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Hearing aid review appointments: attendance and effectiveness

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ABSTRACT

Purpose: To (i) identify participant factors associated with hearing aid review (HAR) appointment attendance; (ii) investigate whether completion of self-report survey identifying hearing aid related problems affects HAR appointment attendance; and (iii) investigate whether hearing aid problems and hearing aid management deficiencies are adequately addressed during HAR appointments.

Method: A prospective cohort study of adult hearing aid owners recruited from a single hearing clinic in Western Australia. Potential participants were invited to an annual hearing aid review appointment via postal letter. The invitation included a paper-based self-report survey evaluating either (a) hearing aid problems, (b) hearing aid management skills, or (c) hearing aid outcomes, depending on which intervention/control group the potential participants were assigned to, and a reply paid addressed envelope. Two months later,

potential participants were sent all three paper-based self-report surveys, irrespective of whether they had attended or not attended a HAR appointment.
Results: (i) There was no significant difference in gender or source of funding for hearing services between HAR appointment attendees and non-attendees. HAR non-attendees lived a greater distance from their clinic and were younger than attendees. (ii) Survey completion did not influence HAR appointment attendance rates. (iii) A significant reduction in individuals' self-reported hearing aid problems were recorded following attendance at the HAR appointment. No significant changes in hearing aid management skills or overall hearing aid outcomes were detected.
Conclusions: Long travel distances may be a barrier to attendance at review appointments. HAR appointments appear to be effective in improving hearing aid problems.

INTRODUCTION

Hearing loss is a chronic health condition affecting many facets of an individual's life (Vas et al., 2017; World Health Organization, 2017). It is one of the most common causes of disability amongst the ageing population, affecting approximately one third of adults over the age of 55 (Chia et al., 2007; World Health Organization, 2006), and is commonly managed with the use of hearing aids. Typically, hearing aids are provided as part of an audiological rehabilitation program comprising five stages, each with a different purpose: (1) the hearing evaluation; (2) discussion and decision on rehabilitation options and selection of the hearing aid(s); (3) the initial fitting and programming of the hearing aid (including device management training); (4) follow-up fine tuning appointments; and (5) training and support regarding communication and social engagement strategies (Bennett et al., 2021; Bennett et al., 2016; Boymans & Dreschler, 2012; Hickson & Worrall, 2003; Linssen et al., 2013; Valente et al., 2006). This initial, or "acute", period of hearing aid fitting usually occurs within a six to 12 month period, and is reported to take 2-3 sessions in the USA (Kochkin et al., 2010) or 2-10 in Australia (Bennett et al., 2016).

Throughout this initial period of audiological rehabilitation, the clinician will use objective measures of hearing aid performance (such as real-ear insertion gain) and subjective measures of hearing aid performance (such as self-report survey evaluating hearing aid use, benefit or satisfaction) to establish the extent to which the hearing rehabilitation program was successful (Granberg et al., 2014). Once the clinician and client are satisfied with the performance of the hearing aid and the outcomes of the rehabilitation program, payment is finalised and the program is considered completed. From then on, the onus is usually on the client to seek help for any problems that may arise, with the exception of a hearing aid review (HAR) appointment which may be initiated by a clinic.

Clients are often advised by their clinician to attend HAR appointments every six or 12 months in order to evaluate their hearing status and the ongoing outcomes of the hearing rehabilitation program. The HAR appointment is used to: identify and troubleshoot any problems a client might be facing; to evaluate whether or not the hearing aids are functioning optimally for the client's individual needs; and to evaluate whether the hearing aid owner has experienced any changes in their personal circumstances or severity of hearing impairment that might require alteration of the hearing aids acoustical settings (Goggins & Day, 2009). Research suggests that those clients who maintain an ongoing relationship, and receive ongoing follow up support from their clinician, experience improved hearing aid outcomes, including hearing aid use (Bennett et al., 2020a; Brooks, 1979; Solheim et al., 2012). This highlights the importance of the HAR appointment.

We recently investigated hearing aid owners' decisions to accept an invitation to attend HAR appointments (Bennett et al., 2020a). Of 120 participants, 71 (59%) attended a HAR appointment, and 49 (41%) did not; this is in line with previous studies highlighting moderate uptake of HAR appointments (Linssen et al., 2013). Factors significantly associated with attendance at HAR appointments included hearing aid funding source (whether the client received government subsidised hearing services, or privately paid for their services), and whether participants self-reported valuing HAR appointment (Bennett et al., 2020a). Importantly, those clients who attended HAR appointments self-reported better hearing aid outcomes than those who did not attend a HAR appointment, suggesting that HAR appointment attendance is associated with greater hearing aid outcomes. Eighty-nine percent (n=58) of respondents indicated that their reason(s) for attending the HAR appointment were discussed during the appointment, and 100% (n=61) indicated that their needs were met by the appointment. Of note, around half of the participants attended their appointment for reasons related to their hearing aids (i.e. requiring adjustments or repairs).

We sought to investigate factors contributing to non-attendance of an HAR appointment, as well as factors contributing to unmet needs during HAR appointments. Given that an awareness of hearing aid issues were most often raised as a reason for attending a HAR appointment, we hypothesised that increasing the client's awareness of their own shortfalls relating to hearing aid management or hearing aid problems may lead to appointment attendance, and subsequently may enhance the outcomes obtained from the HAR appointment.

The objective of this study was thus to investigate whether a self-report tool of hearing aid problems can be used to increase attendance rates of the HAR appointment. Specifically, the aims of this study were:

1) To identify factors associated with HAR appointment attendance;

2) To investigate whether hearing aid owners are more likely to attend a HAR appointment if they complete a self-report survey identifying hearing aid related problems or shortfalls in hearing aid management skills just prior to the appointment; and
3) To investigate whether hearing aid problems and hearing aid management deficiencies are adequately addressed during HAR appointments;

METHODS

All three aims of this study were investigated using a randomised control cohort intervention study. Potential participants were randomly allocated to one of three groups: (a) hearing aid problems group, (b) hearing aid management group, or (c) control group. As per the normal practice for the clinic from which participants were recruited, those hearing aid owners who were due for a HAR appointment were mailed a reminder letter prompting them to call the clinic to make a HAR appointment. The standard letter was slightly modified by the research team to include a request that an enclosed survey (the International Outcome Inventory for Hearing Aids: IOI-HA; Cox & Alexander, 2002) be completed and returned via a self-addressed reply envelope. Participants were not made aware that this was a research project at this point in time, so as not to influence their decision to attend or not attend their HAR appointment. Potential participants who were allocated to each of the two intervention groups also received one of two surveys which were designed to identify: (a) hearing aid related problems (Bennett et al., 2020b), and; (b) hearing aid management skills and knowledge (the Self-administered Hearing Aid Skills and Knowledge Inventory: HASKI-self; Bennett et al., 2018). The control group received only the IOI-HA survey.

In order to address aim three, all potential participants were sent a second survey set two months following the first to gather information on any changes in hearing aid outcomes, problems, or management skills and knowledge. The two-month time frame allowed for participants to naturally choose to attend or not to attend their HAR appointment (Figure 1). At this stage potential participants were made aware that this was a research project, and those who provided written consent were included in the study.

Materials

Client clinical history form. The short clinical history form was used to collect participant data, including date-of-birth and gender. It was also used to collect basic information regarding the participants hearing aids (device-related factors), included fitting configuration (unilateral or bilateral), style of hearing aid (Behind-The-Ear: BTE or In-The-ear: ITE), and when they received their current hearing aid. Participants were also asked to indicate the source of funding for their hearing services (whether they were self-funded:

Private, or whether they received financial support from the Australian Government through the Office of Hearing Services: OHS), and to rate their satisfaction with their hearing aid.

International Outcome Inventory for Hearing Aids. The IOI-HA was selected to be used in this study as it is a well-established test, utilized in both clinic and research for hearing aid outcome evaluation. It was designed to be administered in conjunction with other related surveys in order to provide a common platform to facilitate comparison of results between different audiological studies. The IOI-HA is a seven-item survey developed to assess the effectiveness of hearing aids in improving hearing and general life enjoyment in real-life situations (Cox & Alexander, 2002). It evaluates daily hearing aid use, benefit, residual activity limitations, satisfaction, residual participation restrictions, impact on others and quality of life. Each item on the IOI-HA is assessed on a five-point Likert scale and calculation of the overall score involves averaging the scores across all the items.

A survey identifying hearing aid problems. A survey evaluating hearing aid problems was included in this study for two reasons. First, to test the hypothesis that self-identification of hearing aid problems through self-report survey would promote help-seeking for such problems, in taking up the invitation to attend the HAR appointment. Second, to test the hypothesis that should the client be empowered with the knowledge of the hearing aid problems they were experiencing, that these hearing aid owners would have been able to raise these problems with their clinician and thus have them addressed during the HAR appointment. The self-administered survey required participants to indicate through a binomial (yes/no) scale whether they were currently experiencing any of the 26-hearing aid related problems listed, including a not applicable option (Bennett et al., 2020b). Scores are calculated by summing the total number of items identified as problematic and converting this into a percentage. The larger the overall score, the greater number of problems the hearing aid owner was experiencing (i.e., a score of 0% indicates the hearing aid owner were currently experiencing none of the problems listed).

Self-Administered Hearing Aid Skills and Knowledge Inventory (HASKI-self). A survey evaluating hearing aid skills and knowledge was included in this study to test the hypothesis that self-identification of hearing aid skills and knowledge deficiencies would promote help-seeking for such problems, and to test the hypothesis that empowered with the knowledge of their hearing aid skills and knowledge deficiencies, these hearing aid owners would have been able to raise their concerns with their clinician and thus have them addressed during the HAR appointment. The HASKI-self was selected as it is the most thorough self-report survey available to evaluate hearing aid management skills (Bennett et al., 2018). The HASKI-self is a self-administered survey evaluating the skills and knowledge required for

hearing aid management (Bennett et al., 2018). The HASKI-self contains 14 questions (73 items) across three domains: 1) daily hearing aid use, 2) hearing aid maintenance and repairs, and 3) advanced hearing aid knowledge. Items describe various tasks, skills or knowledge that is required for hearing aid use and participants are required to subjectively rate their skills on a four point Likert scale: “Never”, “Sometimes”, “Most of the time”, “Always” (for tasks based items) and to identify whether or not they were aware of the item using a 3-point Likert scale: “Yes, I am aware”, “I now recall receiving this information, but had forgotten” and “I do not recall receiving this information” (for knowledge based items). A not-applicable option is also available for many of these items. A score for the HASKI-self is calculated by summing the total number of items identified as competent (not problematic) and converting this into a percentage of competency. The higher the score, the greater competency of the hearing aid user (i.e., a score of 100% signifies complete competency).

Participants

Hearing aid owners were recruited from four metropolitan clinic sites of a small chain of hearing aid clinics in Perth, Western Australia. Participants aged 18 years or older, who were due for their HAR appointment (to the month) were identified as potential participants, sent the HAR letter, and subsequently invited to participate in the study.

Sample size. Assuming a type one error rate of 5% and a power of 0.9 when utilising the assumption of 0.1 for the control group, and 0.4 for each intervention group, a sample size of N=39 for each of the three groups was calculated to be sufficient to address our aims and hypothesis; a total sample size of N=117 participants.

Procedure

This study was approved by the Human Research Ethics Office of The University of Western Australia. All participants provided written consent for the inclusion of their data in the study.

A list of potential participants was generated by the partnering clinic. Potential participants were randomly allocated to one of the three groups (one of the two intervention groups or the control group) using a random number generator in Microsoft Excel. Potential participants were then sent a letter via post inviting them to make a HAR appointment, and including the surveys based on the groups they were allocated to. The information provided did not mention appointment attendance or non-attendance so as not to influence their

decision to attend their appointment or not. This procedure was repeated over four consecutive months to ensure a sufficient sample size was reached.

Two months after the potential participants were invited to participate in the study, allowing sufficient time for them to have made and attend a HAR appointment, all potential participants (irrespective of whether they completed the first survey or not, or whether they attended their appointment or not) were then sent a survey set including all three surveys: IOI-HA, client clinical history form, the hearing aid problems survey and HASKI-self, along with an invitation to participate in the study. At this stage, potential participants were identified as having attended or not attended their HAR appointment.

Data Analyses

Data were analysed using SPSS statistics (IMB Corp, 2012). Data were inspected for outliers (*i.e.,* visual inspection and |z| score calculations using a cut-off point of +/-2.58) prior to conducting tests of normality and skewness (*i.e.,* Shapiro-Wilk test of normality).

Aim One: Factors associated with HAR appointment attendances

Binary logistic regression was used to investigate participant factors that may have influenced appointment attendance. Data were inspected to ensure all assumptions (binary dependent variable, independence of observations, and no multicollinearity between independent variables) were met. The dependent factor was HAR attendance (dichotomous: attendance (1) or non-attendance (2)) and the independent predictors were age, gender, funding source (private or government funded), and distance travelled. The Where*is* website was used to establish the distance, in kilometres, travelled by participants from their home postcode to attend the appointment.

Aim Two: Impact of self-report survey on HAR appointment attendance

Binary logistic regression was used to investigate the impact of completing a self-report survey (either hearing aid problems survey, HASKI-self, or IOI-HA) on HAR attendance. Factors that were significant in the aim one (*i.e.,* distance travelled) were controlled in this analysis so as to provide an independent understanding of completing the self-report survey on attendance. Data were inspected to ensure all assumptions (binary dependent variable, independence of observations, and no multicollinearity between independent variables) were met. The dependent factor was HAR attendance (dichotomous: attendance (1) or non-attendance (2)) and the independent predictor was completion of a pre-appointment survey (dichotomous: completion (1) or non-completion (2)), controlling for age and distance travelled.

Aim Three: Effectiveness of HAR appointments at addressing hearing aid problems and hearing aid management deficiencies

Only participants who had completed a pre-appointment and post-appointment survey on the HASKI-self, IOI-HA, and/or the hearing aid problems survey were retained for these analyses, as these analyses examined differences in hearing aid use, skills and outcomes pre-appointment to post-appointment.

These data were examined for change at the individual level and at the group level.

Individual level change. The reliable change index (RCI) was calculated to estimate if each case in the sample experienced a reliable change due to their HAR appointment, rather than measurement error alone (Estrada et al., 2019). Scores were created for each participant on each survey separately (HASKI-self and the hearing aid problems survey) by dividing the change in a client's score by the standard error of the difference for the respective survey. Standard error of measurement (SEM) for this calculation was derived from the pre- and post-appointment descriptive scores in the statistical software. Standard error of difference (SEdiff) was hand calculated: SEdiff = √ ($SEM1^2$ + $SEM2^2$). The 'compute' function in the statistics software was used to calculate the RCI from the following equation: RCI = (post-test score – pre-test score)/SEdiff (Guhn et al., 2014).

RCI scores of +/-1.96 or greater indicated statistically significant change.

For HASKI-self, effectiveness was indicated by an increase in scores from pre-to-post HAR appointment, and for the hearing aid problems scale, effectiveness was indicated by decreases in pre-to-post HAR appointment.

The percent of individuals who had a reliable positive change (effective HAR appointment), percent reliable decline (detrimental HAR appointment), and percent no-change (ineffective HAR appointment) are provided and discussed.

Group level change. Paired samples T-tests were used to investigate if pre-test scores differed significantly to post-test scores for the HASKI-self and the hearing aid problems survey. Due to the ordinal nature of the IOI-HA survey, Wilcoxon signed-ranks test was used to investigate if pre-test scores differed significantly to post-test scores. Bonferroni correction for multiple comparisons (2 comparisons, $p = 0.05$, corrected to $p = 0.025$). Cohen's d effect sizes were also calculated to obtain a measure of effect for each pre-post, where; Cohen's d = (M2 - M1) ⁄ SDpooled.

Data were inspected to ensure all assumptions for the paired-samples t-test (continuous dependent variable, related samples, no significant outliers, distribution approximates normality) were met.

RESULTS

Potential participants included 916 adult hearing aid owners who were sent an invitation to participate in the study with their regular letter inviting them to attend their HAR appointment.

In Round One (pre-HAR appointment data collection) 145 adults returned completed surveys (15.8% response rate), and are described in Table 1. These participants ranged in age from 32 to 100 years (mean 73.1, SD 11.0), with 59% (n=86) male and 41% (n=59) female. Mean scores of the IOI-HA questionnaire for all participants was 3.9 (SD 0.7; range 1.7 to 5), signifying high self-reported outcomes (Hickson et al., 2014). Almost one third of the participants (n=41 of 143) received a government subsidy for their hearing aids (OHS) and hearing services, while the remaining (n=102 of 143) paid in full. Of all the participants, 13.8% (n=20) used a single hearing aid (monaural fitting), while the remaining used binaural hearing aids (84.8%, n=123). The majority of participants (84.8%, n=123) reported being fitted with behind-the-ear style hearing aids, 12.4% (n=18) were fitted with in-the-ear style hearing aids, and the remaining 1.4% (n=2) reported wearing one of each. Hearing aid use and satisfaction was high with 77.2% (n=112) of participants self-reporting using their hearing aids for more than 4 hrs per day (IOI-HA item 1), and 73.8% (n=107) self-reporting being “satisfied” or “very satisfied” with their hearing aids. Although potential participants were allocated across the three test groups in equal numbers, responses were received from 52 (35.9%) participants who received and completed the survey identifying hearing aid problems, 53 (36.6%) who completed the HASKI-self survey and 40 (27.6%) who were in the control group.

For Round Two (post-HAR appointment data collection) 169 adult hearing aid owners returned completed surveys (18.4% response rate). A greater number of participants responded in this round. These participants ranged in age from 32 to 101 years (mean 74.3, SD 11.7), with 52.7% (n=89) male and 42.0% (n=71) female (n=9 did not provide sex information). Approximately one quarter of the participants (n=44) received a government subsidy for their hearing aids (OHS) and hearing services, while 60.4% (n=102) paid in full (private), and n=23 did not indicate how the HA was paid for. Mean scores of the IOI-HA questionnaire for all participants in Round Two was 3.8 (SD 0.9; range 2.28 to 5). Mean scores for the survey identifying the presence of hearing aid problems ranged from 0 (no problems) to 73 (19 problems), with a mean of 29.7 (SD 16.6), equating to eight problems. HASKI-self scores ranged from 12 to 98.5 (mean 63.4, SD 17.7).

All potential participants (n=916) were invited to complete the Round Two (post HAR appointment) survey, irrespective of whether they attended a HAR appointment or not, and irrespective of whether they had participated in the first round (pre appointment) survey. Of those who responded in the second round, n=91 had also responded in the first round: 31 (34%) had completed the survey identifying hearing aid problems in round one, 33 (36.3%) had completed the HASKI-self survey in round one, and 27 (29.7%) were control group participants.

According to the clinic database, of the 916 adult hearing aid owners who were identified as potential participants and recruited for the study, 30.2% (n=277) attended a HAR appointment within two months of the invitation being sent out. Of the 145 participants who returned the pre-appointment surveys, 49% (n=71) attended an HAR appointment. Chi-square test showed that the attendance rates for participants (49.3%) was significantly higher than attendance rates for potential participants (30.2%); $X^2(1) = 20.511$, $p = <0.001$.

Aim One: Factors associated with HAR appointment attendances

All data assumptions were met. Due to the requirement of logistic regression for complete data, only those participants with values for age, gender, funding source (private or government subsidised), and distance travelled (*n = 139)* were retained for this analysis*.* There was no significant association between attendance and gender ($p = 0.97$), or funding source (private or government subsidised; $p = 0.797$). There was a significant association between distance of residence and clinic attended ($p < 0.001$), with non-attendees living a greater distance from their clinic (mean 48.75km, SD 85.35) than attendees (mean 10.4km, SD 10.6), and in age ($p < 0.001$) with non-attendees being younger (range 32 to 101 years, mean 72.7, SD 11.6) than attendees (range 55 to 100 years, mean 76.0, SD 10.4).

Aim Two: Impact of self-report survey on HAR appointment attendance

All data assumptions were met. Due to the requirement of logistic regression for complete data, only those participants with values for age, gender, funding source, and distance travelled (*n = 139)* were retained for this analysis*.* After controlling for participant variables, age and distance travelled, completing a survey relating to hearing aid management or problems was not associated with HAR appointment attendance.

Aim Three: Effectiveness of HAR appointments at addressing hearing aid problems and hearing aid management deficiencies

Individual level change. The RCI for the HASKI-self indicated that 36% (n = 8) of the sample demonstrated a reliable improvement, 23% (n = 5) demonstrated decline, and 42% (n = 9) demonstrated no change, after their HAR appointment. The RCI for the hearing aid problems survey indicated that 81% (n = 17) of the sample demonstrated a reliable improvement, 9.5% (n = 2) demonstrated decline, and 9.5% (n = 2) demonstrated no change, after their HAR appointment.

Group level change. All data assumptions were met. A paired samples t-test revealed no significant differences between pre-appointment and post appointment scores for the HASKI-self scores. However, a paired-samples t-test did reveal a significant difference for the hearing aid problems survey scores (*p < 0.001)*. Participants' individual

hearing aid problems survey scores improved by an average of 10.8% (SD 12.6) [t = 4.794(30), $p < 0.001$].

Cohen's d revealed that the difference in pre to post HAR appointment scores for the hearing aid problems survey had a large effect size (*d = 1.605),* whilst Cohen's d showed no effect of appointment attendance on HASKI-self.

DISCUSSION

The aims of this study were: (i) to identify factors associated with HAR appointment attendance; (ii) to investigate whether hearing aid owners are more likely to attend a HAR appointment if they complete a self-report survey identifying hearing aid related problems or shortfalls in hearing aid management skills just prior to the appointment; and (iii) investigate whether hearing aid problems and hearing aid management deficiencies are addressed during HAR appointments.

Aim One: Factors associated with HAR appointment attendances

Attendance rates at HAR appointments recorded in this study (30.2%) were comparable to the one other existing report quantifying attendance rates (40%) (Bennett et al., 2020a). Similar rates are to be expected as the two studies were conducted within the same clinical organisation, although different sites, different participants and at different times of the year. Awareness of the level of HAR appointment uptake is informative as it can provide clinicians and hearing aid clinics with a baseline of attendance which can be used to set clinic goals for improvement of these rates. The low rates of review appointment up-take are interesting in light of the high prevalence of self-reported hearing aid problems (94% of participants), and self-reported gaps in hearing aid management skill and knowledge (100% of participants who completed the HASKI-self reported difficulties). These results signify that although participants are experiencing problems, they are not attending appointments to have them rectified. These findings echo those of Bennett et al. (2020b) who explored the prevalence of hearing aid problems associated with hearing aid use. In a cohort of n=413 adult hearing aid users recruited from seven clinics across Australia, almost all participants (98%) indicated that they were experiencing at least one of the hearing aid problems included on the survey, with a range of 0 to 25 (of a possible 26 problems), and a mean of 10 problems per participant (SD 5). However, participants indicated that they had reported less than half (46.3%) of these problems to their clinic (range of 0–100%, mean 43.4, SD 13.9). Participants who reported experiencing a greater number of hearing aid problems also reported lower levels of hearing aid benefit, and satisfaction with their hearing aids. This body of research highlights the need for a better understanding of help-seeking behaviours for hearing aid problems.

The association between travel distance and HAR appointment attendance is a novel finding; greater distance between the client's home and clinic reduced the likelihood of HAR appointment attendance. Further afield, the literature is inconclusive as to the impact of travel distance and time on healthcare appointment attendance. Jackson et al. (2006) found that clients undergoing treatment at an alcohol rehabilitation centre were less likely to attend treatment appointments if they lived further away. However, others report no association between travel distance and appointment attendance, including in obstetrics (Campbell et al., 2000) and alcohol treatment centres (Booth & Bennett, 2004).

Distance itself may not be the sole contributing factor impacting HAR attendance rates. There may be a combination of factors which are associated with the distance required to be travelled. For example, older adults often require a companion to bring and accompany them to their appointments (Iwahashi et al., 2015). If such a companion is not available due to work or personal commitments, this may influence participants' availability to make or attend an appointment (Iwahashi et al., 2015). Additionally, transportation difficulties have been found to be an important factor when determining reasons for client's attendance or non-attendance in other fields of health (Ersin & Bahar, 2011; Halpern et al., 2013; Iwahashi et al., 2015). The impact that distance can have on appointment attendance is important for clinicians to understand so that they can determine proposed solutions to overcome accessibility barriers which are related to geographic, mobility and patient schedule disruptions that may otherwise delay access to audiological services. It is perhaps not that these clients do not want to attend an appointment, but that this barrier prevents it. Proposed solutions to such barriers include the utilisation of visiting sites, self-help tools (Ferguson et al., 2018; Ferguson et al., 2019) and tele-audiology services (Rushbrooke & Houston, 2015; Saunders, 2019).

Aim Two: Impact of self-report survey on HAR appointment attendance

Several factors may have influenced the finding that survey completion did not increase a client's likelihood of attending a HAR appointment. Firstly, it is possible that participants who received the surveys did identify significant problems with their hearing aids, but chose to seek help through means other than to attend an appointment with a clinician. Hearing aid administration staff are commonly trained to be able to provide basic hearing aid trouble shooting, and some hearing aid clinics have hearing aid technicians readily available to assist clients with technical issues with their hearing aids.

Secondly, it needs to be considered that some participants who attended an appointment may not have done as a result of seeing or completing the surveys. Some clients may be naturally more compliant than others and may simply have booked an appointment as they

were instructed to do so by the clinic. In a recent study exploring client's reasons for attending annual hearing aid review appointments, 83% indicated one of the core influencing factors to be "invited by clinic/clinician" (Bennett et al., 2020a). Personality variables are associated with medical appointment keeping adherence (Hershberger et al., 1999). It is thus possible that the personality traits also influenced participants' decision to attend or not attend an appointment in the current study.

Thirdly, results of the IOI-HA survey data in the current study revealed that the majority of the participants were satisfied or highly satisfied with their hearing aids. It is possible then that despite the number of problems reported, clients were still satisfied with their hearing aids and thus did not feel that a HAR appointment was necessary. Meis and Gabriel (2006) identified the invisibility of hearing health services and audiology, stating that there is "a general lack of knowledge about what can and cannot be accomplished by engaging in hearing aid rehabilitation". It is possible that hearing aid owners may be unaware of the full benefits to be gained from HAR appointments. Finally, participants were provided the survey(s) but were not given any information on how to interpret their survey results, nor an indication that the survey results should influence whether they attend a HAR appointment, nor any information regarding whether their self-reported hearing aid problems were rectifiable. If these had been included in the study, it is possible that more participants may have been prompted to attend. This may be expected because previous research has shown that clients are more likely to attend a HAR appointment if they value the importance and benefit of the appointment (Bennett et al., 2020a).

Aim Three: Effectiveness of HAR appointments at addressing hearing aid problems and hearing aid management deficiencies

This is the first study to examine the effectiveness of the HAR appointment in reducing problems related to the hearing aid. When examining change in clients before and after HAR appointments, we can examine change at the group level and at the individual level. Examining change using the RCI enables measurement of reliable change within each individual. This ensures the change we see if not due to errors of measurement alone.

The findings of individual and group change in scores for the hearing aid problems survey demonstrate the benefit of HAR appointments for improving client outcomes and provide clinicians with evidence to support their efforts to encourage clients to continue to return for regular HAR appointments.

It is worth noting that clinicians providing clinical services to the participants were unaware of the study, and not provided with a copy of the survey results. This was done to maintain participant privacy, but also to better understand the behaviours of the clients when armed with the knowledge of their own hearing device management and problem status. Providing

the survey results to the clinicians may have enabled them to better address the identified problems and resulted in greater improvement in post- HAR appointment survey scores. This notion is worthy of future investigation.

Limitations and further research

Participants were recruited from a single chain of hearing aid clinics limiting the generalisability of the findings. Other clinics may utilize alternative methods of recalling clients for HAR appointments, use reminders, or other forms of follow up following the original invitation to attend a HAR appointment, all of which likely affect appointment attendance rates. As the clients recruited for this study would have been serviced by multiple clinicians at the time of data collections, a variety of personal approaches to client care may have impacted on results. This is something that further research could explore. Additionally, the clients self-selected to participate in the study, and sample sizes were small. The low response rate observed may be in part explained by the age of potential participants, as it is possible that the cognitive load required for survey completion was too high for this population as there were several surveys to complete at each time point (Bowling, 2005).

CONCLUSION

HAR appointment attendance rates range from 30.2 to 49.3%, and appear to be influenced by distance travelled. Greater distance between the clients' home and the hearing clinic appears to reduce the likelihood of HAR appointment attendance. Clients self-reporting greater issues relating to hearing aid problems or hearing aid management skills do not appear any more likely to attend HAR appointments. Furthermore, completing surveys relating to hearing aid problems or hearing aid management skills does not appear to prompt clients to subsequently attend HAR appointment attendance rates. Finally, a significant reduction in individuals' self-reported hearing aid problems were noted following attendance at the HAR appointment, suggesting that HAR appointments contribute to improved hearing aid performance.

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Table 1: Cohort description (Round One data), comparing hearing aid review (HAR) appointment attendees versus non-attendees.

Cohort description	HAR appointment attendees (n = 71)	HAR appointment non-attendees (n = 74)
Participant factors		
Age (years: mean, SD)	75.97, 10.4	72.7, 11.6
Gender (n)	44 male, 27 female	41 male, 31 female
Funding source (n)	21 OHS, 49 private	20 OHS, 51 private
Distance travelled (km: mean, SD)	10.4, 10.6	48.8, 85.4
Hearing aid factors		
Years since current hearing aid fitting (years: mean, SD)	3.9, 3.5	3.3, 3.4
Fit (monaural/binaural)	11 mon, 59 bin	9 mon, 62 bin
Hearing aid style (BTE/ITE)	60 BTE, 9 ITE, 1 both	62 BTE, 8 ITE, 1 both
Survey responses		
HASKI-self score (mean, SD)	60.8, 19.7	62.4, 23.79
Hearing aid problems survey score (mean, SD)	33.27, 14.6	30.1, 17.1
IOI-HA (mean, SD)	3.9, 0.7	4.1, 0.6

Figure 1. Flow diagram depicting participant groups, rounds of data collection, and hearing aid review appointment (HAR) attendance.