Characteristics and Help-Seeking Behavior of People Failing a Smart Device Self-Test for Hearing

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Abstract

Purpose: This study investigated user characteristics, help-seeking behavior, and follow-up actions of people who failed an app-based digits-in-noise hearing screening test, considering their stage of change.

Method: Test and user characteristics of 3,092 listeners who failed the test were retrospectively analyzed. A posttest survey determining follow-up (verb) actions was sent to listeners who failed the test (n = 1,007), of which 59 responded.

Results: The majority of listeners were in the precontemplation stage (75.5%). Age and stage of change were significant ($p < .05$) predictors of the digits-in-noise speech recognition threshold (DIN SRT). Listeners in the precontemplation stage were significantly younger than in other stages ($p < .05$). Posttest survey response rate was low (5.9%). Of those, most (82.4%) did not think they had a hearing loss. Only 13.6% followed up with an audiologist.

Conclusion: Older people presented with poorer DIN SRTs and were typically in a more advanced stage of change. The majority of those who did not follow up after failing the screening test did not believe they had a hearing loss. A combination of factors, including poor DIN SRT, older age, and a more advanced stage of change inclined participants to follow up with audiological care.

Secondary prevention strategies, such as hearing screening programs, are essential to detect hearing loss early and to ensure that intervention is provided promptly (Wilson et al., 2017). To make hearing loss screening methods widely available, digits-in-noise (DIN) tests delivered through telephone and Internet platforms have proliferated in recent years (Jansen et al., 2010; Smits et al., 2004; Watson et al., 2012). To cope with poor landline penetration in South Africa (Statistics South Africa, 2016), a self-test for hearing was launched as a smart device app (*hearZA*) in 2016 (De Sousa et al., 2018; Potgieter et al., 2016, 2018). hearScreen USA and hearWHO were also recently launched as similar apps for online hearing screening tests in other countries. The test is clinically validated and uses digits presented in speech-weighted noise to adaptively determine the signal-to-noise ratio (SNR) where 50% of the digit triplets are recognized correctly (Potgieter et al., 2016, 2018). Although sentences were historically preferred for speech-in-noise assessment, the use of digits makes speech-in-noise testing widely applicable because digits are easily understood in multilingual environments and by people with limited linguistic skills (Smits et al., 2013). The test indicates functional hearing ability with high sensitivity and specificity (> 70%) to detect a sensorineural hearing loss in the better ear of more than 25 dB HL using a four-frequency pure-tone average, for native (high English proficiency) and nonnative (lower English proficiency) English speakers (Potgieter et al., 2018).

Besides hearing screening, the DIN test app also serves as a public awareness tool for hearing loss. It can monitor oneself or someone else's hearing status using personalized profiles and can connect people to a hearing health care provider using location-based referral systems (De Sousa et al., 2018; Swanepoel, 2017). The app includes a decision support tool, developed in collaboration with the Ida Institute (Denmark), encouraging listeners to take the next step to manage their hearing loss (De Sousa et al., 2018; Swanepoel, 2017). In this way, smart device–based screening methods are offering new possibilities not only for detection but also for supporting listeners by aiding their decision making and linking them with professionals (Swanepoel et al., 2019).

Although the DIN test provides access to accurate screening, it does not guarantee follow-through with actions to address hearing loss (Chou et al., 2011; Gussekloo et al., 2003; Laplante-Lévesque et al., 2015; Linssen et al., 2013; Meyer et al., 2011; Smits et al., 2006; Swanepoel et al., 2019; Yueh et al., 2003). Various factors, such as the perception of symptom severity or stigma associated with hearing loss, have been reported to influence readiness to take up action (Gussekloo et al., 2003; Wallhagen, 2009). Furthermore, access to hearing specialists and cost of audiological services and aids could negatively affect help-seeking efforts (Bainbridge & Ramachandran, 2014). Help-seeking and rehabilitation are desired behavioral standards for individuals with hearing loss (Ingo et al., 2016). However, although hearing screening may increase the rate of help-seeking, it may not necessarily increase rehabilitation uptake (Arlinger, 2003; Smits et al., 2006). Characteristics of individuals who are aware of their hearing loss, but who are not seeking help or who decline rehabilitation, are elusive (Manchaiah et al., 2015). Meyer et al. (2011) followed up 4–5 months after the test on 193 participants who failed a telephone-based hearing screening and found that only 36 sought help by contacting a professional. Nineteen were recommended hearing aids, but only eight received hearing aids, of whom six reported successful outcomes (Meyer et al., 2011). Therefore, about 3% of individuals who failed the screening achieved the desired outcome of rehabilitation. Analyzing help-seeking for hearing loss within a framework of a multifactorial model of change could help health care practitioners understand individual behaviors toward health care practices and ways to alter those behaviors (Saunders et al., 2012).

The transtheoretical stages of change (SoC) model is designed to describe an individual's current attitudes, behaviors, and intentions to assess their readiness to change by adopting and sustaining healthy behaviors (Ekberg et al., 2016; Prochaska & DiClemente, 1983). The original model consisted of four sequential SoC: precontemplation, contemplation, action, and maintenance (Prochaska & DiClemente, 1983). The model was later revised to include the preparation stage between contemplation and action stage (Prochaska et al., 1992), acknowledging the need for adequate guidance for adults who are yet to seek help for their hearing (Laplante-Lévesque et al., 2015, 2013). These individuals have a more definite plan of action than those in the earlier stages (Laplante-Lévesque et al., 2013). Identifying an individual's SoC may ultimately help tailor a screening and intervention program to promote help-seeking and rehabilitation (Ekberg et al., 2016; Ingo et al., 2017; Laplante-Lévesque et al., 2015, 2013).

A staging questionnaire (Staging algorithm), based on the SoC, was developed by Milstein and Weinstein (2002) to categorize people with hearing loss into a specific stage of readiness to contemplate or accept intervention (e.g., hearing aids). The algorithm consists of a single question: *Which of the following statements best describes your view of your current hearing status?* Four possible answers are offered, each referring to one of four SoC (Milstein & Weinstein, 2002): (a) I do not think I have a hearing problem, and therefore, nothing should be done about it (precontemplation); (b) I think I have a hearing problem. However, I am not yet ready to take any action to solve the problem, but I might do so in the future (contemplation); (c) I know I have a hearing problem, and I intend to take action to solve it soon (preparation), and; (d) I know I have a hearing problem, and I am here to take action to solve it now (action; Milstein & Weinstein, 2002; Prochaska et al., 1992).

Laplante-Lévesque et al. (2015) classified adults who failed an online screening test using the staging questionnaire and found that 50% of participants were in preparation, 38% were in contemplation, 9% were in precontemplation, and only 3% were in the action stage. The small percentage of participants in the action stage suggests that screening alone may not be sufficient motivation to seek professional assistance (Laplante-Lévesque et al., 2015). Lin et al. (2011) found substantial differences in the rates of hearing aid use according to the severity of the hearing loss. Of those with mild hearing loss, 3.4% used hearing aids, compared to 40.0% and 76.6% for those with moderate or severe hearing loss, respectively. Furthermore, the perception of the severity of the loss could have an influence on the motivation to seek out assistance for hearing loss (Gopinath et al., 2011). Laplante-Lévesque et al. (2013) found that individuals with less severe hearing loss, who report less hearing disability and who have lived with their hearing loss for a shorter duration of time, are prone to be in the earlier SoC. This suggests those with mild hearing loss do not perceive their difficulties as having a negative impact on their lives. As a result, they do not seek assistance.

Help-seeking behaviors for chronic conditions such as hearing loss are complex (Saunders et al., 2012), and many factors may influence those behaviors. Meyer et al. (2011) identified two factors that could influence the decision to take action, the individual's consideration of hearing aids before a hearing screening test, and their ability to recall their test results. Almost half (45%) of individuals who correctly recalled their test results sought help for their hearing loss. In contrast, for individuals who did not recall their test results, only 15% sought help (Meyer et al., 2011). Low reported recall rates may be attributed to individuals not being ready to accept that they have a hearing loss severe enough to warrant taking action and therefore do not disclose their test results (Meyer et al., 2011). However, they may also

indicate a problem with the transfer of test results from tester to client/patient (Meyer et al., 2011).

W. Miller and Rollnick (2002) suggest that the SoC can inform intervention and counseling needs when motivational interviewing takes place. Moreover, a randomized controlled trial found that motivational interviewing achieved better treatment outcomes than traditional methods of advice for both psychological and physiological health conditions (Rubak et al., 2005). SoC measures implemented together with online hearing screening provide good predictive validity for help-seeking (Ingo et al., 2016) and can therefore direct appropriate motivational counseling toward timely uptake of interventions.

Population-based DIN screening may thus provide individuals with a means to confirm a hearing loss but may be insufficient to motivate transition toward action (Laplante-Lévesque et al., 2015). A more extensive understanding of an individual's motivation at the time of the screening may better predict and, perhaps, influence actions taken (Ingo et al., 2016). More evidence on the SoC as applied to hearing loss is required to understand the patient journey toward rehabilitation (Manchaiah et al., 2015). Identifying a person's profile and specific needs would be valuable to provide appropriate person-centered intervention (Manchaiah et al., 2015). The national hearing screening test for South Africa was launched in 2016 as a smart device DIN app (*hearZA*) to increase access by capitalizing on the widespread penetration of smart devices (De Sousa et al., 2018). The purpose of this study was, therefore, to investigate characteristics, help-seeking behavior, and follow-up actions of people who failed the South African DIN national hearing screening, considering their SoC.

Method

The study received institutional review board approval from the Faculty of Humanities Research Ethics Committee, University of Pretoria (GW20181112S).

Participants

Phase 1: Retrospective Cross-Sectional Analysis of Listener Characteristics

In the period from March 2017 to March 2018, anonymized data from 5,331 failed *hearZA* tests were collected. Online informed consent to use data in an anonymized format was provided by accepting the terms and conditions and privacy policy of the *hearZA* app. Data of people younger than 18 years or older than 100 years (n = 1,025) or those who completed the test without earphones (n = 1,008) were excluded. Earlier versions of the app did not prevent test completion when earbuds or headphones were not plugged in, which was subsequently changed. Although the *hearZA* test is available on both iOS and Android platforms, the Staging algorithm implementation was adequate for Android platforms only, so tests completed on iOS devices were excluded (n = 755), resulting in 3,178 tests for analyses. The iOS devices did not accurately collect data because the iOS platform was not fully implemented at the time of testing.

South Africa has 11 official languages, and although English is widespread, is it estimated that less than 10% of the population speaks English as their first language (Statistics South Africa, 2018). Participants reported their level of English proficiency on a scale from 1 to 10. As described previously (Potgieter et al., 2016, 2018), people who reported ≥ 6 out of 10 were described as having high English proficiency. Listeners with low English proficiency (≤

5/10) were excluded due to the small sample size (n = 86), as this group was too small to include in the regression analyses as a separate variable. Pass and fail criteria were based on norms established by Potgieter et al. (2018): high English proficiency of ≥ 6 with a digits-in-noise speech recognition threshold (DIN SRT) cutoff of −9.6 dB SNR. When the DIN and another form of a speech-in-noise test, such as the words-in-noise test, were compared, normative criteria for cutoff differed. Better DIN cutoff could be attributed to DIN tests that are closed-set stimuli, the overlearned nature of the digits, and simpler linguistic structure (G. A. Miller et al., 1951; Smits et al., 2013). Only listeners with a fail were included, resulting in 3,092 listeners left for analyses.

Phase 2: Prospective Help-Seeking Survey

Informed consent to contact participants for Phase 2 was provided within the app in Phase 1, as they selected the terms set out in the application. Only participants that indicated their English competence was high (≥ 6/10) received further communication for Phase 2. Additionally, informed consent to participate in Phase 2 was provided by clicking on the link to complete the survey. A prospective survey was sent to the participants from Phase 1 who requested to be contacted by a hearing care professional (n = 1,007). An average delay of 20.7 months (SD = 3.1 months) was present between the fail screening result and completion of the online survey. Fifty-nine participants between the age of 18 and 81 years (average age = 48.3 years, SD = 17.2 years) responded.

Procedure

Phase 1. Retrospective Cross-Sectional Analysis of Listener Characteristics

Listeners completed the DIN test by downloading the *hearZA* app (available on AppStore and Google Play) on their smart device (smartphone/tablet). The app was available in other countries where app stores were available. Prior to initiating the test, the application required the listener to enter their date of birth, home language, presence of known hearing loss, and self-rated English competence. In addition, listeners were linked to an SoC using adapted phrasing of the Staging algorithm (see Figure 1), presented in the form of either one or two questions (Ingo et al., 2016, 2017; Ratanjee-Vanmali et al., 2018). Then speech-in-noise testing started. First, the application instructed the listener to select a comfortable listening intensity before the test commenced. The listener was required to enter the digits heard onto the keypad shown on the screen. The test used a fixed overall level (i.e., the level of the mixed speech and noise signal) and a 1-up, 1-down adaptive procedure with a 2-dB step size (Potgieter et al., 2016, 2018). When triplets with negative SNRs were presented, the noise remained at a fixed level (70 dB SPL) while the speech level varied in 2-dB steps. When triplets with positive SNRs were presented, the speech level became fixed and the noise level varied. The application presented the digits diotically together with broadband speech-weighted masking noise. The test presented 23 digit triplets, of which the DIN SRT was calculated by averaging the last 19 SNRs (Potgieter et al., 2016, 2018). After completing the test, listeners who failed, indicative of four-frequency pure-tone average > 25 dB HL in the better ear, could opt to be contacted by their closest hearing health care professional based on their geolocation when completing the DIN test. Data were stored on a secure cloud-based server.

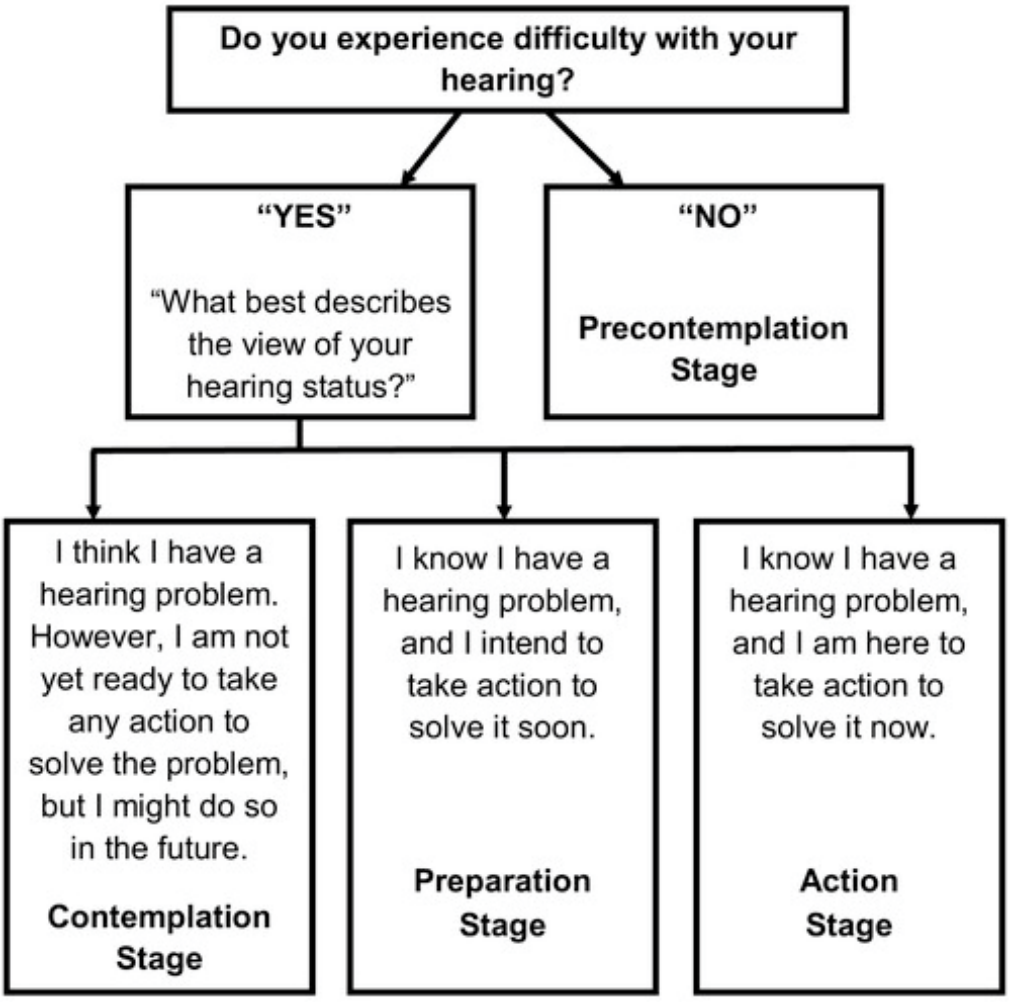

Figure 1. Staging algorithm embedded in *hearZA* application.

Phase 2: Prospective Help-Seeking Survey

People who failed the *hearZA* screening test and requested contact with a hearing health care professional in their area were included in this phase. People requesting to be contacted by an audiologist, based on geolocation, left their contact details. These were subsequently shared securely to the three closest audiology practices registered on the *hearZA* referral platform. For this phase, these individuals were sent a link to an online survey using either a short message service or an electronic mail. Individuals were only contacted once, as South Africa's Protection of Personal Information Act, which applies to the application, prohibits multiple contact attempts if individuals do not respond to the initial request. The online survey was designed (Google forms) to obtain information on attendance at an audiological follow-up appointment after the screening and, for those who did not follow up, to give personalized reasons why they did not proceed to seek help. Furthermore, information on the recommendations made and follow-up actions were collected. Satisfaction of the outcomes was collected with a 4-point Likert scale. Additionally, participants could provide personalized reasons for not following through with the recommendations.

Data Analysis

Data were analyzed using the Statistical Package of the Social Sciences (SPSS v.25.0). For the retrospective phase, an ordinal regression analysis was conducted to assess whether DIN SRT and age affected a listener's SoC. A one-way analysis of variance and an analysis of covariance were used to determine age and DIN SRT differences between SoC, respectively. Post hoc tests were done using a Bonferroni adjustment. Independent-samples *t* test and chi-square test for association was used for comparison of characteristics of Phases 1 and 2.

Results

Phase 1: Retrospective Cross-Sectional Analysis of Listener Characteristics

The average age of listeners who failed the test (n = 3,092) was 46.0 years (SD = 18.5 years). The minimum age of the listeners was 18 years, and the maximum age was 99 years. Of the listeners who indicated gender (446/3,092), 190 were women (43.0%). The distributions of SoC indicated 75.5% of listeners were in the precontemplation stage, 9.7% in the contemplation stage, 8.2% in the preparation stage, and 6.6% in the action stage. Figure 2 depicts the corresponding age and DIN SRT for each of the four SoC.

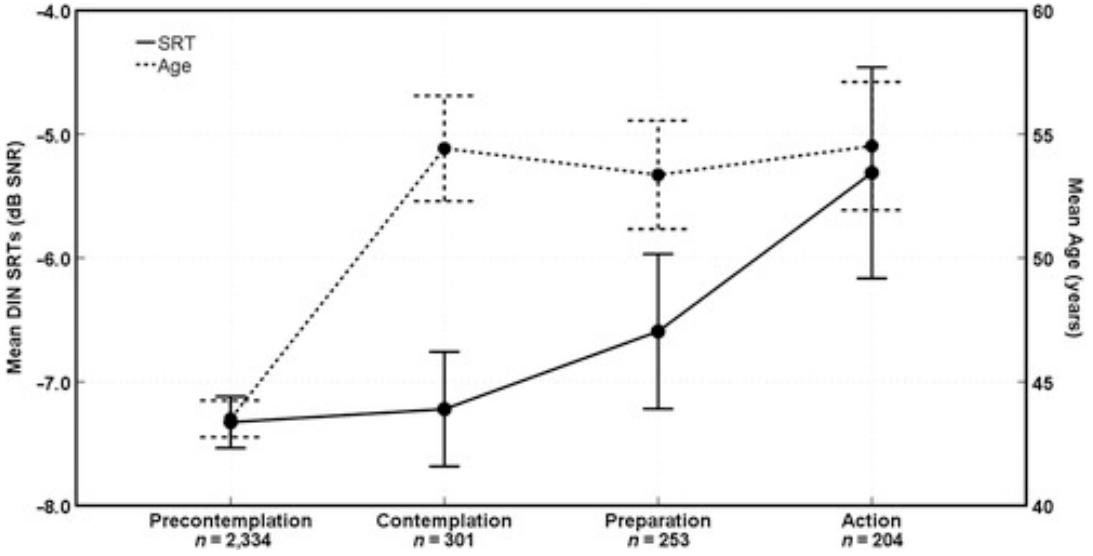

Figure 2. Mean age and digits-in-noise speech recognition threshold (DIN SRT) for corresponding stage of change. Error bars indicate ± 2 *SE*s from the mean.

Ordinal logistic regression showed that poorer DIN SRT (OR = 1.03 [1.015, 1.046], Wald $\chi^2(1) = 15.072$, $p < .001$) and increasing age (OR = 1.031 [1.026 1.035], Wald $\chi^2(1) = 166.938$, $p < .001$) increased the odds of being in a more advanced SoC. Listeners in the precontemplation stage were significantly younger than the participants in other stages, $F(3, 3088) = 11.155$, $p < .0005$. Listeners in the action stage had a significantly worse DIN SRT than participants in other stages, $F(3, 3087) = 9.487$, $p < .0005$.

Phase 2: Prospective Help-Seeking Survey

Approximately one third (1,007/3,092) of participants from Phase 1 who failed the screening requested to be contacted by a hearing health care professional. These participants were invited to take part in the prospective survey: The response rate for the survey was 5.9% (59/1007). Of these, 20.3% (12/59) of participants were in the contemplation, preparation, or action stage at the initial hearing screening test. Approximately 80% (47/59) of surveyed respondents were in the precontemplation stage (see Table 1). Only 10.6% (5/47) of participants in the precontemplation stage attended an appointment with an audiologist after a failed screening test. In contrast, 25.0% (3/12) of participants in contemplation to action stages attended an appointment with an audiologist (see Table 1). Participants in the precontemplation stage had a mean DIN SRT of −7.5 dB SNR and mean age of 46.7 years compared to a mean DIN SRT of −4.9 dB and mean age of 54.3 years across contemplation to action stages, suggesting that those with poorer speech understanding in noise and those who were older tended to be in a more advanced state of change (see Table 1).

Table 1. Initial stage of change, age, digits-in-noise speech recognition threshold (DIN SRT), and follow-up action for surveyed respondents (n = 59).

Stage	Percentage (n)	M_{age} (SD)	Mean DIN SRT (SD) (min; max)	Participants who followed up with an audiologist (n)	
				Yes	No
Precontemplation	79.7% (47/59)	46.7 (17.2)	−7.5 (5.5) (−9.8; 16.5)	5	42
Contemplation	11.9% (7/59)	58.6 (16.9)	−7.8 (1.7) (−9.8; −6.2)	1	6
Preparation	5.1% (3/59)	46.0 (20.4)	2.6 (13.1) (−9.6; 16.5)	1	2
Action	3.4% (2/59)	52.0 (12.7)	−6.1 (0.7) (−9.6; −5.6)	1	1

About 13.6% (8/59) participants followed up with an audiologist, of whom half were recommended hearing aids, two were referred to an otorhinolaryngologist (ENT), and two had normal audiometric results. Four participants proceeded with these recommendations, three with hearing aids, and one with an ENT evaluation. Two participants who did not proceed with the recommendations indicated that they would do something about their hearing in the next year. Furthermore, two participants with normal audiometric results received no further recommendations.

Only 5.1% (3/59) of participants indicated that an audiologist contacted them following their failed screening test. Fifty-one of the total sample of participants (86.4%) did not independently seek further help by contacting an audiologist. These participants chose from Options 1–3 (see Table 2) in the survey that provided a reason for their lack of help-seeking. However, the majority (82.4%, 42/51) of those did not think they had a hearing loss and therefore were in the precontemplation stage. Participants could also opt to select an "other" option to provide individualized answers. Table 2 displays the most frequently reported personalized reasons for not pursuing any actions after a failed test. As can be seen in Table 3, although the response rate of Phase 2 was only 59/1,007 (5.9%), the characteristics of the respondents did not differ significantly from the 3,092 participants who failed the DIN test in Phase 1 considering age, DIN SRT, and SoC.

Table 2. Main reason identified by participants for not following up after a failed test result (n = 51).

Reason for no follow-up action	%
1. Did not think they have a hearing loss	51.0
2. Aware of hearing loss but not ready to seek help	13.7
3. Aware of hearing problem and will seek help within the next year	13.7
4. Financial constraints	11.8
5. Not contacted by an audiologist	5.9
6. Stigma	2.0
7. Living abroad	2.0

Table 3. Characteristic comparison of samples of Phase 1 and Phase 2.

Characteristic	Phase 1 (n = 3,097)	Phase 2 (n = 59)	Group differences
			Independent sample t test
Age, M (SD)	46.0 (18.5)	48.3 (17.2)	$p > .05$
SRT, M (SD)	−7.1 (5.0)	−6.9 (5.9)	$p > .05$
Stage of change			χ^2
Precontemplation	75.5% (n = 2,334)	79.7% (n = 47)	*(Precontemplation vs. remaining combined stages)* $p > .05$
Contemplation	9.7% (n = 301)	11.9% (n = 7)	
Preparation	8.2% (n = 253)	5.1% (n = 3)	
Action	6.6% (n = 204)	3.4% (n = 2)	

Note. No significant differences in age, digits-in-noise speech recognition threshold, or distribution of stage of change between the two samples.

Discussion

Phase 1: Retrospective Cross-Sectional Analysis of Listener Characteristics

Overall, hearing screening has been proposed as a method to promote help-seeking for people with hearing loss (Arlinger, 2003). Various studies have investigated the help-seeking rates following adult hearing screening, and the outcomes have varied greatly, from as low as 2.7% to as high as 61.0% (Ingo et al., 2016, 2017; Laplante-Lévesque et al., 2015; Meyer et al., 2011; Ratanjee-Vanmali et al., 2018; Smits et al., 2006; Yueh et al., 2010). In this study, a minority (6.6%) of listeners who completed the *hearZA* smart device screening were in the action stage of readiness, with the majority (75.5%) in the precontemplation stage and typically not willing to pursue further diagnostics or intervention at the time. Similar findings regarding online screening programs have been reported with less than 8.0% of people who failed the screening test in the action stage (Ingo et al., 2017; Laplante-Lévesque et al., 2015). Screening on its own may not be enough to promote help-seeking for hearing loss (Laplante-Lévesque et al., 2015). Assisting people to decide to follow up with a hearing health care professional using tailored tools inspired by health behavior change theories could promote follow-up action (Pronk et al., 2011). Furthermore, Ratanjee-Vanmali et al. (2018) indicated that online digital tools in combination with face-to-face consultations may hold promise for improved service delivery outcomes. They suggested that service providers can use such modes to support individuals during initial stages of seeking hearing health care online before attending a physical appointment (Ratanjee-Vanmali et al., 2018).

Previous studies indicated that people with more severe hearing loss are more inclined to seek diagnostic help and intervention (Laplante-Lévesque et al., 2013; Meyer & Hickson, 2012). The DIN SRT was significantly worse in the action stage compared to the preceding stages. The more severe the DIN SRT, the more likely an individual was to be in a later SoC and therefore to seek out assistance for their hearing loss. This indicated DIN SRT was a predictor of SoC. In contrast, a study that used online adaptive hearing screening with a closed set of words to determine the SRT did not report a relationship between SRT and SoC. In the study by Laplante-Lévesque et al. (2015), SoC was determined after the screening, whereas our study collected it before the screening. Providing the results of the screening could thus influence the SoC measured. However, earlier research has indicated that the stage of readiness for intervention did not differ when the SoC was presented before and after hearing screening (Milstein & Weinstein, 2002). The average age of listeners in our study was 46 years compared to 68 years in a previous study (Ingo et al., 2016, 2017; Laplante-Lévesque et al., 2015, 2013). The younger age of participants in our study may be attributable to the smart device screening test being advertised through digital marketing campaigns. The test was marketed as a tool for younger people to "know their hearing status," rather than to confirm a suspected hearing loss (De Sousa et al., 2018). Moreover, the study by Laplante-Lévesque et al. implemented the University of Rhode Island Change Assessment (URICA) SoC measurement, whereas this study used the Staging algorithm. The former study showed no relationship between the URICA SoC measurement and SRT, but our study indicated a relationship between the Staging algorithm measures and DIN SRTs. The Staging algorithm may be a better suited measure than URICA to identify a relationship between SoC and DIN SRT.

Age significantly predicted SoC, with listeners in the precontemplation stage significantly younger than those in successive stages, as found in other studies using online DIN hearing screening (De Sousa et al., 2018; Ratanjee-Vanmali et al., 2018). With younger age also associated with better DIN SRT, fewer difficulties related to hearing loss may be perceived, leading to more participants in the precontemplation stage. Older age is associated with hearing loss; approximately one third of individuals 65 years and older are affected by a disabling hearing loss (World Health Organization, 2018). Since noticing hearing loss, it takes individuals, on average, 10 years to seek help (Davis et al., 2007; Hickson et al., 2014; Meyer et al., 2014). Consequently, older individuals have had a longer time since the onset of hearing loss to accept them. Our listeners may thus be represented mainly in the precontemplation stage due to their younger age. They were also recruited through marketing campaigns directed at discovering hearing status, rather than confirming a hearing loss, so they may not actively been seeking out assistance for their hearing loss. In comparison, the participants in the study of Laplante-Lévesque et al. (2015) were older and subsequently more represented in the contemplation and preparation stages.

Phase 2: Prospective Help-Seeking Survey

One in every three participants who failed the initial hearing screening test opted to be contacted by a hearing professional. Approximately 13% of the participants in this study followed up with a hearing care professional, of whom the majority (63.0%) proceeded with treatment recommendations, including acquiring hearing aids and complying with ENT referrals. One in 10 participants in the precontemplation stage followed up with a hearing care professional as opposed to one in four across the contemplation, preparation, and action stages. Meyer et al. (2011) reported that 36.0% of failed screenings sought help, and only 5.0% acquired hearing aids, which is similar to the 5.0% hearing aid uptake (3/59) in the

current study. Ingo et al. (2016) observed higher follow-up rates (60.8%), with 25.4% of those who failed the screening obtained hearing aids, despite only 12.2% being in the action stage. Only 1.4% of participants in the Ingo et al. study who sought help were in the precontemplation stage before their initial screening compared to 10.6% in the current study. In another previous study, participants who were in the precontemplation stage had less successful intervention outcomes compared to those who scored higher on the action stage, being more likely to take up hearing intervention 6 months later (Laplante-Lévesque et al., 2013). Similarly, Saunders et al. (2016) indicated that less than 15% of participants in the precontemplation stage at baseline acquired hearing aids 6 months later, compared to the nearly 80% of participants who were in the action stage at baseline and acquired hearing aids. Using the transtheoretical SoC model can, therefore, be a robust predictor of intervention uptake and successful outcomes. Targeting those in the precontemplation stage could inform candidacy for audiological rehabilitation and help identify clients before they are likely to require more clinical attention (Laplante-Lévesque et al., 2012, 2013).

In the current study, very few (5.1%) of the surveyed respondents reported being contacted by a hearing professional. This points to a problem in the pathway from *hearZA*, referral to successful professional support, and therefore, further investigation is required to identify its causes. The majority (86.4%) of participants who failed the screening test and requested to be contacted by an audiologist did not self-initiate further action. Primary reasons for not following up included not noticing hearing loss (51.0%), followed by not being ready to take action yet (13.7%) or planning to take action in the next year (13.7%). Financial constraints were also highlighted (11.8%) as a prohibitive reason. Cost of hearing health care and of hearing aids, in particular, has been identified as a reason for the delay in not seeking out help for hearing loss (Fischer et al., 2011; Kochkin, 2007).

Most surveyed participants were in the precontemplation stage at screening. The precontemplation stage is characterized by people not realizing they have a hearing loss or thinking nothing should be done about it (Milstein & Weinstein, 2002). Interestingly, these participants still opted to be contacted. However, participants provided their SoC before taking the screening test and only submitted contact details once informed of the fail result. It could be that they initially thought no hearing loss were present but, once they failed, may have wanted further information on their test result. Furthermore, the SoC may better be represented as a continuum rather than a movement from one distinct step to another (Laplante-Lévesque et al., 2013). Therefore, these individuals may be represented across more than one stage or as transitioning between stages.

Screening test outcomes were followed up and related to the SoC measure to determine the effectiveness of hearing screening without additional motivators. This study provides outcomes of the application of the Staging algorithm as a single measure of SoC presented together with online hearing screening. Clinically, this is of importance as we can provide directed support based on their SoC to ensure timely help-seeking. Furthermore, participants could provide reasons for their lack of follow-up, highlighting barriers to help-seeking following a fail result, with particular focus on the precontemplation stage. Screening, in combination with additional motivators, might improve help-seeking.

Although the response rate in Phase 2 was low, there was no evidence of response bias (i.e., systematic difference between participants who responded and those who did not). Participants in Phase 1 (retrospective) and Phase 2 (prospective) did not differ significantly (see Table 3) in terms of age, DIN SRT, and distribution of SoC supporting the assumption

that it is a representative subsample of Phase 1 participants. Future research could assess whether timely follow-up from a professional or online aural rehabilitation after a failed screening increases awareness of hearing loss.

Study Limitations

Online marketing led to samples that were younger than typical first-time audiology patients in a public health perspective of prevention and early detection and intervention. Younger age may impede help-seeking behavior due to milder degrees of hearing loss compared to older populations (Meyer & Hickson, 2012). Therefore, conclusions are only relevant for preclinical populations and are unlikely to be generalizable to people seeking traditional diagnostic services. The average delay of nearly 2 years between hearing screening may have contributed to low response rates and could have also lead to inconsistencies in reporting.

Audiological services require technology for assessment and intervention for hearing loss. In South Africa, service provision and resources are constrained, particularly within the public sector (Swanepoel et al., 2009). This rather than lack of readiness may have been a barrier to help-seeking by participants in this study due to poor access and perceived affordability of hearing care. The SoC model may therefore not capture all the factors determining help-seeking behavior.

Pinpointing geographical locations where screenings took place proved to be challenging because location information was an optional app permission. Therefore, interpretations could not be made with regard to the available services in the area where the participants' were screened, which may have influenced help-seeking, or lack thereof.

Conclusion

Older people who completed a hearing screening presented with poorer DIN SRTs and were typically in more advanced SoC than younger participants. Therefore, a combination of factors predispose people to follow-up screening with audiological care.

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