Characteristics, behaviours and readiness of persons seeking hearing healthcare online

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ABSTRACT

Objective: This study describes characteristics, behaviours and readiness of people who are interested in seeking hearing healthcare (HHC) online.

Design: A non-profit clinic was established from which services through a virtual clinic are offered. Most of the patient–audiologist interactions are conducted online. We used online means to invite individuals to take a free online digit-in-noise (DIN) test. Upon failing the test, individuals reported their readiness to seek HHC by using two tools: the line and the staging algorithm.

Study sample: Individuals ≥18 years of age, within the greater Durban area, South Africa, were eligible to participate in the study.

Results: A total of 462 individuals completed the online DIN test during the first 3 months. Of those, 58.66% (271/462) failed the test and 11.04% (51/462) submitted their details for further contact from the clinic audiologist. Five individuals proceeded to a comprehensive hearing evaluation and hearing aid trial: all those individuals showed readiness to seek further HHC on the measurement tools. These individuals have reported knowing of their hearing challenges prior to taking the test and have waited for a period of between 5 and 16 years before seeking HHC. A significant association between age and DIN test result was found.

Conclusion: This explorative study is the first clinic to utilise digital tools across the entire patient journey in combination with face-to-face interactions in providing HHC. Internet-connected devices provide an opportunity for individuals to seek HHC and for providers to offer initial services to detect, counsel and support persons through the initial engagement process of seeking HHC. This may open up new audiology patient pathways through online hearing screening, assessment of readiness to seek further HHC and enhancement of service delivery using hybrid services by combining online and face-to-face modes of synchronous and asynchronous communication.

Introduction

According to the World Health Organization (WHO), 466 million people, or over 5% of the world’s population, live with disabling hearing loss (WHO 2017). Prevalence of hearing loss varies significantly across the world and is higher in sub-Saharan Africa, South Asia and Asia Pacific than in other parts of the world (WHO 2017). With an ageing world population and with hearing loss being more prevalent in older age, hearing healthcare (HHC) needs will grow (Mulwafu et al. 2016). Untreated hearing loss is often associated with various negative health conditions like depression, isolation and dementia in adults aged ≥65 years (Livingston et al. 2017). The HHC could contribute to the prevention or delay of dementia, with one-third of dementia cases being preventable (Livingston et al. 2017).

Help-seeking for hearing loss is often delayed, taking an individual on average between 7 and 10 years from the time that hearing difficulties are first noticed to further investigation (Davis et al. 2007; Hickson et al. 2014; Meyer et al. 2014). On average, initial hearing aids are fitted at 74 years of age (Henshaw et al. 2012). The delay in seeking HHC is often due to the negative association of hearing loss with ageing, cognitive impairment, stigmatisation, embarrassment, loneliness, restricted employment options (Mulwafu, Kuper, and Ensink 2016; Wilson et al. 2017).

Without appropriate diagnosis and intervention, hearing loss has severe consequences on quality of life, loss of autonomy, impaired driving ability, mental health, societal integration and participation (Arlinger 2003; Davis et al. 2016). Untreated hearing loss is often associated with various negative health conditions like depression, isolation and dementia in adults aged ≥65 years (Livingston et al. 2017). The HHC could contribute to the prevention or delay of dementia, with one-third of dementia cases being preventable (Livingston et al. 2017).

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and partly attributed to limited accessibility and affordability of care (Swanepoel, Olusanya, and Mars 2010). Access to HHC for many individuals is scarce and awareness of hearing loss is low (WHO 2013: Lin, Hazzard, and Blazer 2016). Other barriers to access and affordability of services are due to limited accessibility to HHC solutions, high out-of-pocket costs with current treatment models and limitations of currently available hearing device technologies (Clark and Swanepoel 2014; Lin et al. 2016).

Human resources for ear and hearing care are unequally distributed in the world, with a higher concentration of HHC professionals in high- and upper-middle-income countries (WHO 2013). In low- to middle-income countries, the shortage of HHC professionals to the large population requiring services is well documented (Fagan and Jacobs 2009; Mulwafu et al. 2017). However, higher income countries like those in Europe also face a shortage of healthcare professionals which is mostly due to retirement rates surpassing recruitment rates (Lapão and Dussault 2017). A significant increase in the number of trained professionals is, however, unlikely, as training programmes are costly and on average take 2 to 4 years to complete (Clark and Swanepoel 2014).

Technological innovations could also improve access to HHC and the automation of specific tasks (Clark and Swanepoel 2014). Innovative HHC service delivery through eHealth and community health workers are needed to improve access and to complement current service delivery models (Lin et al. 2016). Service delivery supported by eHealth could be part of the solution as connectivity can facilitate better access to HHC professionals and services. Mobile phones are becoming more affordable. By the end of 2016, two-thirds of the world had a mobile subscription (Global System for Mobile Communications Association (GSMA) 2017). In 2020, it is projected that three-quarters of the population will subscribe to mobile services, with penetration rates of up to 50% in sub-Saharan Africa and 87% in Europe (GSMA 2017). With the promise of more people around the world being connected, this presents the opportunity to use this connectedness for global sustainability initiatives.

Telephone-based hearing screening tests have been tested in approximately 10 countries, including the Netherlands, United Kingdom and Australia (Smits, Kapteyn, and Houtgast 2004; Smits, Merkus, and Houtgast 2006; Stenfelt et al. 2011; Dillon et al. 2016). This adaptive test presents three digits in noise (DIN) and the listener has to recognise 50% of the digits correctly (Potgieter et al. 2018). In areas like sub-Saharan Africa where telephone landline penetration is poor, a self-administered hearing screening test available on a mobile device increases accessibility to HHC services (Potgieter et al. 2018). A South African household survey reported 87% of households had access to at least one mobile device, while 9.4% of households had access to both landlines and a cellular device, with only 0.1% of households solely having a landline connection (Statistics South Africa 2016a).

Earlier research successfully used electronic mail (email) communication between audiologists and patients as a tool to help first-time hearing aid users through the personal adjustment process (Laplante-Lévêque, Pichora-Fuller, and Gagné 2006). More recent research points to the successful use of Internet-based support systems for hearing aid users as an aural rehabilitation tool (Thorén et al. 2014; Brännström et al. 2016) as well as offering Internet-based cognitive behavioural therapy interventions for patients with tinnitus (Beukes et al. 2016). Computers and Internet delivery of hearing screening, information and intervention have been reported as a feasible method of dissemination to adults with hearing loss between the ages of 50 and 74 years (Henshaw et al. 2012). The increase in mobile penetration globally holds promise that more individuals will have access to the Internet, which may increase accessibility to HHC services. Therefore, this study aimed to target the ≥40-year age group in the light of the increased accessibility and feasibility to dissemination knowledge to individuals with hearing loss.

The challenges described above include the rise of hearing loss globally, the consequences of untreated hearing loss in terms of costs, the association to detrimental health conditions as well as the poor audiologist to patient ratio. It is therefore imperative that identification and treatment of hearing loss be addressed more proactively. This study aims to describe the characteristics, behaviours and readiness of individuals who seek HHC online through a virtual clinic offering using a sample from the greater Durban metropolitan area, South Africa. A secondary objective was to describe considerations in the virtual audiology clinic set-up and processes.

Methods

This is an exploratory project, describing online hearing health seeking characteristics, behaviours and readiness of persons who seek HHC through a virtual eHealth research clinic in South Africa. The University of Pretoria Faculty of Humanities Research Ethics Committee approved the research (GW20170409HS).

A description of the virtual audiology clinic

A non-profit entity, Hearing Research Clinic Non-Profit Company (NPC) (http://hearingresearchclinic.org), was established in June 2017 in Durban, KwaZulu-Natal, South Africa. The greater Durban area (eThekwini) has a population of approximately 3.7 million people (Statistics South Africa 2016b). This is a virtual clinic: most of the patient–audiologist interactions are conducted online, with two face-to-face interactions in the patient’s home or office, or a satellite site for the clinic. This face-to-face visit ensures any diagnostic red flags would be identified until a time that technology could possibly support this step with eHealth means. Patients pay for their services out-of-pocket and receive partial coverage from their private medical insurance if relevant. In South Africa, 17% of the population is covered by private medical insurance (Statistics South Africa 2016a). The clinic is a test bed to determine the viability of offering services through a hybrid model of face-to-face and online communication and services. The reason for the clinic being established as an NPC was to ensure that patients pay for the services they receive to avoid any confounding influence of receiving services free of charge.

The clinic aims to provide services throughout the patient journey, from the time of the first investigation of hearing challenges, through to hearing evaluation and treatment. We propose five steps using a hybrid eHealth model to support the patient along their journey to better hearing (Figure 1). This model uses both synchronous (real-time) and asynchronous (store-and-forward) modes of service delivery between the audiologist and patient. Asynchronous refers to data being collected and then sent via a network for later interpretation and usage (Krumm 2016).

As described above, the Hearing Research Clinic Non-Profit Company advertises its services through online presence and word of mouth. The clinic website was launched on 23rd June 2017 and has a responsive design to accommodate different devices. The quality of information presented on websites as well as attention to design, layout and readability is paramount for successful engagement and to ensure that the written
information provided does not exceed the literacy levels of online hearing health seekers (Laplane-Lévesque et al. 2012; Laplane-Lévesque and Thorén 2015).

Therefore, the following five considerations were taken into account for the design and content of the website: (1) short sentences with limited text were used to ease readability; on average a, Flesch–Kincaid Grade Level of 8.8 was achieved on the web pages, where below 9 is considered good; (2) large fonts; (3) upbeat tone of voice; (4) segmentation of the website information into five sections; and (5) pictures that represent the cultural diversity of South Africa.

Participants

Inclusion criteria for the study were to be of adult age (≥ 18 years), living within the greater Durban area, and have access to a mobile, tablet or computer with Internet or mobile data access. The study period covered the first three months of the launch of the clinic (23rd June–22nd September 2017).

Recruitment

Before Step 1 (Figure 1), persons in the greater Durban area were invited to visit the clinic website to take the online DIN test on the website. A Facebook page was created for the clinic. A link to the DIN test which is hosted on the clinic’s website was promoted on the clinic’s Facebook page. During the study period, online advertising through the social media platform Facebook was the primary method of recruitment. Online advertising was targeted to Facebook users in the age group of ≥40 years and within the geolocation of the greater Durban area. Information regarding the importance of seeking HHC was disseminated from the clinic’s Facebook page utilising image adverts, articles, blogs and videos. These were used to capture the attention of the audience and promote the importance of knowing one’s hearing status. Eight Facebook posts were targeted to the ≥40 years age group. The clinic also shared one press release when it was launched. An online eHealth news channel published the press release and shared the press release on their Facebook page which was later shared on the clinic’s Facebook page. Other means of recruitment included one interview on a community radio station, promotion of the clinic website by the WhatsApp messaging platform to personal friends and family contacts and finally word of mouth.

Procedures

Figure 1 depicts the five steps of the patient flow. Each step is described regarding the type of data collected, data collection method (synchronous and asynchronous), as well as the process of both the clinic audiologist and the participant.

Step 1 – online screening

The completion of the online DIN test hosted on the clinic’s website is Step 1 (Figure 1) of the patient flow. This step is conducted asynchronously. At the completion of the DIN test, a score is immediately displayed indicating whether hearing loss may or may not be present (pass/fail result). At this point, all individuals had the opportunity (by consent) to share their contact details (name, telephone number and email address) with the clinic audiologist to make contact. More information on the DIN screening test is provided below.

Step 2 – audio/video phone call

During Step 2 (Figure 1), the clinic audiologist emailed (asynchronous communication) the individual to suggest a time and date for a 15-min audio or video call (synchronous) to discuss their hearing concerns. Even if no response was obtained by email, all participants who supplied their details were followed up with an audio call. During the call, the clinic audiologist addressed the individual’s hearing concerns and used readiness assessment tools (the line and the staging algorithm) to determine whether the individual was ready for Step 3. When a participant scored above 5 on the line rating scale from 0 to 10 (Rollnick, Mason, and Butler 1999; Tønnesen 2012) and the staging algorithm a score of 3 or 4 (Milstein and Weinstein 2002), a face-to-face visit for the comprehensive hearing evaluation was scheduled. Reasons from participants not willing to proceed to Step 3 are listed in Table 4.

Step 3 – hearing evaluation and hearing aid trial

Step 3 (Figure 1) consisted of a face-to-face (synchronous) appointment either at the participants’ home or at the satellite clinic. At this point, the individual provided written informed consent to participate in this project. This face-to-face visit included an in-depth case history (including history of hearing challenges, period of time since first difficulty, symptoms and signs, medical history, exposure to noise and so on), a comprehensive hearing evaluation which included counselling, a discussion of treatment plan options and a two-week hearing aid trial period if the
participant wished to proceed. During the trial period, the participant and clinic audiologist were in contact via audio or video call (synchronous) and/or instant messages WhatsApp/text messages/email (asynchronous) to discuss the progress and note any challenges the participant faced with the hearing aids.

**Step 4 – hearing solution and rehabilitation plan**

Step 4 (Figure 1) consisted of the participant successfully benefiting from the hearing aids and opting to purchase their hearing aids to continue their treatment plan. The fitting and verification of the hearing aids are conducted in a face-to-face appointment. These participants were then offered access to an online aural rehabilitation programme.

**Step 5 – continued support and coaching**

Continuous face-to-face and online support is offered from the clinic audiologist to the participant for additional fine-tuning of hearing aids as well as support during the personal adjustment to hearing aids. An online aural rehabilitation programme (Eriksholm Guide to Better Hearing) is also offered to these participants to become satisfied hearing aid users. The International Outcome Inventory – Hearing Aids (IOI-HA), as well as satisfaction ratings, measure the outcomes after completion of the Eriksholm Guide to Better Hearing (Cox et al. 2000).

**Material and apparatus**

**Online hearing screening**

The online DIN test is a triple-digit hearing screening test developed and validated for South African English which uses an adaptive digit-to-noise ratio procedure (Potgieter et al. 2016, 2018). The software widget (hearX Group Pty Ltd, Pretoria, South Africa) is embedded on the clinic website using validated materials (Potgieter et al. 2016, 2018). Digits are considered universal and less reliant on language competence. On beginning the DIN test in Step 1, each individual is required to insert their date of birth as well as their first language and self-reported the DIN test in Step 1, each individual is required to insert their date of birth as well as their first language and self-reported English-speaking competency level on a scale of 1–10 required (Statistics South Africa 2011). Therefore, self-reported English competency levels of 0–5 and 6–10 leading to the following cut-off scores; English competency levels of 0–5 required ≤–7.50 dB SRT and English competency levels of 6–10 required ≤–9.55 dB SRT to pass the screening DIN test (Potgieter et al. 2018). The DIN test results are stored in a cloud-based system called mHealth studio which records information on all DIN tests taken even if no contact details were submitted with an accurate geolocation (hearX Group Pty Ltd, Pretoria, South Africa). Only the clinic audiologist has access to the back-end cloud-based mHealth studio (hearX Group (Pty) Ltd, Pretoria, South Africa) which is password-protected securing participant data.

**Website visits**

Data regarding usage, length of time spent on the website, new users who are unique to the website and returning users to the website, type of mobile devices, operating systems used to access the website and IP address to track location were collected using Google Analytics (Google.com 2017a). Data were not collected on all users to the website as firewall and cookie settings on some devices block websites from collecting this type of data. Also, some mobile browsers send compressed files to Google Analytics making it difficult to correctly identify the browser and device used to take the DIN test (Google.com 2017a). Google Analytics does not report data on users ≤18 years according to the laws protecting minors. Google Analytics reports its data to be accurate with a low error rate of less than 2% (Google.com 2017b).

**Readiness measures**

Two readiness measures, the line and the staging algorithm, were used during Step 2 of the patient journey. The line is a one-item measure of readiness for hearing help-seeking which consists of the question: How important is it for you to improve your hearing right now? Responses were recorded on a Likert scale from 0 to 10, where 0 indicates not at all and 10 indicates very much (Rollnick et al. 1999; Tønnesen 2012). The Ida Institute have adapted the line for use within the audiology profession (Ida Institute, 2009). The staging algorithm is a one-item questionnaire assessing stages of change (Milstein and Weinstein 2002). The question has four possible answers, each corresponding with a stage of change: (1) I do not think I have a hearing problem, and therefore nothing should be done about it (pre-contemplation); (2) 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); (3) I know I have a hearing problem, and I intend to take action to solve it soon (preparation) and (4) I know I have a hearing problem, and I am here to take action to solve it now (action) (Milstein and Weinstein 2002).

**Data analysis**

Data were analysed using the software IBM SPSS Statistics for Windows, version 24 (SPSS Inc., Chicago, IL). Statistical significance was set at $p < 0.05$. Descriptive statistics were used to analyse the characteristics, online behaviours and readiness of the people who seek HHC online.

**Results**

**Characteristics of people who visited the clinic website**

**Website traffic information**

Within the three-month study period (23rd June–22nd September 2017), 2693 people visited the clinic website, of which 2667 (99.03%) were new (unique) visitors. This data are presented in Table 1. The majority (83.66%) of visitors were from South Africa. Only data pertaining to visitors located in the greater Durban area are presented as only participants from this
total 512464 4 4 4 6 2
Other 00100 0 1
Afrikaans 51046 2 1 8
English 000004 4 2 4 4 2

191 passed and 271 failed the online DIN test. The majority
visitors completed the DIN test (Table 2). Of the 462 individuals,
During the study period, 24.95% (462 of 1852) of the website
visitors, are described below.
First language and self-reported English-speaking competency for
participants in Step 1 (n = 462).

<table>
<thead>
<tr>
<th>Language</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>442</td>
</tr>
<tr>
<td>Afrikaans</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Xhosa</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>444</td>
</tr>
</tbody>
</table>

The reported age range of individuals who completed the DIN
test (n = 462) was 22–94 years, with a mean age of 56.61 years
(SD 12.65). A Pearson correlation test indicated a statistically
significant correlation (p < 0.05; r = 0.21) between age and the
SNR (n = 462). Older participants presented with poorer SNR
scores (Figure 2).

**Relationship between age and DIN test score**
As expected, this relationship was also reflected in the character-
istics of those who passed/failed the DIN test. The minimum age
of the 271 participants who failed the DIN test in Step 1 was
24 years and a maximum of 94 years, with a mean of 60.22 years
(SD 11.77). When compared to the 191 individuals who passed
the DIN test, this group had a minimum age of 22 years and
a maximum of 79 years with a mean of 51.49 years (SD 12.11).
People who passed the DIN test were significantly younger than
those who failed the DIN test, t(460) = 7.76, p < 0.001.

Participants (n = 51) who proceeded to Step 2 included 29
(56.86%) females and 22 (43.14%) males with ages ranging from
28 to 85 years (mean age 60.08 years; SD 11.65). A mean SNR of
−6.18 dB (SD 5.22) for the group of 51 participants who submit-
ted their details and mean age of 59.94 years (SD 11.64) was
recorded. For the group of 220 participants who did not submit
their details, a mean SNR of −6.19 dB (SD 4.43) and mean age
of 60.29 years (SD 11.83) were recorded. No statistical signifi-
cance was found between SNR and age of the 51 participants
who submitted their details compared to 220 participants
who did not submit their details, t(269) = 0.021, p = 0.98 and
t(269) = −0.19, p = 0.85 respectively.

The participants’ reasons (Step 2) for taking action or not to
Step 3 were collected during the audio call in Step 2 (see
Table 4). Only 51 participants (18.82%) showed interest in seeking
further HHC (Step 3). Four of the five participants in Step 3
were first-time amplification users, while one participant was
experienced with amplification and has used hearing aids.

**Time of day and day of the week that DIN test was completed**
A graphical representation below indicates (Figure 3) a high
portion of the 462 users who took the DIN test completed the test
in the morning and evening. The highest number of DIN tests
completed during the day was 28 at 7 am, 34 at 1 pm and ≥30 participants between 7 pm and 10 pm. This indicates that HHC services can be made available for self-administration (asynchronously) outside of the traditional 9 am to 5 pm work day.

When looking further at DIN tests taken, Friday had the highest number (31) of tests taken especially in the age group ≥65 years (see Figure 4). More than 65 participants completed the DIN test on Sunday, Wednesday, Friday and Saturday. This suggests that HHC services can be administered asynchronously at a time and place convenient for HHC seekers, often beyond the traditional five-day workweek according to different age groups.

**Discussion**

There is a pressing need for HHC services to meet the demand of an ageing population. The consequences of untreated hearing loss are detrimental on a micro-level of one’s family and communication partners as well as at a macro-level affecting society at large. With the unequal distribution of resources and services

| Table 3. Number of participants for each step of the patient journey at the end of the three-month study period (22nd September 2017). |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| **Visitors to the website 1852** | **Total tests:** 24.95% (462/1852) | **Fail:** 58.66% (271/462) 18.82% (51/271) | **9.80%** (5/51) | **40.00%** (2/5) |
| **Pre-Step 1** | **Website behaviour** | **Step 1 DIN test** | **Step 2 Submitted details after fail result** | **Step 3 Evaluation and hearing aid trial after submitting details** | **Step 4 Treatment selected after evaluation and trial** |
| **Step 1 DIN test** | **Step 2 Submitted details after fail result** | **Step 3 Evaluation and hearing aid trial after submitting details** | **Step 4 Treatment selected after evaluation and trial** |

**Figure 2.** Relationship of DIN test result (SNR) and age of participants who completed the DIN test (n = 462).

**Figure 3.** Distribution of DIN tests completed per time of day (n = 462).

**Figure 4.** Distribution of DIN tests completed per age group and per day of the week (n = 462).

**Table 4.** Summary of themes that participants in Step 2 reported in regards to taking action towards Step 3 (n = 51).

<table>
<thead>
<tr>
<th>Theme</th>
<th>(n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not interested</td>
<td>38 (74.51%)</td>
</tr>
<tr>
<td>No answer</td>
<td>17 (44.74%)</td>
</tr>
<tr>
<td>Investigation:</td>
<td>11 (28.95%)</td>
</tr>
<tr>
<td>Curious to try the online test</td>
<td>3 (7.89%)</td>
</tr>
<tr>
<td>Has hearing aids and curious to recheck</td>
<td>3 (7.89%)</td>
</tr>
<tr>
<td>if hearing loss is still present</td>
<td>3 (7.89%)</td>
</tr>
<tr>
<td>Incorrect contact details</td>
<td>3 (7.89%)</td>
</tr>
<tr>
<td>Doctor said nothing can be done</td>
<td>3 (7.89%)</td>
</tr>
<tr>
<td>Finance</td>
<td>3 (7.89%)</td>
</tr>
<tr>
<td>Other: Beyond geographic location</td>
<td>1 (2.63%)</td>
</tr>
<tr>
<td>Interested</td>
<td>13 (25.49%)</td>
</tr>
<tr>
<td>Possibly in the future</td>
<td>8 (61.54%)</td>
</tr>
<tr>
<td>Trialled hearing aids but not purchased</td>
<td>3 (23.08%)</td>
</tr>
<tr>
<td>Trialled hearing aids and purchased</td>
<td>2 (15.38%)</td>
</tr>
</tbody>
</table>
Making individuals aware of the importance of testing their hearing and knowing their hearing status is a possible first step to raising HHC awareness. While the typical age for an initial hearing aid fitting is 74 years (Henshaw et al. 2012), this study used the advancements of technology to attract a broader age group (≥40 years) of individuals to take a DIN test using online modes of recruitment. Making the DIN test available online allows for seekers of HHC to have access to a tool to screen their hearing asynchronously. This study provides insights on offering HHC services through a virtual platform.

Internet-based recruitment methods were used to create awareness of HHC services by offering free online hearing screening (DIN test) to individuals within the Durban area, South Africa. Within a limited period of three months, 1852 people visited the website within the targeted location. Of those, approximately 1 in 4 completed the online DIN test. Only 18.82% (n=51) of individuals who failed the DIN test indicated possible further help-seeking with 9.80% (n=5) of those taking the next step of completing a comprehensive hearing evaluation and 40% (n=2) of those choosing to purchase hearing aids. Characteristics of people regarding age, gender and devices used to seek HHC online, and the behaviours related to motivation and readiness to seek HHC online are discussed below.

**Age, gender and devices of people who seek HHC online**

The clinic achieved its goal to target older adults with 35.47% (354/998) of users older than 64 years of age within the target geographical location through online recruitment. Online recruitment can, therefore, be one way in which to target an older age group from a specific geographical area. The majority (76.88%) of visitors to the webpage were female. The gender difference found in seeking HHC is comparable to literature which reported males to be more reserved in their actions (Smits et al. 2006). According to the Pew Research Center, 68% of the American adult population use the social media platform Facebook. When looking closer at the gender split, 62% of males use Facebook and females are slightly higher at 74% (PEW 2018). This indicates that more women are active on social platforms than men and tend to seek HHC help earlier than men. An implication of this would mean that providers of HHC should create gender-specific content to reach these specific target groups.

Mobile phones were most frequently (83.21%) used to access the DIN test over tablets and computers. In South Africa where lined Internet is limited, more individuals have access to a mobile device with Internet capabilities which increases one’s accessibility to online services. Sub-Saharan Africa remains the fastest growing mobile market in the world with 420 million unique mobile subscribers and a penetration rate of 43% reported at the end of 2016 (GSMA 2017). By 2020, more than half a billion unique mobile subscribers will be from this region, by which time half of the population will subscribe to a mobile service (GSMA 2017). Android operating systems were predominantly (73.65%) used to access the website in this study geolocation highlighting the importance of responsive website design. This finding infers that mobile services developed for the test region of Durban, South Africa, are to be compatible on an Android platform.

Using the insights from the time of day and week that participants completed the online DIN test, this supports asynchronous hearing screening which can be self-administered at a time and place convenient for a person which brings HHC to them. Essentially offering services on the clinic’s website which can be accessed 24/7 by a potential HHC seeker. This supports the notion put forward that this new era of healthcare is moving beyond the traditional clinic but rather into the daily lives of patients by striving to link the patient with the right care with the right provider at the right time (Gladden, Beck, and Chandler 2015).

**Motivation to seek HHC services**

More individuals completed the online DIN test and did not submit their contact details, and this would indicate that people are curious to know their hearing status, however, not ready to take action. Many individuals could have opted to seek HHC services from other providers after being made aware of their hearing result through the DIN test. This study, however, did not track these individuals. A study which followed up on individuals 4–5 months after failing a telephone-based DIN hearing screening test indicated that only 36% sought further HHC services (Meyer et al. 2011), while previous studies indicated that 46% and 57% of individuals who failed a DIN test sought further HHC services when recommended (Smits et al. 2006). In this study, the number of people who took Step 1 (DIN test) is high, and fewer individuals went on to take Step 2 by providing their details to make contact with the clinic audiologist. After Step 1, 81.18% of individuals did not leave contact details for the audiologist in Step 2. Persons may have dropped out since it may be more familiar to receive HHC information in a face-to-face consultation. This could also reflect that online seekers may not know how to validate the quality of online healthcare services or may not be ready to receive this type of information online without the referral of their healthcare provider. Therefore, this highlights the need to normalise online HHC offerings. The clinic was newly established for this project and did not have referral sources other than the online recruitment strategies described.

The individuals who decided to seek help (Steps 3–4) indicated higher scores on the line and staging algorithm indicating that motivational interviewing tools provide useful insights for planning rehabilitation (Ingo et al. 2017). In a study of 224 participants (Ingo et al. 2017), mean score of 6.14 (SD 2.80) was obtained on the line as compared to a mean score of 7.80 (SD 2.59) in our study. The difference in the mean scores and SD could be attributed to the small sample size which produced higher results in our study. Our study had two participants in the contemplation stage and three participants in the action stage of the staging algorithm. In the Ingo et al. (2017) study, 44.60% of persons were in the contemplation stage, and 7.60% were in the action stage with the remainder of the 47.80% of participants in the pre-contemplation (2.70%) and preparation (45.10%) stages of the staging algorithm. Younger participants had significantly lower (i.e. better) SNR scores and therefore were more likely to pass the DIN test in our study.

While many isolated eHealth studies have been conducted within HHC, there is a scarcity of studies of the entire patient journey using an eHealth paradigm. This study systematically combined the available tools to form this hybrid model of synchronous and asynchronous services while still remaining agile to include newer tools once technology allows for
services to be offered online. Even though not all touch points along the patient journey are ready to be included using online services; this is the first of its kind to place together the pieces which are ready to be tested using the advantages of both face-to-face and online modes of communication. This real-life study aims to be a sustainable model which other audiologists can look upon for inspiration when adapting to the changing landscape of HHC. The next steps of this study are to investigate the experiences and outcomes of the patients who have received HHC services through this hybrid model as well as a cost consequence analysis.

Implications and future directions

The implications of the virtual clinic offering make online hearing screening (DIN test) possible through asynchronous methods allowing access to individuals to take the screening test without the involvement of the audiologist are the first step towards the positive use of the audiologist’s time be spent on other more complex tasks. Pre-qualifying individuals for hearing loss could potentially lead to time-saved for audiologists, as individuals who then opt to further their hearing help-seeking through diagnostic measures are made aware that hearing loss may be present. Another possibility is that individuals who may not have been aware of their hearing status may now become aware of their hearing challenges through an online offering which could potentially reach a younger audience using online recruitment strategies. Research points to the advances of innovative technology and greater access to global connectivity are opportunities which may change current HHC service delivery methods to maximise access, efficiency and impact (Clark and Swanepoel 2014). Moving the pre-qualifier as the online hearing screening test (DIN test) allows audiologists to free up some time to spend more time on complex tasks such as counselling and hearing aid fittings as well as to provide services to more patients, increasing service delivery efficiency (Margolis and Morgan 2008; Swanepoel et al. 2010).

Despite the online availability of HHC services, barriers to help-seeking continue to exist. This is indicated by a low number of individuals who provided their contact details after failing the DIN test. This explorative research study has provided initial results for the inclusion of a hybrid patient model within the HHC profession.

To the authors’ knowledge, this study is the first clinic of its kind, utilising digital tools across the entire patient journey combined with face-to-face interactions to provide HHC. Currently, research along the entire patient journey using eHealth as a service delivery medium is still insufficient.

Study limitations

A limitation of the current study is its recruitment methods, which relied mainly on Facebook and not on other online sources such as doctor websites, patient organisations, or forums where people who might be more readily looking for HHC services or be trusting of online HHC information. Another limitation is that the website is only available in English and requires some literacy skills (reading level of at least Grade 9), whereas in South Africa there are 11 official languages and low literacy is common (Van der Berg 2015). However, 442 of the 462 participants who completed the DIN test reported level 10 English competency which indicates a high literacy level. Our study also did not focus on the reasons why some individuals visited the website but did not begin or complete the DIN test, suggesting that they had other needs than those the website addressed.

Conclusions

This study shows promise of using online recruitment to a virtual hearing clinic. The proposed hybrid model (combination of online and face-to-face modes of communication) holds promise by which services can be offered. Providers of services can take advantage of such a model to support an individual during the initial stages of seeking HHC online prior to a physical appointment. This can be done by using the hours in a day and days of the week strategically to provide access to services outside of office hours by using asynchronous methods which takes advantage of a virtual offering of services with the potential of being open 24/7.

The use of online platforms to create awareness of prevention and promotion of hearing loss and HHC services is possible and effective. As technological advancements increase over the coming years and accessibility increases, integration of this proposed hybrid model into existing audiology practices can lead to new audiology patient pathways through online hearing screening, assessing readiness to seek further HHC services using synchronous and asynchronous methods and the enhancement of service delivery models.

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References
