Responses

Figure 2 displays the ranges and distributions of mean individual responses for the four scales of the TPB-HHS: Intentions, Perceived Behavioral Control, Attitudes, and Subjective Norms.

Table 1

Participant Demographics

Measure	%	<i>n</i>
Sex (Female)	63.1	257
Race		
White	80.8	329
Black	5.9	24
Hispanic/Latino	5.2	21
Asian/Pacific Islander	2.0	8
American Indian	1.0	4
Prefer not to answer/Missing	4.9	20
Duration of Hearing Difficulty		
No hearing difficulties	18.9	77
One month	2.5	10
Less than a year	14.0	57
1 – 5 years	43.0	175
More than 5 years	21.4	87
Missing	0.2	1

Table 2

TPB Factors Derived from PCA and Reliability Analyses

Item	Factor			
	Intentions	Perceived Behavioral Control	Attitudes	Subjective Norms
I intend to get a hearing test in the next 6 months. { <i>Extremely unlikely</i> ; <i>Extremely likely</i> }	.778	.205	.224	.045
Most people whose opinions I value think that I should get a hearing test in the next 6 months. { <i>Definitely false</i> ; <i>Definitely true</i> }	.514*	.020	.266	.259
For me to get a hearing test in the next 6 months would be: { <i>Completely worthless</i> ; <i>Extremely valuable</i> }	.749*	.168	.345	.029
I have decided to get a hearing test in the next 6 months. { <i>Definitely false</i> ; <i>Definitely true</i> }	.832*	.126	.265	.045
It is entirely up to me whether I get a hearing test in the next 6 months. { <i>Definitely false</i> ; <i>Definitely true</i> }	-.021	-.641*	-.019	.072
For me to get a hearing test in the next 6 months would be: { <i>Extremely unpleasant</i> ; <i>Extremely pleasant</i> }	.274	.090	.756*	.027
There is little that could prevent me from getting a hearing test in the next 6 months. { <i>Strongly disagree</i> ; <i>Strongly agree</i> }	.156	.526*	.326	.099
I am planning to get a hearing test in the next 6 months. { <i>Strongly disagree</i> ; <i>Strongly agree</i> }	.843*	.166	.256	.056
Getting my hearing tested in the next 6 months would be: { <i>Completely impossible</i> ; <i>Definitely possible</i> }	.466	.604*	.141	.001
For me to get a hearing test in the next 6 months would be: { <i>Extremely boring</i> ; <i>Extremely exciting</i> }	.296	-.050	.762*	-.005
I am willing to get a hearing test in the next 6 months. { <i>Definitely am</i> ; <i>Definitely am not</i> }	-.478	-.073	.195	.072
Many people I know will get a hearing test in the next 6 months. { <i>Definitely false</i> ; <i>Definitely true</i> }	.216	-.142	.027	.631*
Most people my age have had their hearing tested. { <i>Strongly disagree</i> ; <i>Strongly agree</i> }	-.056	.053	.041	.794*
I am inclined to get a hearing test in the next 6 months. { <i>Definitely am</i> ; <i>Definitely am not</i> }	-.839*	-.020	.006	-.002
For me to get a hearing test in the next 6 months would be: { <i>Extremely bad</i> ; <i>Extremely good</i> }	.619	.211	.511	-.061
It is expected of me to get a hearing test in the next 6 months. { <i>Strongly disagree</i> ; <i>Strongly agree</i> }	.601	-.060	.336	.262
I am confident that I can get a hearing test in the next 6 months. { <i>Strongly disagree</i> ; <i>Strongly agree</i> }	.540	.558*	.063	.093
For me to get a hearing test in the next 6 months would be: { <i>Extremely useless</i> ; <i>Extremely helpful</i> }	.691	.163	.438	-.031
Most people who are important to me would approve of my getting a hearing test in the next 6 months. { <i>Definitely false</i> ; <i>Definitely true</i> }	.447	.310	.259	.159
If I wanted to, I could get a hearing test in the next 6 months. { <i>Definitely false</i> ; <i>Definitely true</i> }	.126	.794*	-.037	.014
For me to get a hearing test in the next 6 months would be: { <i>Extremely stressful</i> ; <i>Extremely relaxing</i> }	.031	.050	.768*	.047
I expect that I will get a hearing test in the next 6 months. { <i>Definitely will</i> ; <i>Definitely will not</i> }	-.861*	-.085	-.072	-.058

Item	Factor			
	Intentions	Perceived Behavioral Control	Attitudes	Subjective Norms
I have complete control over getting a hearing test in the next 6 months. <i>{Definitely <u>false</u>; Definitely <u>true</u>}</i>	-.002	-.810*	.053	-.009
I know many people who have had their hearing tested. <i>{Definitely <u>false</u>; Definitely <u>true</u>}</i>	-.001	.110	-.009	.765*
Cronbach's α	.91	.70	.78	.60

Table 3

Summary of Correlations between TPB-HHS Factor Scores and Age, Sex, Race, and Duration of Hearing Loss

Measure	Intentions	Perceived Behavioral Control	Attitudes	Subjective Norms
Age	-.104 *	-.036	.027	.236 **
Sex	-.060	-.157 **	-.061	.048
Duration HL	.179 **	.118 *	.048	-.006

Note. HL = Hearing loss.

*
 $p < .05$

**
 $p < .01$.

Sex: Male = 1, Female = 2.

Table 4

Six-Month Follow-Up Results for TPB-HHS Results

Hearing Test Reported at 6 Months?	Scale											
	Intentions			Perceived Behavioral Control			Attitudes			Subjective Norms		
	<i>M</i>	<i>SD</i>	<i>t</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>M</i>	<i>SD</i>	<i>t</i>
Yes (n = 98)	75.6	18.6		90.9	8.9		66.8	15.8		47.1	17.7	
No (n = 264)	56.2	20.8	8.13*	82.9	11.9	6.92*	58.8	14.8	4.49*	46.2	20.0	.375

Note. TPB-HHS = Theory of Planned Behavior Hearing Help-Seeking questionnaire.

*
 $p < .001$.