

# Enhancing Screening Systems to Facilitate Hearing-Healthcare Access: A Qualitative Study

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## Abstract

**Background:** Although hearing loss is a common health issue, hearing healthcare (HHC) is poorly accessed. Screening to identify hearing loss is an important part of HHC access, specifically for those who screen positive for hearing loss and would benefit from seeing a HHC provider. New technologies can be automated to provide information and recommendations that are tailored to the needs of individual users, potentially enhancing rates of HHC access after positive screens. A greater understanding of the facilitators of postscreening HHC access that could be leveraged in such systems is needed.

**Purpose:** The purpose of this project was to identify facilitators of postscreening HHC access that can be used in automated screening systems.

**Research Design:** This qualitative study used focus groups (FGs) to understand perceived barriers, perceived benefits, and potential cues to action, as informed by the Health Belief Model, for accessing HHC after use of automated hearing screening systems.

**Study Sample:** Fifty individuals participated in one of seven FGs. FGs were conducted separately with three types of stakeholders: four FGs included adults who reported some degree of perceived hearing loss and had recently completed a hearing screening; two FGs included adults who had recently sought HHC for the first time because of hearing loss; and one FG involved significant others/family members of individuals with hearing loss.

**Data Collection and Analysis:** FGs were 60–90 minutes in length and were led by a trained facilitator following a discussion guide. A research audiologist was present at each FG and served as a notetaker. FGs were recorded and transcribed by research team members, and transcripts were then coded in an iterative process by multiple team members. Qualitative content analysis was used to reduce data and to identify salient themes and subthemes, following an inductive approach. We focused on identifying themes that were related to facilitators of HHC access after positive screens for hearing loss and, separately, potential enhancements to automated hearing screening systems that would leverage these facilitators to improve HHC access.

**Results:** We identified five key themes related to HHC access after a positive screen for hearing loss, along with ideas for enhancing automated hearing screening systems based on these themes. The themes included knowledge, trust, access, quality of life, and interpersonal influence.

**Conclusions:** The results of our work help inform the development of innovative hearing screening systems that can be automated to leverage individual facilitators of HHC access.

**Key Words:** audiology, auditory rehabilitation, hearing, hearing healthcare, kiosk, screening

**Abbreviations:** FG = focus group; HBM = Health Belief Model; HHC = hearing healthcare; IRB = Institutional Review Board; QOL = quality of life; VA = Veterans Affairs

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## INTRODUCTION

Hearing loss is a major source of disability in the United States and other countries (World Health Organization, 2013). Although hearing loss is a common health issue, hearing healthcare (HHC) is poorly accessed (Gates et al, 1990; Smits et al, 2006; Lin et al, 2011; Nash et al, 2013). Screening to identify individuals with hearing loss who could benefit from auditory rehabilitation is an important part of HHC access; however, significant proportions of individuals who screen positive for hearing loss still fail to seek HHC (Yueh et al, 2010; Chou et al, 2011; Meyer et al, 2011; Thodi et al, 2013; Ingo et al, 2016).

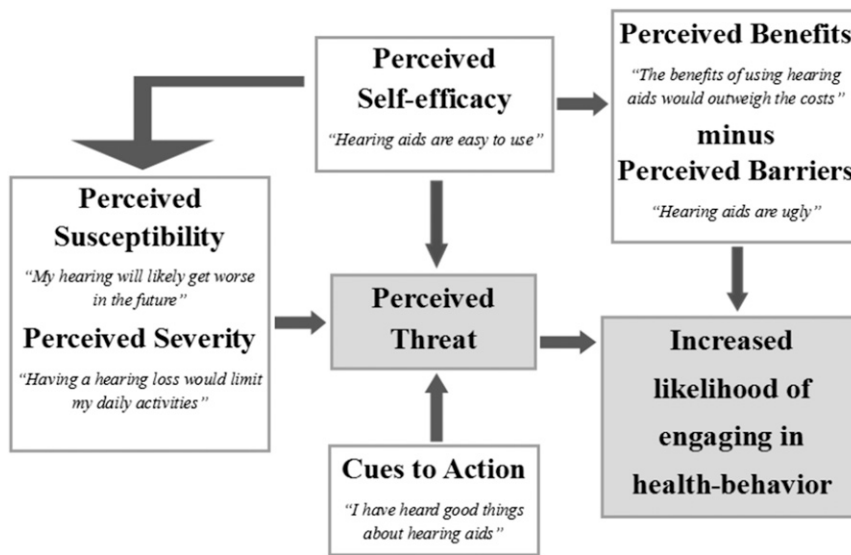
Across public health and medicine broadly, new technologies are being developed to improve screening and subsequent access to healthcare. These technological innovations include telephone-based screenings, mobile apps, and community- or healthcare-based kiosks with enhanced user interfaces such as touch screens (Folmer et al, 2012; Bolin et al, 2013; Gaydos et al, 2013; Joshi et al, 2013; Eakin et al, 2014; Saunders et al, 2015; Schluter et al, 2015; Folmer et al, 2017). The integration of user-friendly, automated technologies into healthcare has been successful across a large number of specialties (Bolin et al, 2013; Dale et al, 2014; Eakin et al, 2014; Rosas et al, 2014; Schluter et al, 2015). In tandem, there has been considerable focus on the integration of new technologies into HHC, particularly hearing screening programs (Donahue et al, 2010; Stenfelt et al, 2011). Recent developments include telephone-based hearing screening systems (traditional landline phones and mobile phones), speech-based screening methods, mobile health or “m-health” hearing screening apps, and internet-based hearing screening programs (Meyer et al, 2011; Szudek et al, 2012; Watson et al, 2012; Zokoll et al, 2013; Swanepoel de et al, 2014). Technology-driven screening systems can be automated to provide information and recommendations that are tailored to the needs of individual users, potentially helping facilitate their subsequent HHC access. The development and dissemination of validated technology-driven screening systems also affords the opportunity to bring hearing screening services to significantly larger portions of the population, a need that has been elucidated by public health practitioners (Reavis et al, 2016).

Despite their potential, current hearing screening innovations have not necessarily improved rates of HHC access among those potentially in need (Smits et al, 2006; Yueh et al, 2010; Meyer et al, 2011; Ingo et al, 2016). Yueh et al (2010) reported that of 462 participants screened with a pure-tone screening alone (40 dB HL at 2.0 kHz), a traditional hearing screening method, 86 (18.6%) failed the screening and 79% of those went on to seek HHC by one year. In comparison,

in the same study, only 31% of 272 participants who failed hearing screening using the Hearing Handicap Inventory for the Elderly sought HHC at one year. Similarly, in a 5-month follow-up of a telephone hearing screener using a digits-in-noise test, Smits et al (2006) found that only about 50% of respondents who failed the screening had sought hearing help. This is also similar to the findings of Meyer et al (2011), who reported that 36% of 193 participants who failed a telephone-based hearing screening test sought HHC. So, although hearing screening innovations may result in a higher number of positive screenings than traditional methods, they may not necessarily lead to a greater proportion of individuals seeking HHC.

Reasons for low rates of HHC access after failed screenings are largely unknown. Although there is an existing body of literature that describes the barriers to HHC access, much of this work has focused on hearing aid receipt, use, and satisfaction as the primary end points (Knudsen et al, 2010). Much less is known about factors that help or hinder entry into the HHC system *after* individuals screen positive for hearing loss, and whether these factors differ from those related to hearing aid uptake once an individual has engaged with the HHC system. Similarly, little is known about individuals’ experiences with automated hearing screening systems and what features of automated systems may be leveraged to help facilitate recommended follow-ups with HHC.

It is possible that hearing screening technologies could help increase HHC access if they better integrated factors known to prompt action among individual users. The Health Belief Model (HBM; Rosenstock, 1966) is a commonly used model for outlining the barriers and facilitators to corrective and preventive action regarding one’s own health. The HBM comprises six constructs: perceived susceptibility; perceived severity; perceived barriers; perceived benefits; cues to action; and self-efficacy. The HBM has been used to help guide data collection in past audiologic inquiries (Stephenson and Stephenson, 2011; Saunders et al, 2013; 2014; 2016a; 2016b; Pronk et al, 2017). Saunders et al (2016a) determined that individuals who were less ready to seek help had lower perceived self-efficacy (i.e., felt less capable of acquiring help for hearing loss), perceived fewer benefits (i.e., placed less value on hearing well), and had noticed fewer cues to action than those who were more ready to seek help. Conversely, individuals more ready for behavior change had higher self-efficacy, perceived hearing loss to have more negative impacts (i.e., higher perceived severity), and had noticed more cues to action than individuals with lower action scores. We have depicted the potential application of the HBM to hearing health and access to HHC in Figure 1, providing hypothetical quotes to illustrate each construct.



**Figure 1.** Health Belief Model (Rosenstock, 1966) applied to study framework for increasing hearing-healthcare access. Quotes are hypothetical and for illustration purposes.

Our team is using the HBM as a conceptual framework in mixed methods (i.e., qualitative and quantitative; Creswell and Plano Clark, 2011) research to develop a theory-based hearing screening system that integrates screening with education and counseling demonstrations within a screening kiosk that could be located in community settings (Folmer et al, 2017). An evaluation of the efficacy of kiosk-based hearing screening for improving HHC access is currently underway. The purpose of our qualitative research, presented herein, was to identify beliefs, attitudes, and mechanisms that might increase access to HHC after a positive screen for hearing loss (i.e., “facilitators” of HHC). Our focus was on factors with the potential to be integrated into hearing screening kiosks and other technological innovations in hearing screening that can enhance rates of HHC access among populations in need.

**METHODS**

**Overview**

All activities conducted as part of this study were approved by the Veterans Affairs (VA) Portland Health Care System and Oregon Health & Science University (OHSU) joint Institutional Review Board (IRB). This qualitative research used focus groups (FGs; Krueger and Casey, 2009) to encourage individuals with various levels and types of experience with hearing health and the HHC system to share their personal opinions and experiences. FGs were 60–90 minutes in duration and took place from April 2013 through May 2014. As in our overarching research program, the HBM served as a conceptual framework in the design of this qualitative study, as depicted in Figure 1. Consistent with

prior research findings (Saunders et al, 2016a), we particularly focused on the roles that (a) perceived barriers; (b) perceived benefits; and (c) cues to action may play in the decision to access HHC after a positive screen for hearing loss. These were selected as possible domains that could most readily be addressed in automated hearing screening systems such as those employed in community-based kiosks.

**Participant Recruitment**

FG participants were recruited through newspaper advertisements and flyers posted in the community, VA clinics, and an urban academic health center (Oregon Health and Science University). A repository of potential hearing health research participants maintained by the investigators’ institution was also used for recruitment purposes. Participants were offered \$20 as an incentive for participation. To triangulate perspectives from multiple types of stakeholders (Creswell and Plano Clark, 2011), we conducted separate FGs for three categories of participants: (a) adults who thought they had some degree of hearing loss and had recently used a hearing screening kiosk; (b) adults who had recently (within the past year) sought HHC for the first time because of hearing loss; and (c) significant others or family members of individuals with hearing loss. The first group—those who had recently used a hearing screening kiosk—comprised individuals who had participated in a pilot test of our newly developed hearing screening kiosk; this evaluation had recently taken place in research space at the investigators’ institution. These participants had not had a hearing test in the three years before using the hearing screening kiosk. The second group—those who had recently sought HHC for the

first time—had varied outcomes (e.g., hearing aid fittings) of their recent HHC visit. The third group—significant others/family members of individuals with hearing loss—had no eligibility requirements pertaining to their own hearing loss or use of HHC; their loved ones may or may not have recently accessed HHC.

### Data Collection

FGs were conducted in a conference room in a research space at the investigators' institution. All FGs were facilitated by the lead investigator (K.C.) with support from at least one other research team member who served as a FG notetaker (S.S. and J.V., both research audiologists). After completion of informed consent with participants, the facilitator welcomed participants and further oriented them to the format and expectations of the FG. Subsequently, the facilitator led a brief ice-breaker in which participants introduced themselves and described their experiences with hearing loss and/or HHC. The facilitator then led participants through the group interviews, adhering to the respective IRB-approved discussion guide (one for each group type, as described below). Main points that emerged during each section were summarized and checked for accuracy with participants before moving to subsequent sections/questions. At the conclusion of the FGs, participants were thanked for sharing their experiences and paid \$20 for their time. They were also provided the opportunity to further discuss FG points or ask questions of the research team. Debriefings between research team members were held after each FG. All interviews were audio recorded and subsequently transcribed by the notetakers, who had experience in transcription as well as in-depth knowledge of audiological terminology.

FG discussion guides were developed to promote conversation among participants relevant to the three HBM domains of particular focus (perceived barriers, perceived benefits, and cues to action). Similar discussion guides were developed for each FG type (i.e., there were only minor changes in wording to ensure language was relevant to each group type); all three guides were approved by the IRB before their use. The following are examples of interview questions asked of FG participants; example modifications made for the third stakeholder group (significant others/family members) are identified in brackets:

#### Perceived Barriers

- "If you [your loved one] have [has] never made an appointment for HHC, what has prevented you [your loved one] from making that first appointment?"
- "What are the biggest things that prevent you [your loved one] from making and attending a HHC appointment? Is this different from things that prevent

you [your loved one] from making other healthcare appointments?"

#### Perceived Benefits

- "What aspects of hearing loss do you think are the hardest to live with?"
- "In your opinion, what are the greatest benefits of having good hearing?"
- "What do you think is or would be the best part about seeing a HHC specialist?"

#### Cues to Action

- "Have [has] you [your loved one] ever made an appointment for HHC? If so, what caused you [your loved one] to make that first appointment?"
- "What are the biggest things that *help* you [your loved one] make and attend a HHC appointment? Is this different from the things that help with other healthcare appointments?"
- "Are there things that you think would make people like yourself [your loved one] more likely to get the HHC they need?"
- "What kind of information could an automated hearing screening system provide to encourage you [your loved one] to make that first appointment with a HHC provider?"
- "What do you wish your spouse/family members knew about hearing loss and HHC?"

#### Data Analysis

Qualitative data analysis was performed in the following stages: (a) familiarization with data (i.e., reviewing transcripts); (b) generating codes and code categories; (c) searching for themes; (d) reviewing themes; and (e) defining and naming themes (Krueger and Casey, 2009). The focus of data analysis was on identifying themes that were related to facilitators of HHC access after positive screens for hearing loss and, thus, might be leveraged in technological or other hearing screening innovations to help prompt action. Therefore, only the portions of each transcript that were pertinent to this focus were coded.

Generating codes and code categories (stage 2) involved identifying keywords or phrases that arose from the raw data that reflected participants' experiences, without interpretation from the study team, and then reducing coded data, where possible, into categories. For example, a participant comment about "Having to ask 'What?' over and over again," may be coded as "Asking What" under the code category of "Communication." This is an example of an inductive approach to data analysis, independent of the HBM constructs that helped guide the development of interview questions. Two research team members (S.S. and K.C.)

reviewed transcripts and developed and compiled these codes and code categories into a study codebook (stages 1–2). They then independently pilot coded the first interview transcript—identifying salient quotations and applying one or more codes as appropriate—and met to resolve discrepancies and refine the codebook as needed. This process was repeated iteratively throughout the coding of all interview transcripts.

The identification of themes (stages 3–5) followed a qualitative content analysis approach (Graneheim and Lundman, 2004; Knudsen et al, 2012) and was completed collaboratively by study team members. This approach helped further reduce the data, summarize higher level meanings that participants attributed to their experiences, and provide insight into the groups’ perceptions, emotions, and belief systems related to HHC. Based on the coded data, the team reflected analytically about what information emerged in reference to the study questions. For example, comments assigned under the code category of “Communication” contributed to the development of a theme reflecting social functioning and quality of life (QOL), with the idea that knowledge of this theme could be used to enhance relevant information provided to individuals who fail a hearing screening test (e.g., “This is a demonstration of how hearing loss may affect your communication with coworkers, friends, and loved ones...”), with the intent of prompting follow-up action. The themes presented in this article represent those determined by the research team to best reflect the weight, emotion, emphasis, and extensiveness of participants’ comments (Krueger and Casey, 2009) relative to our analytical focus (facilitators of HHC access after a positive screen). Within each theme, information was also organized into subthemes to further help summarize and contextualize the common discussion points among participants (Graneheim and Lundman, 2004). Finally, potential enhancements to hearing screening kiosks or other screening technologies that would leverage the facilitators encompassed by each theme were identified.

Data analysis was conducted concurrent with ongoing FGs. Once analyses revealed no new themes emerging from the interviews (a concept known as “saturation”;

Krueger and Casey, 2009; Knudsen et al, 2012), the team stopped scheduling additional FGs. Thematic saturation was reached after seven FGs (four involving those with self-perceived hearing loss who had recently tested the hearing screening kiosk; two involving those who had recently sought HHC for the first time; and one involving significant others/family members of individuals with hearing loss). The research project was initially designed (and IRB-approved) so that up to 12 FGs could be conducted in an attempt to reach thematic saturation.

## RESULTS

### FG Participants

FGs involved 3–11 individuals each, for a total of 50 participants (39 with self-perceived hearing loss who tested the kiosk; eight who had recently sought HHC for the first time; and three significant others/family members of individuals [men] with hearing loss). Relatively large proportions of participants were women (n = 21; 42%) and/or veterans (n = 21; 42%). Participant characteristics by stakeholder type are summarized in Table 1.

### Facilitators of HHC

Five primary themes emerged across FGs that were related to the likelihood of seeking HHC after screening positive for hearing loss. We perceived these themes as potential “facilitators” or, inversely, potential “barriers” to seeking HHC. These data-driven themes are reflective of the HBM constructs depicted in Figure 1, but represent a wide scope of factors associated with health behaviors and healthcare access in general. Themes are described in the following paragraphs in the order of their relative importance as determined by research team members. This was based on the weight, emotion, emphasis, and extensiveness of participants’ comments, as well as the frequency with which the themes came up (Krueger and Casey, 2009). The five themes were: (a) Knowledge; (b) Trust; (c) Access; (d) QOL;

**Table 1. Characteristics of n = 50 Participants in FG Interviews**

	FGs 1–4*	FGs 5–6†	FG 7‡	Total Sample
Participant characteristics	n	n	n	n (%)
Total	39	8	3	50 (100%)
Male	25	4	0	29 (58%)
Veterans	18	2	1	21 (42%)
Age (years)	Median = 67 Range = 31–81	Median = 66.5 Range = 40–77	Median = 55 Range = 46–60	Median = 66.5 Range = 31–77

\*FGs 1–4 included those with self-perceived hearing loss who had not had a HHC visit in the prior three years but had recently used a hearing screening kiosk as part of the parent study.

†FGs 5–6 included those who had recently sought hearing-healthcare for the first time.

‡FG 7 included significant others of individuals (males) with hearing loss; both the FG participants and their loved ones may or may not have had recent HHC visits.

and (e) Interpersonal Influence. Within each theme, we also present respective subthemes; sample quotations to exemplify each are presented in Table 2. (Some small modifications to quotations were made to provide clarity or context and are denoted by brackets.) In the following paragraphs, ideas for enhancement to hearing screening kiosks or other screening technologies are described, in relation to each of these themes and subthemes.

### Theme 1: Knowledge

Many ideas about the benefits of gaining knowledge emerged when FG participants were asked about what encourages a patient with hearing loss to make a HHC appointment. Participants discussed entering the HHC system because they (or their significant other/family member) wanted to know more about their auditory health and how problems with hearing could affect them. As an example, the desire (or need) to learn more about the causes of and potential treatments for “Tinnitus” (subtheme 1) in relation to hearing health was brought up by multiple participants as a driving force in whether or not to seek a HHC provider. Similarly, gaining general “Hearing Health Knowledge” (subtheme 2) such as the determinants of hearing loss or establishing one’s own hearing baseline was also a common discussion topic. Some participants described their family history of hearing loss and their concern about inheritability of hearing loss as a reason to seek HHC.

Many participants also mentioned a desire to speak with a HHC provider simply to find out if there is “Hope” (subtheme 3) that their hearing loss can be treated at some point in the future. Hearing health knowledge and hope were closely intertwined throughout FG discussions. Relatedly, receiving quality information regarding “Aural Rehabilitation Options” (subtheme 4) was a salient point across all groups. FG participants expressed the desire to know what options were available for their particular hearing loss and how technology has made these options better (or less costly) in the past several years.

Finally, understanding the “Real-Life Implications” (subtheme 5) of hearing loss also emerged as a primary reason why one might seek HHC. Some participants acknowledged that they were probably unaware of the many ways in which hearing loss had negatively affected their day-to-day lives. Comments were made regarding the desire to learn how hearing loss is currently impacting one’s life and how these impacts may progress as hearing loss presumably worsens.

### Theme 2: Trust

Trust, or lack thereof, was a common discussion topic among FG participants and was brought up in relation to a number of aspects of HHC access. Three subthemes were elucidated regarding trust. Discussions regarding

the “HHC System” (subtheme 1) demonstrated that many participants had an innate sense of distrust for the HHC system simply because of the involvement of for-profit companies and the high cost of hearing aids. This point was shared across FG types. Many felt that the HHC provider may have a conflict of interest related to the sale of a device rather than having the patient’s best hearing-rehabilitation interest in mind. In this context, the advertisements/incentives used to encourage HHC access were often described with a sense of distrust.

The idea of receiving a “Recommendation from a Primary Healthcare Provider” (subtheme 2) often arose, and was closely related to the topic of trust. Participants frequently mentioned that they (or their loved ones) trust their primary healthcare provider and would follow a recommendation from them to seek HHC. However, some participants reported that their primary care provider does not bring up the topic of hearing.

The trustworthiness of “Hearing Screening Tests” (subtheme 3), whether administered in-person or through technological innovations such as telephones or kiosks, was also questioned across FGs. Individuals had a high level of skepticism for the testing they undergo, in general, at HHC facilities, but especially in reference to hearing screening tests. Participants shared a perception that screening tests provided through kiosks, especially in public settings, are perceived as inaccurate because of environmental noise, or are oftentimes conducted without adequate description of the procedures, results, and interpretation, or with whom (i.e., HHC companies) results would be shared.

### Theme 3: Access

Participants acknowledged difficulty and frustration related to accessing HHC. Two subthemes emerged from these discussions that provide insight into access issues that can encourage people to make and attend HHC appointments. First, the “Location” (subtheme 1) of the HHC provider and HHC services emerged as an important issue. Being able to easily get to the provider and services at a convenient or familiar location, such as a medical office or shopping area, was a priority for participants. Location within one’s established healthcare setting was also mentioned as a facilitator to seeking HHC.

Second, “Advertisements/Incentives” (subtheme 2), despite also having an effect on individuals’ sense of distrust of the HHC system, was identified as a strong facilitator of HHC access. Although some participants expressed skepticism about the advertisements to which they had been exposed, they also shared that a well-placed, meaningful ad with a monetary incentive could make—or had made—a difference for them in deciding to take the first step in accessing HHC.

**Table 2. Themes and Subthemes Related to Facilitators of Hearing Healthcare Access after Positive Screens for Hearing Loss, with Illustrative Quotations**

Themes	Subthemes	Illustrative Quotations
Knowledge	<b>1. Tinnitus</b>	<p>"Well I also have the tinnitus, and uh, that's why I called and wanted to know what the latest learning on tinnitus was and when I came here and had the hearing test I was told I had hearing loss which I didn't know."</p> <p>"If I got a hearing aid, I would have to crank the volume up to overcome the buzzing and hissing I've got going on anyway, so I considered [accessing HHC], but no."</p>
	Description: Participants described bothersome tinnitus as a priority when considering whether to seek HHC.	<p>"My dad's hearing is getting really bad, so I was a little concerned about how I was going in that direction."</p> <p>"[HHC providers] give you a sense of comfort too and tell you what exactly is going on and how extensive it is and whether or not it is going to progress. All of these questions are answered by the professional."</p>
	<b>2. Hearing Health Knowledge</b>	<p>"...and to know if [your hearing health] can be improved, to find out if your hearing can be improved by devices or whatever...or not."</p>
	Description: Participants needed and desired a greater level of understanding about many components of hearing health.	<p>"...and in my situation, it was nice to know that something could be done about it."</p> <p>"Where do you go to find out this whole range of things available to you?"</p>
	<b>3. Hope</b>	<p>"Well [learning about aural rehabilitation options] helps to set some kind of direction as to how you want to proceed. If you want to proceed on treatment, or maybe just find ways to deal with it..."</p>
Trust	<b>4. Aural Rehabilitation Options</b>	<p>"...being able to understand others, not having to turn the TV and radio up..."</p> <p>"I remember there's actually something about what you start missing when your hearing goes...I've heard the first thing is people walking through the grass."</p>
	Description: Participants were generally unaware of aural rehabilitation options and whether they might work for them/their loved ones; a desire for greater understanding about these options was expressed.	<p>"If you have a hearing aid company that's going to sponsor [a hearing screening], they would give you the full range of <i>their</i> products. They aren't going to tell you about 'xyz's' down the road. If it were sponsored by the government, it might have a more honest appraisal of what is available..."</p> <p>"[HHC companies] have other agendas most of the time. And that's why a lot of us still have hearing problems without it being treated."</p>
	<b>5. Real-Life Implications</b>	<p>"After mentioning [hearing difficulty] to my doctor, my doctor said 'you should probably get a hearing test.' So I did."</p>
	Description: Participants believed that HHC providers could help them understand the ways in which hearing loss can negatively impact functioning, or that rehabilitation could help.	<p>"I think I would just fall into a hearing test if my doctor would say '...and we're going to get your hearing test now. We just did your blood pressure, your weight, and we're going to test your hearing.'"</p> <p>"How do I know the results are really accurate?"</p> <p>"So where is the information collected and where does the data go? That's what I want to know."</p>
	<b>1. HHC System</b>	<p>"So where is the information collected and where does the data go? That's what I want to know."</p>
Description: Participants described an innate sense of distrust for HHC companies (and the advertisements/incentives used to sell hearing aids).		
<b>2. Recommendation from a primary healthcare Provider</b>		
Description: Participants expressed that they/their loved ones felt trustful of established healthcare providers and would follow their advice related to HHC.		
<b>3. Hearing Screening Tests</b>		
Description: Participants did not necessarily trust the results of hearing screening systems, particularly if located in public settings. Privacy of one's test results was also important to the participants.		

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Table 2. Continued

Themes	Subthemes	Illustrative Quotations
Access	<b>1. Location</b>	"You would be more liable to get your hearing test on a yearly basis if they were in a convenient location." "It was in close proximity to where I was working at the time, so that helped too" [Participant describing a visit to a hearing aid center.]
	Description: Participants described the location of HHC providers or services as influencing whether or not they sought care. <b>2. Advertisements/Incentives</b> Description: Participants explained that advertisements and incentives could serve as strong facilitators to seeking care.	"So I saw an ad in the [local newspaper] for a free hearing test and [after going] it was a great test and they have marvelous equipment. . ." ". . . I was kind of tuned in to [my need for a hearing test], but I wouldn't have gone if it hadn't been for the \$25 gift certificate."
QOL	<b>1. Social</b>	"Actually I sort of know, the first time they had to send me for a consultation to get me deployed [for military service] because apparently I'd lost 40% of my hearing. I was getting ready to go to Iraq and all of a sudden they said 'No wait, you need to go in for a consultation.' All of a sudden, it's like, whoa wait a minute now. If I can't deploy, it means I don't have a job." "If I get to the point where I don't hear people around me well enough to get along like I'm used to getting along, I will do something about it." "You have to hear the car in the intersection and when the train comes, and when the signal changes, you have to hear all of that." "Loss of quality of music is another big one." ". . . hearing is the ability to interact in your environmental in a way that works for you. So it's more than just conversation and birds. . . it's certainly interacting with coworkers, interacting with the environment whether it's, you know, traffic or anything."
	Description: Participants were aware of some ways in which hearing loss can affect social functioning. They described points at which functional limitations would finally encourage one to seek HHC. <b>2. Environmental</b> Description: Participants were aware of how hearing loss can affect one's interactions with their environment, such as decreasing physical safety and reducing participation in leisure activities.	"My wife, let's say, is the largest impetus for my getting hearing aids." "The grandkids. . . I just marginally understand at all. I think that's the saddest." "But then my friend said, 'What's wrong with you?' [. . . I was saying 'what?' a lot. . .] It was just the two of us in the car at that time, but she had some music on." "So you know, if his [peer] group were supportive of the idea that he got hearing aids, he might look at it differently." "Well my husband wears hearing aids. I'd just go to where he goes. If I didn't have him, I have a neighbor who wears hearing aids, I'd ask him. I'd just go by recommendation." "I'd go by my doctor. See what they recommend, or who."
Interpersonal influence	<b>1. Family Influence</b>	
	Description: Participants or their loved ones could be either negatively or positively influenced to seek HHC by their family members. <b>2. Peer Influence</b> Description: Participants or their loved ones could be either negatively or positively influenced to seek HHC by their peers.	
	<b>3. Testimony</b> Description: Participants shared that a testimony of a respected individual, whether a family member, healthcare provider, or acquaintance, strongly influenced choices regarding HHC.	

#### Theme 4: QOL

The idea that HHC could help improve QOL and functioning in everyday situations was often discussed. For example, it was evident across FG types that those with hearing loss placed high value on good hearing in "Social" (subtheme 1) settings and in their social roles such

as with employment. Significant others/family members appeared to be well attuned to how their partner's hearing loss hindered their confidence in engaging with their social supports. This desire to increase participation in social roles and activities while decreasing the tendency toward isolation was a clear motivation for seeking out HHC.



The impact that hearing loss can have on a person's physical safety or security and their participation in recreation or leisure, both "Environmental" (subtheme 2) domains of QOL, were also referenced as a reason for why people might seek help. The potential for one's own safety, or the safety of others, to be reduced because of hearing loss was a common concern in this sample of potential HHC users. In addition, participants shared many scenarios in which they or their loved ones had experienced a loss of the pleasure of interacting with their environment—such as hearing birds chirp, listening to music, or sensing the rhythmic sound of a car blinker—because of a hearing impairment.

### Theme 5: Interpersonal Influence

A cross-cutting theme identified among all FG types was interpersonal influence, which was organized into three subthemes. "Family Influence" (sub-theme 1) was a common thread across FGs—it was one of the most commonly discussed topics in the FG involving significant others/family members. A common perspective among significant others/family members was that their hearing impaired loved one would draw motivation from their family members to engage in some form of HHC treatment so that they could have improved familial relationships. Although perhaps less intentional, children also exerted an influence on individuals' motivation to access HHC. Multiple FG participants described circumstances in which their inability to hear a child or grandchild triggered their initial HHC visit.

"Peer Influence" (subtheme 2) emerged in the context of a respected peer making a comment related to the individual's hearing loss, or the need for peers to provide greater social support when one is seeking HHC. Many participants expressed the desire to appear more capable and independent to their peers, whether close friends or coworkers. Finally, for some, simply hearing a positive "Testimony" (subtheme 3) from an acquaintance regarding an experience in HHC could play an instrumental role in encouraging them to take the next step, as well as informing the details of how they would take that step.

### Enhancements to Hearing Screening Systems

As presented previously, participants discussed many ideas about what would, or has, encouraged and prompted HHC access among themselves or their significant others/family members. Based on these ideas, FG participants offered their thoughts on how hearing screening technologies could be enhanced to improve HHC follow-up after a positive screen for hearing loss. Potential enhancements to hearing screening systems are presented in the following paragraphs and are organized according to the themes identified previ-

ously. Sample quotations are presented in Table 3 to help illustrate the ideas presented by FG participants.

Interest in, and need for, increasing "Knowledge" was an important theme. FG participants suggested that screening systems could be tailored to provide information specific to the user and their hearing loss, as well as descriptions of new amplification technology and aural rehabilitation options. Furthermore, participants thought that highlighting knowledge the user could gain from visiting an audiologist would be helpful. They suggested that providing all of this information in a summary printout (e.g., at a kiosk-based system) could help users retain and follow up on the information they received.

Participants suggested several factors that would help increase their "Trust" of hearing screening technologies. These included knowing who sponsors the hearing screening system; being informed of the level of accuracy of the screening conducted; and knowing where their screening results or other information goes after their use of the system. These ideas tied into discussions about placing hearing screening kiosks within healthcare settings, which participants suggested would alleviate concerns related to trust and facilitate dialog and follow up with their primary healthcare provider and overarching healthcare system.

Some ideas addressing "Access" also emerged in the context of discussions about locating hearing screening systems within trustworthy settings, including public facilities or healthcare offices. Participants thought that being able to access hearing screening in their healthcare setting would improve convenience as well as interpretation of results. They also suggested that their primary healthcare providers could make an immediate referral to an audiologist, if needed, which would address access and trust. In addition, participants recommended the inclusion of handouts with visual graphics that are simple, yet engaging, to help illustrate the organization of the HHC system and its various access points.

Finally, tailoring hearing screening systems to leverage users' priorities regarding their own hearing-related QOL and building in components to promote positive interpersonal influence were thought to be potential enhancements to screening systems. FG participants suggested that providing examples of how hearing loss can affect one's daily life, socially as well as through reduced safety/security or interaction with, and enjoyment from, one's environment could increase their desire to seek HHC, as could the inclusion of positive HHC testimonies from individuals similar to the screening user, whether a peer or professional health coach.

## DISCUSSION

Our study provides novel information specific to facilitators of HHC access after a failed screening for hearing loss. Using the HBM as a guiding framework,

**Table 3. Illustrative Quotations about Potential Enhancements to Hearing Screening Systems, Organized by Theme**

Theme	Illustrative Quotations
Knowledge	<p>"Put everyday sounds in the context of a hearing [problem]. Like a car horn. If you hear a car horn, raise your hand. How far away does that horn sound?"</p> <p>"Show [aural rehabilitation options] from the past and show things from now."</p> <p>"A resource—a printout—like a compilation so that people who are thinking about investing in a hearing aid, or hearing aids, can read what's involved. What are the price ranges? What are the models? . . . Are there any places that subsidize hearing aids income-wise, stuff like that so we can do our own researching before we take the next step?"</p>
Trust	<p>". . . I would want to know [the hearing screening system sponsor] wasn't some company that had a profit potential."</p> <p>"Here's a support number [provided by the unbiased screening system sponsor], it is not commercially related, we don't care which [hearing aids] you get, we just want you to improve your hearing. I think people are definitely suspicious about marketing."</p> <p>"If you go to [a hospital] lobby, you'll see little kiosks with all kinds of little information sheets. . . If you open it up, it says 'here are some of your choices.' You can follow-up with your physician, or talk to your friends or family if you know someone who had that. So something like that, that helps people feel like 'ok, there is a path that I can walk down with confidence.'"</p>
Access	<p>"What about adding kiosks like that to every county public facility? Immunizations, TB tests, with that."</p> <p>"I would like. . . to be able to concentrate, and with a lot of distractions, visual or audio distractions, I think it's hard to have that. So [the screening system] is going to have to be some place relatively private."</p> <p>"Yeah. . . just a brochure that has graphics that would show something simple, what door to go to, and why that person is qualified to help you. If you need surgery, you need to go to this person . . . diseases of the ear, you can go to these people. And just have the graphics so that people simple like me could understand 'I don't need to go to an MD, I could go to these other qualified partners.'"</p>
QOL	<p>"There could be a statement in [the screening system], an appeal, how your quality of life can be impacted by taking steps for yourself and your loved ones, relationships. . ."</p> <p>"[Make it] so the numbers depict something. . . if the number actually had a correlation like, 'this is the voice range of most males on the planet,' something like that, then you could say, 'this is gonna be an issue for me, all of my coworkers are men,' or 'my boss is a low talker,' or whatever it may be. Other than just numbers."</p> <p>"How do you prove to someone what they're missing? I don't know. Visually? I don't know. You could show a picture of somebody putting in hearing aids and now they hear the birds tweet. . ."</p>
Interpersonal influence	<p>"It would be really nice. . . to have [peer] support people, if you could figure out a way to incorporate the support people."</p> <p>". . . Like a health coach thing, where they just talk to somebody about what the options are, what it means, how different it would be [after aural rehabilitation]."</p> <p>"So they have to have that support I think. . . pretty much everybody—the doctor, the friends, the family friends—calmly saying 'this is something that we think would help you.'"</p>

we found that individuals with a positive screen for hearing loss are primarily encouraged to access HHC if they can gain knowledge from the process, they trust the screening process, the hearing screening system is accessible, there is a desire for improved QOL, and they are influenced to make a change by a family member, friend, or other peer. Elements of these facilitators could be practically implemented in hearing screening systems to improve rates of follow-up with the HHC system.

The facilitators identified previously are consistent with the HBM beyond even the three domains used in the development of our FG discussion guide. Specifically, the HBM construct of perceived susceptibility is reflected in the theme of "Knowledge," such that having knowledge about hearing loss and its causes may make people feel more susceptible to hearing loss and thus, more likely to seek help. The constructs of perceived severity and perceived benefits are reflected in the "QOL" theme, with the realization that untreated hearing loss has negative impacts on QOL, whereas seeking and obtaining help can improve it. The HBM construct of perceived barriers is reflected in the themes of "Trust"

and "Access," such that a lack of trust and access are reasons why help may not be sought. The HBM construct of self-efficacy is reflected in the themes of "Access" and "Knowledge," in that information about hearing loss and knowledge about access to HHC both increase individuals' self-efficacy. Finally, the HBM construct of cues to action is reflected in the themes of "Access" and "Interpersonal Influence," such that advertisements/incentives and the input or support from family and peers can serve to prompt individuals to seek help.

The facilitators identified in this work, particularly those related to help-seeking, are also common to other health conditions. For example, Trust influences help-seeking for emotional and psychological difficulties (Corry and Leavy, 2016); Knowledge (or lack thereof) and Access drive help-seeking for accidental bowel leakage (Brown et al, 2016); reductions in QOL are associated with help-seeking for urinary incontinence (Shaw et al, 2008); and Interpersonal Influence affects help-seeking for prostate cancer and rheumatoid arthritis (Forbat et al, 2014; Tiwana et al, 2015). These examples relating to a variety of health conditions suggest that

hearing-related health services research might also benefit by leveraging the HBM to identify novel ways to increase individuals' likelihood of accessing HHC, particularly after a positive screen for hearing impairment. This notion is supported by a growing literature in hearing research that examines associations between the HBM and HHC. For example, Saunders et al (2016a) found that perceived severity, perceived benefits, and cues to action at the time of individuals' first HHC encounter predicted their uptake of hearing aids six months later; similarly, Pronk et al (2017) found that perceived severity and perceived benefits were associated with entry into a hearing aid trial period among older adults presenting to a hearing specialist. In addition, the interplay between HBM constructs, such that changes in one domain can influence other domains (see Figure 1), is notable and potentially applicable to hearing health. This too has been supported by growing literature (Saunders et al, 2016b) and suggests a potential for additive effects of the HBM constructs on the likelihood of positive hearing-health behaviors. Thus, in theory, incorporating as many of the HBM domains as possible into the development of new hearing screening technologies will likely impart the greatest benefit on HHC access and uptake.

As described in the Introduction, compared with traditional hearing screening methods, research has not shown great gains in HHC uptake among individuals who screen positive for hearing loss using newer hearing screening methods such as telephone hearing screeners or questionnaires (Smits et al, 2006; Yueh et al, 2010; Meyer et al, 2011; Ingo et al, 2016). However, there are numerous examples from other health fields of successful implementation of newer technologies that improve the general healthcare process. For example, chronic disease knowledge has been shown to be increased by implementing kiosks in remote locations (i.e., making the program accessible) (Joshi et al, 2013). The use of motivational text messaging (i.e., making the information hopeful) to patients' phones regarding their cardiovascular health has proven to increase self-efficacy in heart-health maintenance (Dale et al, 2014). In addition, telephone-delivered counseling sessions (i.e., making the message personalized) with patients with type 2 diabetes has shown improvements in weight loss, waist circumference, and diet quality (Eakin et al, 2014). Some of the screening system enhancements identified in the current study are clearly applicable to these other healthcare areas. Conversely, as suggested by our findings, innovations developed for other health fields might also help to increase the efficacy of hearing screening systems.

In a past symposium, Silvey et al (2008) stated that newer screening systems need to be created and deployed based on studies of what will make them as successful as possible before their use. As theorized in the HBM, it is possible that integrating more cues

to action will improve the utility of hearing screening systems. For example, simply identifying the sponsor(s) of a hearing screening system and providing referrals to a variety of HHC providers could help build trust and mitigate individuals' concerns about potential conflicts of interest, profit, and transparency. Similarly, actively offering hearing screening within the context of a primary care appointment or facility, coupled with the provision of follow-up information and referrals from an individual's primary healthcare provider, could help improve access to HHC. These ideas were identified in the current work and in past research focused on the promotion of trust in HHC (Preminger et al, 2015). The effectiveness of these and other cues to action should be evaluated as newer generation screening systems such as kiosks are developed and deployed. Ideally, future screening systems will use technology to provide cues that are substantive and varied enough to stimulate action in a wide variety of individuals in need of HHC.

Past qualitative work has examined barriers to the acceptance and use of hearing aids. Although this was not the focus of our study, some findings were similar to past hearing aid research in that we found individuals to be wary of the HHC system and, by extension, hearing health professionals, expressing distrust due to conflicts of interest, cost, and profit. A study by Preminger et al (2015) also explored components of trust as facilitators or barriers to HHC access, with results suggesting that the "commercialized approach" to HHC can lead to low trust. In addition, we found that individuals perceive reduced communication and social functioning as a major problem with hearing impairment and, conversely, improved communication and functioning a primary benefit of HHC. Communication and social functioning have also emerged as primary themes in studies examining hearing help-seeking in a multinational sample of adults with hearing impairment (Laplante-Lévesque et al, 2012; Preminger and Laplante-Lévesque, 2014). Indeed, a literature review of 39 studies published between 1980 and 2009 found activity limitations to be one of the most consistent predictors of aural rehabilitation outcomes (Knudsen et al, 2010). Our findings relative to family influence, tinnitus, and advertisements/incentives were also consistent with past work examining facilitators of HHC access (Knudsen et al, 2013). Results of our work, in concert with the body of past HHC research, can provide a foundation on which to develop practical applications for encouraging people with hearing loss to take the first step of accessing HHC, specifically when using newer technology to screen for hearing loss. Given that older adults comprise the fastest growing segment of digital technology users in the United States (Madden, 2010), we believe it will be especially important to consider and potentially incorporate these facilitators into the development of new automated hearing screening systems.

In our study, FG participants referred to their primary care physicians as trusted entities and suggested that they would be most likely to follow up on HHC recommendations if provided through their primary healthcare provider and system. Indeed, population-based epidemiologic research has shown a strong association between having spoken with a doctor about hearing or ear problems and having received a hearing test; however, this same research found that only about one-fifth of individuals reported having spoken to a doctor about hearing or an ear problem in the past five years (Nash et al, 2013), suggesting an enormous unmet need and potential missed opportunity on the system level. Past work has also examined the efficacy of primary care-based hearing screening programs and suggested that such programs might be associated with reduced hearing disability among patients (Hands, 2000). Similarly, a systematic literature review found evidence across studies that general practitioners' lack of management of age-related hearing impairment is a significant barrier to HHC access (Meyer and Hickson, 2012). Although healthcare system redesign and provider education could help close this gap, screening systems might also help address this problem by providing users with prompts or other suggested language to facilitate communication with their primary care providers.

The recognition of interpersonal influence as a facilitator of HHC access was a common thread across FGs. This too is consistent with past research. Health services research, in general, has identified social support as a major contributor to adherence to medical treatment (DiMatteo, 2004). In hearing research, specifically, it has been shown that support or involvement of significant others and family members in aural rehabilitation is critical (Kramer et al, 2005; Meyer and Hickson, 2012) and that hearing disability perceived by others can influence uptake of hearing health interventions and successful intervention outcomes (Laplante-Lévesque et al, 2012; Pronk et al, 2017). Interventions have been developed and tested to engage family members in audiological rehabilitation programs (Preminger and Meeks, 2010); our work suggests that these approaches might also increase the efficacy of hearing screening systems.

### Strengths and Limitations

Results of this study should be taken into context with its strengths and potential limitations. This qualitative study was conducted as part of a 5-year effort in which our team is developing and evaluating the effects of a hearing screening kiosk on individuals' HHC access. Our FGs were designed to collect and triangulate data from three different types of stakeholders to inform development of the kiosk program and maximize the likelihood that those who screen positive for hearing loss will subsequently seek HHC. Triangulation is a

technique to improve credibility of qualitative research data (Cho and Lee, 2014) and, therefore, is a particular strength of this study. We did not examine potential differences between stakeholder types because of this study design. Similarly, we did not collect data relevant to participants' socioeconomic status, such as income or education level, and thus were unable to consider these factors in the context of study results. Future work that is designed to examine these or other differences between types of stakeholders might support more precise tailoring of kiosk-based or other interventions to a specific "audience."

The current study had a relatively small number of participants in some FGs; specifically, the groups with individuals who had recently sought HHC and with significant others/family members of individuals with hearing loss. However, we found that discussions in these smaller FGs were rich, with themes that were consistent with the other (larger) groups. Perspectives of our study participants may not be representative of individuals from different regions or study contexts. Specifically, data from this study were collected from participants in the Pacific Northwest region of the United States and therefore may not reflect the opinions or experiences of those from other regions or countries. Similarly, because of the study team's affiliation with the VA, a relatively large proportion (42%) of the participants were veterans, whose opinions and experiences may not represent those of nonveterans. For example, veterans' access to HHC may differ from those of the nonveteran population, particularly if they are enrolled in and using VA healthcare. Moreover, more than half of the participants were male (58%), and the significant others/family members were of males, which could limit the generalizability of the findings. However, the composition of each FG included both veterans and nonveterans and tended to include both males and females, which likely helped generate rich discussions among participants related to HHC access. Future research in other study populations that similarly explores facilitators or barriers to HHC after a failed screen for hearing loss could help validate our findings and/or elucidate additional factors that did not emerge among our participants.

### CONCLUSIONS

The current study identified key factors that encourage people to seek out a HHC provider following a positive screen for hearing loss. Based on these key factors, the optimal hearing screening system components would be trustworthy, personalized, educational, accessible, and hopeful. These study results may be used to inform the development of new hearing screening systems and processes. More broadly, these findings could affect how public health and HHC interventions use

cues to action to motivate people to make a HHC appointment, ultimately resulting in more patients in need receiving hearing-health education and rehabilitation services.

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