Hearing Aid Satisfaction among Adults with Hearing Impairment in Lebanon

Gabriel Yazbeck

SAERA. School of Advanced Education Research and Accreditation

ABSTRACT

Introduction:

The present study thoroughly examined the impact of various factors, including social environment and motivation, age, gender, cost, binaural versus monaural hearing aid use, daily hearing aid utilization hours, hearing handicap, and hearing impairment on the overall hearing satisfaction on adults in Lebanon. The investigation involved a comprehensive review of the relevant literature and a comparison with a sample population in Lebanon.

Method:

Audiological books, Research Gate, PubMed Central, Google Scholar and the author's library were used to select resources. Sources gotten from the internet were written by either certified medical audiologists or ear nose throat physicians, and published on reliable sites, in referred publications or on professional organizations sites. Instructors at the American University of Beirut and certified hearing specialists currently working in the audiological field were also consulted to gain a more appropriate insight on the Lebanese data. Credibility, validity, reliability, and transferability of all the sources were deeply examined in this literature review.

Results found:

Motivation, cost, binaural fitting, hearing impairment and handicap and HA utilization were found to have a significant impact on overall satisfaction. Findings suggest that HA satisfaction may vary over time and between countries and regions.

Conclusion:

A thorough, multifaceted, and holistic strategy is required, examining all factors co-dependently rather than individually. Instead of using a single-item test, a complete, standardized approach to assessing HA satisfaction can aid in the identification of significant related variables.

Keywords: *Hearing aid, Hearing impairment, Audiology, Lebanon*

OVERVIEW

According to the World Health Organization (WHO), around 466 million people worldwide have disabling hearing loss, but only 17% of them use hearing aids (WHO, 2021). The latter are considered as the primary means of enhancing hearing, speaking, and health-related quality of life. Unfortunately, there are significant differences in HA utilization and effectiveness among users, which resulted in a great deal of controversy among HA satisfaction. According to Studebaker (1980), the audiologist must be a "jack of all trades" taking into consideration the multiple factors that may influence HA satisfaction. The aim of this paper will be to explore the different factors affecting HA satisfaction and compare them with other findings including the Lebanese and Arab population.

HEARING AIDS SATISFACTION

Hearing Aids satisfaction as an outcome measure

According to Wong et al. (2003), the concept of hearing aid satisfaction pertains to the emotional experience of pleasure that arises from an evaluation of performance, whereby the consumer perceives that their specific listening needs, communication requirements, or hearing-related goals have been adequately fulfilled. In other words, it can be seen as a process of assessing service, by collecting client feedback and observations regarding their altogether hearing journey. Numerous studies have included satisfaction as a measure of outcome, indicating that it is critical to the HA fitting process and is extremely important in audiology. Hearing aid satisfaction can be viewed as the culmination of the amplification journey. The first step is to seek help, the second is to decide to acquire a HA (uptake), the third is to decide to use an acquired HA, and the final goal is to be satisfied with the HA (Knudsen et al., 2010). Such topic comes really handy in the context of hearing aids sales and development of a successful hearing professional image. In effect, multiple studies discovered that consumers who were "extremely satisfied" with their devices were three times more likely than consumers who were "very dissatisfied" to promote HAs to their friends. As a result, happy HA users make outstanding advocates for the adoption of HA. (Kochkin, 2000). As Michael LeBoeuf, American business author and former management professor at the University of New Orleans used to say: "A satisfied customer is the best business strategy of all" (LeBoeuf, 2007, p.96).

Factors Related to HA Satisfaction

1- Social environment & Motivation

In a study conducted by Ridgway et al. (2005), a substantial correlation was found between rising hearing thresholds in pure-tone audiometry and elevated depressive symptoms ($p = 0.001$). Aural therapy including hearing aid fitting and intervention had a significant positive impact on depression symptoms in the intervention group ($p = 0.000$) and between groups ($p = 0.003$) in P1. This might be explained by the fact that presbycusis, an age-related hearing loss, negatively affects the mental health of senior citizens. Using hearing aids can reduce depression and perhaps improve a person's quality of life by enhancing their social environment.

The severity of a hearing impairment frequently impacts the motivational variables that are taken into account when determining hearing aids candidacy and assessing overall satisfaction. In effect, hearing impairment is harder to quantify than hearing loss, which can actually be quantified using audiometric data. In contrast, hearing impairment relates to how a hearing loss affects a person's capacity for communication and overall quality of life.

In a study done by Öberg et al. (2011), 346 senior citizens participated in a survey that included questionnaires and home visits. Among those, 55% acknowledged having a degree of hearing impairment and 59% of these used hearing aids. The subjects' most common excuse for not purchasing hearing aids was that they believed their hearing issue was not considered to be serious enough. The physical and emotional wellbeing of participants with hearing impairment who did not own hearing aids was worse (Öberg, 2011). Hickson et al., (2014), also examined the different links in 160 older adults (older than 60 years old), between effective hearing aid use and satisfaction level. Results showed that participants were more likely to succeed and be satisfied as hearing aid owners if they had more support from close friends and family members, more positive attitudes toward them, as well as higher perceptions of their own ability to handle hearing aids more adeptly. In addition, Wiesner et al., (1996), similarly investigated the possible correlation between intention and behavior in hearing aids usage and satisfaction. The analyses showed that the person's normative views, desire, and mindset toward using hearing aids, have a tremendous impact on overall hearing aid's usage and satisfaction.

Therefore, it is important for the audiologist to be aware of the individual's perceived need for amplification when considering them as a candidate for hearing aids. Individuals who are willing to acknowledge their hearing loss, committed to using hearing aids, and have positive expectations about their benefits, are more likely to experience success and satisfaction with their use. On the other hand, it is equally probable that people who are unmotivated to use amplification and who do not believe they have a hearing impairment will not use hearing aids effectively which will lead to lower satisfaction level. Therefore, the severity of the hearing impairment and motivation are important variables in deciding hearing device eligibility and future satisfaction.

2- Age

Kaplan-Neeman et al. (2012) discovered that age had unfavorable relationship on SADL ratings among 109 HA users (with an average age of 65.2). There was a link between age and the SADL's Positive Effects subscale, but the relevance of the results was not published. The authors hypothesized that as subjects aged, they became less pleased with changes in acoustic information given by their HAs and did not believe their devices helped them comprehend speech sufficiently. Similar analyses were found in another study (n=1148) conducted in South Korea by Kim et al. (2022). The results indicate that there is a negative correlation between age and satisfaction with hearing aids. To be more precise, for every one-year increase in age, there was a decrease of 0.03 in satisfaction with hearing aids. This relationship was found to be statistically significant (β=-0.03, $p<0.01$).

On the other hand, age was found to have a favorable association with the Service and Cost subscale (r = 0.01, p =.001). As a result, as individuals mature and grow older, they become more pleased with the HA fitting quality, reliability, and cost/value of the devices. In effect, older people may be more likely to use hearing rehabilitation services such as troubleshooting and counselling sessions fitting, reliability, and cost/value of the devices during the trial period (Kaplan-Neeman et al., 2012).

Numerous older studies did not identify a significant connection between age and satisfaction; however, these studies used generic satisfaction measures rather than validated questionnaires (Kochkin, 1992; Bentler et al., 1993).

Knudsen et al. (2010) and Wong et al. (2003) concur that the literature shows no or little association between age and HA overall satisfaction. There are a few findings that stand out. It should be mentioned that a significant proportion of age-related research include participants over the age of 60 (Knudsen et al., 2010).

3- Gender

Cox et al. (2003) investigated the connection between diverse factors and satisfaction among 154 subjects in order to create baseline statistics for the International Outcome Inventory for Hearing Aids (IOI-HA; Cox & Alexander, 2002). MANOVA analyses showed that there was no substantial variation in mean satisfaction ratings between male and female subjects.

Williams et al. (2009) used the IOI-HA to examine satisfaction among 160 individuals with multichannel digital hearing aids; however, no significant relationship between gender and satisfaction was identified. Additionally, when an independent group's t-test was used, Uriarte et al. (2005) discovered no statistically significant variance between SADL Global ratings for male and female subjects. Similar results were observed in Purdy's research, no substantial relationship between gender and satisfaction were found (Purdy, 2001).

4- Cost

Cost can prevent someone from getting hearing devices and may have an impact on satisfaction level. Surprisingly, the relationship between overall cost and satisfaction has rarely been researched, though comparisons of self-paying and non-paying customers' satisfaction have been analyzed. According to Hosford-Dunn and Halpern (2000), clients from private clinics who self-purchased their aids reported being slightly more pleased when facing issues compared to typical hearing aid users. Thus, cost had a direct impact on the Positive image scale of the SADL questionnaire. Put into context, in a study conducted by Cox and Alexander (2001), higher satisfaction levels were obtained when third parties purchased their hearing aids compared to complimentary hearing aids provided free of charge to veterans. These studies appear to show that self-paying customers are more content in some ways, but the impact is minimal. The results might be explained by the fact that clients purchasing their own hearing devices are more aware and will take greater responsibility in using them effectively in order to tackle their hearing impairment. As the saying goes, you only know the value and worth of something when you pay for it from your own pocket.

Kochkin's (2007) survey examined the barriers to acquiring a hearing aid and identified the top five attributes that could

potentially encourage an unassisted individual to pursue obtaining a hearing aid. Among the five identified characteristics, two were found to be cost-effectiveness and the capacity for self-fitting or self-adjustment of a hearing aid. According to the survey results, 40% of the participants expressed that a reduction of US$500 in the price of hearing aids would motivate them to buy (Kochkin, 2007). However, lower cost also means lower technological level. In a study conducted by Newman and Sandridge (1998), a majority of over 75% of the participants expressed a preference for the instruments categorized as "higher end." However, it was observed that 33% of the participants altered their inclination towards the "higher-end" hearing aids subsequent to being apprised of the associated expenses.

5- Binaural vs Monoaural

The advantages of utilizing two hearing aids as opposed to one have been a topic of intense discussion for a considerable period of time. However, it is widely accepted that binaural amplification is the preferred option unless there are notable contraindications. In her article, Holmes (2003) suggests that bilateral amplification is a recommended course of action for elderly patients exhibiting symmetrical hearing loss, unless there is reason to suspect any contraindications. Similar results were also found in Kim's research, in which individuals fitted bilaterally were 1.23 times more likely to get satisfied during their amplification journey (Kim et al., 2022).

The most apparent benefits associated with binaural fitting were found to be an enhanced feeling of spatial localization and an improved speech recognition amidst noisy environments. The literature has repeatedly demonstrated the advantages of binaural hearing when the tasks assigned to the subjects have been adequately challenging (Ross, 1980).

Despite its potential benefits, there is a challenge in demonstrating the clinical efficacy of binaural amplification (Wernick, 1985). Furthermore, certain individuals with hearing impairment may necessitate a period of adaptation prior to exhibiting a binaural advantage and feel more comfortable when sound was presented monaurally. However, this only accounts for a small percentage of the observed individuals, more investigation was found to be necessary before reaching firm findings (Nabalek & Pickett, 1974).

6- HA experience

The MarkeTrak IV survey revealed that novice and inexperienced users (n=800) exhibited a notably reduced mean level of general satisfaction (54% rating) in comparison to users with previous experience (n=913, rating of 63%, $p < .001$). Furthermore, several other studies have extensively examined the correlation between experience and satisfaction and have arrived at a similar finding that individuals with previous experience tend to exhibit higher levels of satisfaction compared to newly fitted individuals (Cox & Alexander, 2000; Kochkin, 2000; Hosford-Dunn & Halpern, 2001). The authors assume that individuals that are already accommodated to the new hearing experience that a hearing aid provides will face less difficulty and be less annoyed in opposition to new users, leading to a higher satisfaction. The brain's ability to adapt, also known as the phenomenon of plasticity, plays a big role in such situations.

7- HI severity

Uriarte et al. (2005) analyzed HA users with more severe hearing impairment (based on superior ear three frequency PTA) and found that the latter were to be considerably happier with their HAs in comparison to individuals with less acute hearing (based on SADL Global scores). However, it is important to mention that since only 1% of the variation in SADL Global scores is explained by degree of HI, this association may be concluded as comparatively insignificant (r = -0.100, p .01). Similar results were deducted in a recent study conducted by Khiavi et al. (2015); adults suffering from severe hearing loss reported significantly higher levels of satisfaction compared to those who had moderate or moderate to severe hearing loss (p=0.01).

In contrast, Hosford-Dunn & Halpern (2001) discovered a mixed association between SADL ratings and HI severity. In effect, greater hearing impairment severity was associated with lower satisfaction on the Negative Feature subscale (rs = -.29, p .001) as feedback and background noise issues were more prevalent. However, taking into consideration the advancement of technology improving feedback management and background noise cancellation, this may no longer be a problem nowadays.

Furthermore, it was discovered that HI intensity influenced SADL subscales by interacting with elements like experience and everyday use (Hosford-Dunn & Halpern, 2001). The Hearing Aid Users Questionnaire (HAUQ) was used by Dillon et al. (1999) to assess the correlation between satisfaction and multiple degree of HI. A moderately negative association was hence discovered by the research and calculation of the effect size reveals that HI intensity was responsible for a significant part (around 20%) of the variation in HA satisfaction. Nonetheless, it is important to mention that this association was found by four hearing centers in a state with lower-than-average outcomes and higher HI; as a result, the link might not hold true for the general population (Dillon et al., 1999).

8- Hearing ability & Handicap

Before delving into hearing ability, it is important to discern the concept of hearing disability and impairment (or handicap).

The World Health Organization (1980) distinguishes between the two terms: impairment and disability. Disability is the limitation or inability to execute a function in a way that is typical for a human being. The latter contrasts with a handicap, which is an impediment or condition that makes it difficult or impossible for a person to perform a function that is natural for that person.

Cheesman et al. (2013) looked into the connection between hearing ability utilizing the Self-efficacy for Situational Communication Management Questionnaire (SESMQ; Jennings, 2005) as well as handicap employing the Hearing Handicap Questionnaire (HHQ; Gatehouse & Noble, 2004). Results show that individuals expressing higher level of handicap did not indicate greater hearing difficulty. Thus, demonstrating that these are somewhat two distinct entities. Sadly, prior studies frequently treated these two factors as a single unit, making it challenging to infer specific connections between each of these factors and HA satisfaction.

Rather than using the word disability, studies frequently assess a person's ability or trouble

hearing in specific listening situations. According to Uriarte et al. (2005), the SADL Global, Positive Effect, Service, and Cost ratings have a substantial relationship with unassisted hearing impairment ($p < .001$). As a matter of fact, higher post-fitting satisfaction was correlated with higher issues and difficulties pre HA fitting. Similarly, Hosford-Dunn and Halpern (2001) noted that perceived hearing difficulties raised the SADL Positive Effect score ($rs = .25$, $p < .005$). According to Cox et al. (2003) findings, individuals with more subjective hearing issues expressed higher levels of satisfaction on the IOI-HA ($p = .001$).

Nonetheless, Kochkin (1997) discovered that individuals with milder disabilities were more likely to experience HA satisfaction. The authors explain that in some specific circumstances (such as when in big gatherings), their better hearing and sound directionality may have contributed to their increased satisfaction (Kochkin, 1997).

Numerous investigations revealed no connection between happiness and self-reported disability (Gatehouse, 1994; Norman et al., 1994; Dillon et al., 1997; Spitzer, 1998; Baumfield and Dillon, 2001; Humes et al., 2001). The use of various auditory ability and satisfaction measurements may account for discrepancies in findings. Even though impairment and handicap have very different meanings, much research does not distinguish between the two, as Gatehouse (1994) has urged. There is a need for more research in this field because the connection between disability and satisfaction is ambiguous, especially noting that disability hasn't been examined as a standalone component.

As for hearing handicap, Hickson et al. (2014) examined the Hearing Handicap Questionnaire (twelve five-point questionnaire which evaluates the adverse emotional effects of hearing impairment, such as emotional distress and discomfort, as well as the adverse societal effects, such as involvement limitations) ratings among 160 people aged 60 or later who had received HAs for the first time in the preceding two years in regressive research. Prior to receiving HAs, a customized variation of the HHQ was used to ascertain their handicap. It was discovered that individuals with higher HHQ difficulty scores were more likely to be successful and satisfied with their HA (defined as using a HA for more than an hour per day and experiencing at least modest benefits) ($p < .05$). However, many authors still believe that hearing handicap is still considered a subject worthy of further examination.

9- HA utilization hours per day

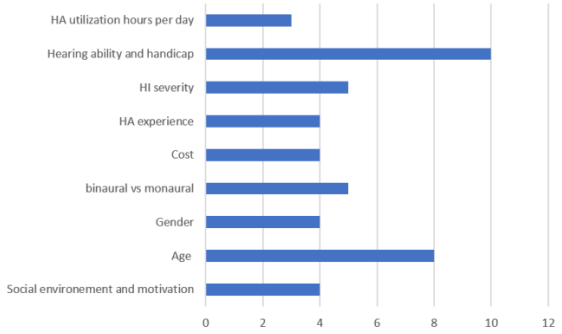
The study conducted by Kim et al. (2022) revealed a noteworthy association between the number of hours of hearing aid (HA) usage per day and satisfaction. Specifically, for every one-hour increase in wearing time, there was a corresponding increase in satisfaction with the hearing aid by 0.28 units. Similarly, in another recent study conducted in 2020, the level of satisfaction was found to be positively correlated with self-reported daily usage of hearing aids with a mean daily usage of 12 hours (Jilla et al., 2020). In the same context, overall "non-regular" use of aids was significantly associated with lower degrees of satisfaction, with overall ratings increasing from 1.92 for low usage to 5.42 for moderate to high usage (Bertoli et al., 2009). In general, it can be observed that increased usage of hearing aids

is positively correlated with increased levels of satisfaction.

Prevalence of HA satisfaction in different geographical locations

After conducting an extensive review of the relevant literature pertaining to the various factors that impact hearing aid satisfaction (found on the graph below), it would be worthwhile to investigate the overall prevalence of hearing aid satisfaction on a national scale.

Figure 1. *Number of articles explored in the literature in function of each individual factor*



However, it should be emphasized that satisfaction rates and satisfaction ratings are two distinct concepts. The former refers to the percentage of study participants who were satisfied with their hearing aids. The latter refers to the average satisfaction rating of all research participants, which may then be converted to a percentage value. Studying satisfaction rates in diverse geographical locations could give audiologists and hearing care professionals a general idea of success in their hearing aid fitting.

A recent study conducted in Israel, which is geographically situated adjacent to Lebanon, utilized the Satisfaction with Amplification in Daily Life (SADL) questionnaire developed by Cox and Alexander (1999). The study found that out of 109 individuals who use hearing aids, 92% reported varying degrees of satisfaction with their hearing aids. (i.e. had a global SADL score of 4 or more on a scale of seven). Another research conducted by the Otolaryngology Sakarya University Medical Faculty, also pertaining to the Middle East region, revealed that a subset of 14.28% (out of the initial 180 patients) did not opt to continue their amplification journey, and thus denied the use of hearing aid despite being good amplification candidate, achieving a satisfaction rate of 85.72% (Kayabaşoğlu et al., 2015). In line with Bertoli et al.'s (2009) findings from a cross-sectional survey conducted in Switzerland, the satisfaction rate of hearing aid users was 80%, as measured by a single 4-point item. All 3 studies seem to report a high satisfaction rate around 80%, meaning that on average 1 person in 5 hearing aid candidate could eventually be unsatisfied.

METHODOLOGY

A comprehensive analysis was conducted on the records of 50 adult participants from Lebanon. This study aimed to gain an in-depth knowledge of the Lebanese population by fitting individuals with hearing aids in three distinct locations: two private hospitals and one private hearing aid center, each situated in a unique demographic area in order to obtain a better holistic idea of the Lebanese population.

Inclusion Criteria

In order to achieve accurate and reliable results, the "adult" status of the participants was deemed significant. It is also important

to note that the study's participants consisted of both individuals who were either novice or proficient in using hearing aids. Consequently, the present study's inclusion criteria stipulated that participant had firstly received a diagnosis of hearing impairment through a complete audiological diagnostic evaluation consisting of otoscopy, tympanometry & acoustic reflexes, pure tone & speech audiometry. Furthermore, it was imperative that all individuals involved possess favorable prognostic indicators, are highly suitable for amplification and decided to experiment with hearing aids. Finally, as previously mentioned, it was necessary that the age of the participants be above 18.

Participants were deemed ineligible if they required medical referral to their primary care physician or an otorhinolaryngologist subsequent to audiological evaluation. In addition, participants with an ongoing occurrence of an ear infection, which encompasses otitis externa, otitis media, and/or discharge were similarly excluded. Moreover, individuals with outer ear atresia or severe ear canal stenosis were excluded from the study due to the assumption that they may not be representative of the typical population of individuals with hearing aids, as they may experience greater challenges. Ultimately, individuals with Word Recognition Scores below 55% were excluded from the study due to their potential unsuitability for amplification.

Factors examined

The independent variables investigated in relation to HA satisfaction were social environment & motivation, age, gender, cost, binaural vs monaural, HA utilization hours per day, hearing handicap and HI.

Procedure

The study involved a comprehensive analysis of 50 patient records, who were previously fitted between 2018 and 2023 at the Lebanese American University Medical Center Rizk Hospital, American University of Beirut Medical Center, and Sound & Vision SARL. Remote interviews were conducted via telephone, utilizing in-depth questionnaires to evaluate each individual's experience with their hearing aid. Upon completion of the interview, participants were required to evaluate their amplification experience using a satisfaction scale consisting of three options: "very satisfied," "satisfied," and "not satisfied." Additionally, they were asked to provide a brief explanation for their chosen response. Individuals who self-reported dissatisfaction were granted the opportunity to return their HA and receive a complete refund.

Data collection

The data gathered underwent analysis and was subsequently presented in the form of graphs and diagrams, which aided in their visual depiction. The study utilized multivariable linear regression analysis to validate the factors that impact satisfaction with hearing aid satisfaction.

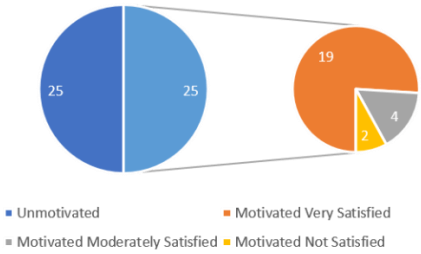
RESULTS

Social Environment & Motivation

Of the 50 individuals, 50% were initially motivated to try amplification and had realistic expectations. Of those, 76% (N=19) reported being "extremely satisfied", 16% (N=4) reported being "satisfied" and 8% (N=2) opted to return their hearing aid after

the completion of their one-month trial their one month free of charge trial.

Figure 2. *Double pie chart correlating satisfaction among motivated hearing aid users*



Age

In terms of age, the preponderance of patients (60%, N=30) was classified as elderly, defined as individuals above the age of 65. The majority of participants expressed satisfaction with their hearing aid following a one-month trial period. Certain elderly individuals have complained of annoyance in response to high frequency sounds, such as the clattering of plates, as well as excessive noise. Additionally, these individuals have commented on difficulty in handling their hearing aids. Nonetheless, upon being presented with the alternative of reducing the maximum level of output, either through a mobile application or by manipulating the buttons on their hearing aids, and having received guidance on appropriate handling, the participants expressed a sufficient level of contentment and satisfaction. Regarding individuals in the younger adult age group (N=20), a proportion of 20% (N=4) reported experiencing concerns related to connectivity problems with their mobile devices and other small inquiries. The influence of age on satisfaction appears to be low ($p > 0.05$), as younger adults exhibit greater selectivity in their responses to encountered issues.

Gender

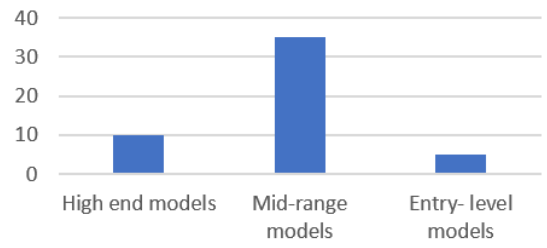
No significant correlation was found between gender and hearing aid satisfaction. Both females (N=15) and males (N=35) exhibited the same behavior and showed a greater interest and satisfaction towards more discrete hearing aids. Males and females who were capable of concealing their hearing aid with their hair, hat, or veil exhibited a preference for smaller behind-the-ear (BTE) models, such as receiver-in-the-ear (RITE) or receiver-in-the-aid (RITA) devices. As for those unable to hide them, ITC or CIC were selected as their preferred option if the shape of their audiograms allows it (to avoid occlusion effect).

Cost

With the financial crisis that Lebanon has been going through, cost is a very delicate subject, especially when it comes to healthcare. The 50 participants were offered 3 options of cost and technological level: An “entry level” hearing aid, an “intermediate” model and an “advanced” pricy model. The subjects had the choice to test each category and make their final decision based on the satisfaction that the hearing aid gave them related to its price. All participants preferred higher end models as it provided them with more comfort, flexibility and overall greater satisfaction. However, when assessing their budget, 70% (N=35) switched to intermediate models and 10% (N=5), went for the entry level model. The rest of the participants (20%, N=10) stated that cost was not an issue and stuck with the costliest and more advanced hearing aid. It is also important to note that lower aids model do

not offer a rechargeable feature, making the regular purchase of batteries twice a week an additional expense, which could explain the big discrepancy between entry and mid models. It seems that the results of the study show that there is a significant relationship between satisfaction and cost when it comes to hearing aids. Specifically, the participants preferred higher-end models for their overall satisfaction, but when considering cost, a majority of them switched to intermediate models, with only a small percentage choosing the entry-level model. This suggests that while satisfaction is important, cost also plays a significant role in the decision-making process for hearing aid selection.

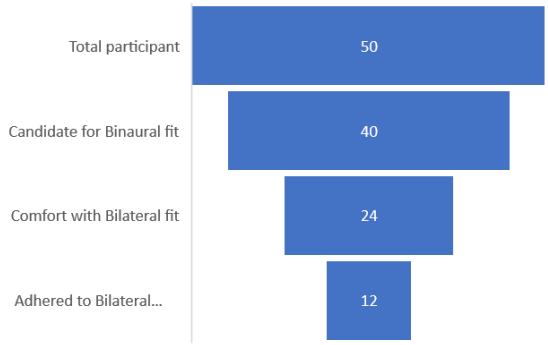
Figure 3. *Preferred hearing aid model in function of their cost and technology*



Binaural Vs Monaural

Out of the total of 50 participants, 80% (N=40) exhibited symmetrical bilateral hearing impairment. Among those participants, 60% (N=24) reported greater comfort and satisfaction with a bilateral fitting due to its ability to offer an improved sound experience, enhanced localization, and better speech discrimination in noisy environments. Nonetheless, considering additional variables such as expenses and appearance, merely fifty percent of them (N=12, 30%) opted to adhere to a pair of hearing aids. While binaural fitting is undoubtedly associated with increased satisfaction, it is noteworthy that other factors, including cost and aesthetics, have been identified as significant determinants in shaping the patient's choice.

Figure 4. *Number of patients choosing binaural amplification among the selected sample*

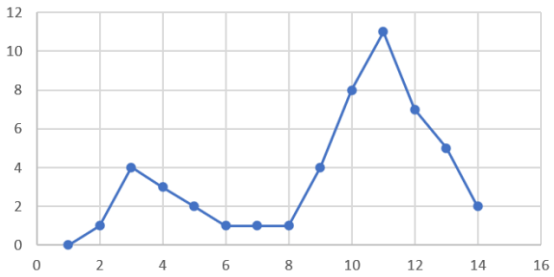


HA utilization hours per day

At the outset of their fitting session, all participants were provided with precise guidelines on a gradual methodology elucidating the utilization of their auditory aids. Participants were instructed to gradually increase their daily usage of hearing aids by one hour per day, with the goal of wearing them for a full day by the end of the third week. Furthermore, it was mandated that the patients undergo a period of two weeks in a quiet environment, followed by a gradual exposure to noisy environments. The findings indicate that 80% of patients who comply with this methodology, were able to retain their hearing aid throughout the day by the fourth week and exhibited increased plasticity and adaptation to new auditory sounds, resulting in higher levels of overall satisfaction. According to the data logging results, the mean average of hours per day was 11.5. Conversely, individuals who utilized their

hearing aids minimally (data logging indicating usage of less than four hours per day) during their one-month trial period, encountered difficulties when exposed to noisy environments and reported overall discomfort with the hearing aids.

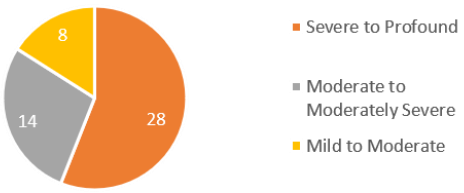
Figure 5. *Mean hearing aids utilization hours after 4 weeks of amplification*



Hearing handicap and HI

Out of the total of 50 participants, 28 individuals exhibited hearing loss that ranged from severe to profound, while 14 participants experienced moderately severe hearing loss. Additionally, 8 participants had hearing loss that ranged from mild to moderate.

Figure 6. *Distribution of the degree of hearing impairment in the selected sample*

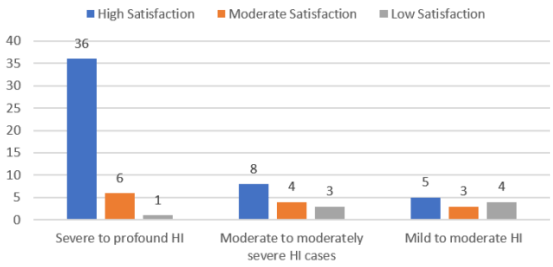


Among individuals classified as having severe to profound hearing loss, 75% (N= 21) reported experiencing significant satisfaction and benefit from amplification, while 21.43% (N=6) expressed moderate satisfaction with their amplification outcomes, and 3.57% (N=1) reported dissatisfaction with their results.

Within the moderately severe category, a majority of 57.14% (N=8) reported experiencing a high level of satisfaction, while 28.57% (N=4) reported moderate satisfaction and 21.43% (N=3) reported insufficient satisfaction.

Within the mild to moderate range, 41.67% (N=5) of participants reported experiencing a high level of satisfaction, while 25% (N=3) reported a moderate level of satisfaction, and 33.33% (N=4) reported feeling dissatisfied.

Figure 7. *Satisfaction in function of degree of hearing impairment*

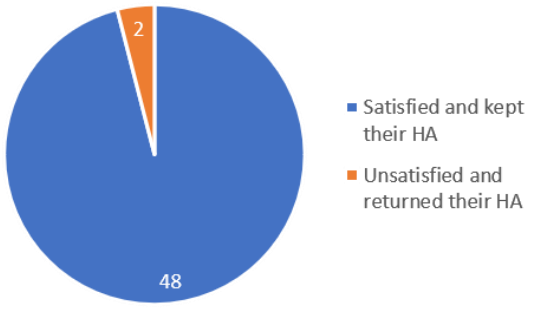


Regarding auditory handicap, 60% of individuals were categorized as highly socially engaged and encountered significant difficulties in terms of speech intelligibility. Among the surveyed population, a significant proportion comprising 80% reported a restoration of self-assurance in social environments and conveyed a high level of satisfaction. The individuals expressed their ability to engage in communication and exhibited a decreased level of discomfort in social settings compared to their previous state. The satisfaction levels of individuals with lower levels of handicap varied, however, they generally expressed a lower degree of satisfaction due to the fact that hearing loss was not their primary concern.

Overall Satisfaction

Upon completion of the one-month trial period for hearing aids, participants were given the choice to either return the device if they were dissatisfied or retain it and offer feedback regarding their overall satisfaction with the hearing aid and their auditory experience. Among the sample of 50 patients, a minority comprising merely 4% (N=2) opted to return their hearing aids, citing a lack of significant benefits derived from the device. Upon analyzing the outcomes of a binary objective, it can be inferred that a negative result would entail the act of returning the aid, while a positive result would involve retaining the aid. Patients who express dissatisfaction with their overall experience are likely to seek a refund and revert to using hearing aids. Conversely, patients who experience benefits and derive pleasure from their new hearing aids are more likely to continue using them. In this particular context, it is possible to compute a comprehensive satisfaction rating by considering the quantity of contented individuals and the number of successful fittings (knowing that hearing aid was not returned), resulting in a satisfaction rate of 96% (N=48).

Figure 8. *Overall Satisfaction based on the number of HA returned and kept*



DISCUSSION

A comparison between the literature and the Lebanese satisfaction study revealed certain variations in the satisfaction rates.

The primary consideration that arises is the size and scale of the sample. With reduced sample sizes, the likelihood of encountering skewed outcomes in one or multiple categories is significantly increased. To obtain a more accurate and realistic understanding of the correlation between hearing aid fitting and satisfaction, it is recommended that a larger sample size be utilized, with an equal distribution of the factors under investigation. It is noteworthy to mention that the Ministry of Public Health in Lebanon does not have an established official program for audiology syndicate. Therefore, the variations in best practices across institutions pose a significant challenge in obtaining unbiased and accurate data.

An additional consideration pertains to the temporal parameters of the articles incorporated within the literature review. Due to the rapid evolution of technology, modern research, which are less than a decade old, have the potential to present and communicate significantly more dependable and significant data. In order to maintain current relevance, it is advisable that sources associated with technological subjects should ideally not exceed a decade in age. In this particular context, it is plausible that a higher level of satisfaction could have been achieved by minimizing the disparity between the literature review and the study conducted in Lebanon.

Furthermore, it is noteworthy that certain abilities, namely cognitive and auditory processing, have not undergone individual evaluation. Research has indicated that non-auditory abilities play a significant role in the post-fitting stage of hearing aid usage and can impact the patient's level of utilization and subsequently satisfaction. Therefore, this could potentially be identified as another limitation of the current research.

Ultimately, it appears that the variables that impact satisfaction with hearing aids are interrelated rather than independent. To clarify, it can be observed that intrinsic factors, including but not limited to age, gender, cost, hearing impairment, and utilization hours, exhibit interconnectivity with one another, however, the presence of a relationship between two factors does not necessarily imply a dependence of one on the other. In other words, the many variables employed in HA satisfaction study make it difficult to draw firm conclusions on overall outcomes. Single-scale satisfaction assessments provide a general picture of satisfaction but do not reveal why a client is content or dissatisfied, nor do they allow the audiologist to determine what may be done to improve satisfaction. There is a need for a comprehensive, multifaceted, and holistic approach in order to achieve more precise results, which ultimately will help audiologists in improving a patient's hearing journey.

Conclusion

The aim of this research was to investigate the factors affecting HA user satisfaction scores among Lebanese adults. Specifically, the study sought to address the following questions: What client factors influence HA satisfaction? How do the satisfaction findings of this study compare with other HA satisfaction data? And what are the current HA satisfaction levels amongst adult HA users in Lebanon? Based on the literature reviewed, several theories are proposed. Firstly, it is suggested that the satisfaction rate among the Lebanese population should be comparable to, or better than, rates reported in previous studies. Additionally, the mean SADL scores in this study are expected to align with modern findings reported by Kaplan-Neeman et al. (2012) and Uriarte et al. (2005). The impact of social environment and motivation on HA satisfaction is also highlighted, while no significant correlation was found between age or gender and HA satisfaction. Furthermore, experienced HA users are expected to report higher satisfaction rates compared to new users. The study also found a relationship between hearing handicap, impairment, and HA satisfaction, while daily utilization hours were found to be positively correlated with satisfaction. Finally, it is suggested that a comprehensive approach is needed to examine all factors together rather than in isolation to achieve more accurate results.

References

American University of Beirut. (2023). Medical Audiology Sciences Program.

Baumfield, A., & Dillon, H. (2001). Factors affecting the use and perceived benefit of ITE and BTE hearing aids. *British journal of audiology*,

35(4), 247–258. https://doi.org/10.1080/00305364.2001.11745243.

Bentler, R. A., Niebuhr, D. P., Getta, J. P., & Anderson, C. V. (1993). Longitudinal study of hearing aid effectiveness. II: Subjective measures. *Journal of speech and hearing research*, *36*(4), 820–831. https://doi.org/10.1044/jshr.3604.820

Bertoli, S., Staehelin, K., Zemp, E., Schindler, C., Bodmer, D., & Probst, R. (2009). Survey on hearing aid use and satisfaction in Switzerland and their determinants.

Byrne, D., Dillon, H., Tran, L., Arlinger, S., Wilbrahan, K. Cox, R., et al. (1994). An international comparison of long-term average speech spectra. *Journal of the Acoustic Society of America, 96*(4), 2108-2120.

Cox, R. M., & Alexander, G. C. (2000). Expectations about hearing aids and their relationship to fitting outcome. *Journal of the American Academy of Audiology*, *11*(7), 368–407.

Cox, R. M., & Alexander, G. C. (2002). The International Outcome Inventory for Hearing Aids (IOI-HA): psychometric properties of the English version. *International journal of audiology*, *41*(1), 30–35. https://doi.org/10.3109/14992020209101309

Cox, R. M., & Alexander, G. C., & Beyer, C. M. (2003). Norms for the International Outcome Inventory for Hearing Aids. *Journal of the American Academy of Audiology, 14*(8), 403-413.

Dillon, H. (2012). *Hearing Aids 2nd ed.* Turramurra, Australia: Boomerang Press.

Dillon, H., Birtles, G., & Lovegrove, R. (1999). Measuring the Outcomes of a National Rehabilitation Program: Normative Data for the Client Oriented Scale of Improvement (COSI) and the Hearing Aid User's Questionnaire (HAUQ). *Journal of the American Academy of Audiology*, *10*(2), 67-79.

Dillon, H., James, A., & Ginis, J. (1997). Client Oriented Scale of Improvement (COSI) and its relationship to several other measures of benefit and satisfaction provided by hearing aids. *Journal of the American Academy of Audiology*, *8*(1), 27–43.

Fooladi, M. M. (2012). Involuntary and persistent environmental noise influences health and hearing in Beirut, Lebanon. *Journal of environmental and public health*, *2012*, 235618. https://doi.org/10.1155/2012/235618

Gatehouse S. (1994). Components and determinants of hearing aid benefit. *Ear and hearing*, *15*(1), 30–49. https://doi.org/10.1097/00003446-199402000-00005

Gatehouse, S., & Noble, W. (2004). The Speech, Spatial and Qualities of

Hearing Scale (SSQ). *International journal of audiology*, *43*(2), 85–99. https://doi.org/10.1080/14992020400050014

Hickson, L., Meyer, C., Lovelock, K., Lampert, M., & Khan, A. (2014). Factors associated with success with hearing aids in older adults. *International journal of audiology*, *53* Suppl 1, S18–S27. https://doi.org/10.3109/14992027.2013.860488

Holmes, A. E. (2003). Bilateral amplification for the elderly: are two aids better than one?. *International journal of audiology*, *42* Suppl 2, 2S63–2S67.

Hosford-Dunn, H., & Halpern, J. (2001). Clinical application of the SADL scale in private practice II: predictive validity of fitting variables. Satisfaction with Amplification in Daily Life. *Journal of the American Academy of Audiology*, *12*(1), 15–36.

Humes, L. E., Garner, C. B., Wilson, D. L., & Barlow, N. N. (2001). Hearing-aid outcome measured following one month of hearing aid use by the elderly. *Journal of speech, language, and hearing research : JSLHR*, *44*(3), 469–486. https://doi.org/10.1044/1092-4388(2001/037)

Hutton, C. L., & Canahl, J. A. (1985). Scaling patient reports of hearing aid benefit. *Journal of Audiology Research*, *25*, 255-269.

International journal of audiology, *48*(4), 183-195.

Jennings, M. B. (2005). Factors that influence outcomes from aural rehabilitation of older adults: The role of perceived self-efficacy. Unpublished doctoral dissertation, University of Western Ontario, London, Canada.

Jennings, M. B., Cheeseman, M. F., & Laplante-Levesque, A. (2013). Psychometric properties of the Self-Efficacy for Situational Communication Management Questionnaire (SESMQ). *Ear and Hearing*, *35*(2), 221-229.

Jerram, J. C., & Purdy, S. C. (2001). Technology, expectations, and adjustment to hearing loss: predictors of hearing aid outcome. *Journal of the American Academy of Audiology*, *12*(2), 64–79.

Jilla, A. M., Johnson, C. E., Danhauer, J. L., Anderson, M., Smith, J. N., Sullivan, J. C., & Sanchez, K. R. (2020). Predictors of Hearing Aid Use in the Advanced Digital Era: An Investigation of Benefit, Satisfaction, and Self-Efficacy. *Journal of the American Academy of Audiology*, *31*(2), 87–95. https://doi.org/10.3766/jaaa.18036

Kaplan-Neeman, R., Muchnik, C., Hildesheimer, M. & Henkin, Y. (2012). Hearing aid satisfaction and use in the advanced digital era. *The Laryngoscope*, *22*(9), 2029-2036.

Kayabaşoğlu, G., Kaymaz, R., Erkorkmaz, Ü., & Güven, M. (2015). Study of hearing aid effectiveness and patient satisfaction. Kulak burun bogaz

ihtisas dergisi : KBB = *Journal of ear, nose, and throat*, *25*(3), 158–162. https://doi.org/10.5606/kbbihtisas.2015.29939

Khiavi, F. F., Bayat, A., Dashti, R., & Sameni, S. J. (2017). Hearing aid-related satisfaction based on type and degree of hearing loss in elderly. *Auditory and vestibular research*, *23*(6), 114-122.

Kim, G. Y., Cho, Y. S., Byun, H. M., Seol, H. Y., Lim, J., Park, J. G., & Moon, I. J. (2022). Factors Influencing Hearing Aid Satisfaction in South Korea. *Yonsei medical journal*, *63*(6), 570–577. https://doi.org/10.3349/ymj.2022.63.6.570

Kim, H. H., & Barrs, D. M. (2006). Hearing aids: a review of what's new. *Otolaryngology–head and neck surgery : official journal of American Academy of Otolaryngology-Head and Neck Surgery*, *134*(6), 1043–1050. https://doi.org/10.1016/j.otohns.2006.03.010

Knudsen, L. V., *Öberg*, M., Nielsen, C., Naylor, G., & Kramer, S. E. (2010). Factors influencing help seeking, hearing aid uptake, hearing aid use and satisfaction with hearing aids: A review of the literature. *Trends in amplification, 14(3),* 127-154.

Kochkin, S. (1992). MarkeTrak III: Higher hearing aid sales: Don't signal better market penetration. *Hearing journal*, *45*(7), 47-54.

Kochkin, S. (1996). MarkeTrak IV: 10-year trends in the hearing aid market—Has anything changed? *Hearing journal*, *49*(1), 1–6.

Kochkin, S. (1997). Subjective measures of satisfaction and benefit: establishing norms. *Seminars in hearing, 18,* 37-48.

Kochkin, S. (2000). MarkeTrak V: Consumer satisfaction revisited. *Hearing journal*, *52*(1), 1-8.

Kochkin, S. (2005). MarkeTrak VII: Customer satisfaction with instruments in the digital age. *Hearing journal*, *58*(9),30-39.

Lebanese American University of Beirut-Rizk Hospital. (2023). Ear, nose & throat department, audiology lab.

LeBoeuf, M. (2007). 6, More Magnetic Marketing: How to Network, Close Sales, and Keep your Customers for Life. In The Perfect Business (pp. 93–99). essay, Gramedia Pustaka Utama.

Meyer, C. , Hickson L., Lovelock, K., Lampert, M., & Khan, A. (2014). An investigation of factors that influence help-seeking for hearing impairment in older adults. *International Journal of Audiology*, *53,* S3-S17.

Nábělek, A. K., & Pickett, J. M. (1974). Reception of consonants in a classroom as affected by monaural and binaural listening, noise, reverberation, and hearing aids. *The Journal of the Acoustical Society of America*, *56*(2), 628–639. https://doi.org/10.1121/1.1903301

Newman, C. W., & Sandridge, S. A. (1998). Benefit From, Satisfaction With, and Cost-Effectiveness of Three Different Hearing Aid Technologies. *American journal of audiology*, *7*(2), 115–128. https://doi.org/10.1044/1059-0889(1998/021)

Norman, M., George, C. R., & McCarthy, D. (1994). The effect of pre-fitting counselling on the outcome of hearing aid fittings. *Scandinavian audiology*, *23*(4), 257–263. https://doi.org/10.3109/01050399409047517

Öberg, M., Marcusson, J., Nägga, K., & Wressle, E. (2012). Hearing difficulties, uptake, and outcomes of hearing aids in people 85 years of age. *International journal of audiology*, *51*(2), 108–115. https://doi.org/10.3109/14992027.2011.622301

Power, J. K., & Power, E. A., (1978). Hearing problems of elderly persons: social consequences and prevalence. *ASHA, 20,* 79-83.

Ridgway, J., Hickson, L., & Lind, C. (2015). Autonomous motivation is associated with hearing aid adoption. International journal of audiology, 54(7), 476–484. https://doi.org/10.3109/14992027.2015.1007213

Ross M. (1980). Binaural versus monaural hearing aid amplification for hearing impaired individuals. In Libby E, ed. Binaural hearing aid and amplification. Chicago, 1980.

Sacre Coeur Hospital. (2023). Departement d'Otolaryngologie, Liban, Baabda.

Saunders, G. H., Chisolm, T. H., & Abrams, H. B. (2005). Measuring hearing aid outcomes – not as easy as it seems. *Journal of rehabilitation research and development, 42*(4), 157-168.

Sidenna, M., Fadl, T., & Zayed, H. (2020). Genetic Epidemiology of Hearing Loss in the 22 Arab Countries: A Systematic Review. Otology & neurotology : official publication of the American Otological Society, *American Neurotology Society [and] European Academy of Otology and Neurotology*, *41*(2), e152–e162. https://doi.org/10.1097/MAO.0000000000002489

Sound & Vision SARL. (2023), Lebanon, Dekweneh

Spitzer, J. B. (1998). Factors predictive of patient satisfaction with hearing aids. *Hearing journal, 51*(3), 31 – 42.

Studebaker G. (1980). Fifty years of hearing aid research: an evaluation of progress. *Ear and hearing*, *1*(2), 57 – 62

Uriarte, M., Denzin, L., Dunstan, A., Sellars, J., & Hickson, L. (2005). Measuring hearing aid outcomes using the Satisfaction with Amplification in Daily Life (SADL) questionnaire: Australian data. *Journal of the American Academy of Audiology*, *16*(6), 383–402. https://doi.org/10.3766/jaaa.16.6.6

Vuorialho, A., Sorri, M., Nuojua, I., & Muhli, A. (2006). Changes in hearing aid use over the past 20 years. *European Archives of oto rhino laryngology, 263*(4), 335-360.

Wernick J. (1985). Use of hearing aids. In Katz J, Ed. Handbook of clinical audiology, 3rd ed., 911-935

Wiesner, M., & Tesch-Römer, C. (1996). Hörgerätebenutzung im Alter: Der Zusammenhang zwischen Intention und Verhalten [Use of hearing aids by the elderly: correlation between intention and behavior]. *Zeitschrift fur Gerontologie und Geriatrie, 29*(4), 273–279.

Williams, V. A., Johnson, C. E., & Danhauer, J. L. (2009). Hearing aid outcomes: effects of gender and experience on patients' use and satisfaction. *Journal of the American Academy of Audiology*, *20*(7), 422–460. https://doi.org/10.3766/jaaa.20.7.4

Wong, L. L. N., Hickson, L., & McPherson, B. (2003). Hearing aid satisfaction: what does research from the past 20 years say? *Trends in Amplfication, 7*(4), 117-161.

World Health Organization. (1980). International Classification of Impairments, Disabilities, and Handicaps: A manual of classification relating to the consequences of disease.

World Health Organization. (2021). Deafness and hearing loss. World Health Organization. https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss.