



OPEN Sex-specific differences factors in quality of life among people with hearing impairment

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Quality of life (QoL) in deaf and hard of hearing (DHH) adults is a complicated combination of social, emotional, and communicative factors. Understanding sex-specific nuances is essential for targeted interventions. This study explores gender differences in QoL among DHH adults in Poland, focusing on relationship dynamics, mental health, and communication effectiveness. We surveyed 247 DHH Polish adults (136 women, 111 men) aged 18–71, assessing life satisfaction (SWLS), relationship quality, mental health (composite self-reported depressive and anxiety symptom index), and communication skills. We employed t-tests, chi-square tests, and correlational analyses to identify significant sex-related disparities. Key findings reveal significant gender differences in QoL. DHH men reported markedly higher life satisfaction scores compared to women ($M = 22.95$ vs. $M = 20.88$, $p < 0.001$). Women reported disproportionately greater difficulties in communicating with their partners (42% vs. 28%, $p = 0.03$) and exhibited significantly higher levels of self-reported depressive ($M = 15.2$ vs. $M = 12.8$, $p = 0.008$) and anxiety ($M = 18.5$ vs. $M = 16.1$, $p = 0.016$) symptom indexes. The capacity for partners to understand sign language was significantly correlated with relationship quality, and women exhibited superior comprehension of sign communication. Sex is a significant predictor of QoL in deaf and hard of hearing adults. The results highlight the critical necessity for customised interventions to address the specific challenges women face, such as communication obstacles, relationship issues, and increased mental health risks. The results highlight the critical necessity for customised interventions to address the specific challenges women face, such as communication obstacles, relationship issues, and increased mental health risks.

Keywords Quality of life, Hearing loss, Mental health

Quality of life is a multifaceted concept encompassing physical, psychological, social, and environmental aspects. The World Health Organization (WHO) defines quality of life as an individual's subjective evaluation of their position in life, considering the cultural context and value system within which they live. It is a dynamic construct reflecting an individual's well-being across various domains of activity and their capacity to adapt to changing life circumstances. Quality of life serves as a crucial indicator of population health and well-being, and it is a significant objective of both medical and social interventions^{1–3}.

Hearing impairment is a significant health and social issue affecting individuals of all ages. It is estimated that over 466 million people worldwide experience hearing dysfunctions, a substantial proportion of whom encounter difficulties in communication, interpersonal relationships, education, and professional activities¹. The consequences of hearing loss can lead to social isolation, diminished self-esteem, emotional problems, and a decline in quality of life². Individuals with hearing disabilities constitute a heterogeneous group, and their experiences and needs may vary depending on the degree and etiology of hearing loss, age, sex, sociocultural environment, and access to appropriate support and rehabilitation.

Deafness can be understood within both a medical and a cultural-linguistic framework. The medical model conceptualises hearing loss as a sensory impairment with functional consequences, while the cultural-linguistic model emphasises deaf identity, community belonging, and the central role of sign languages as fully fledged natural languages. In this study, we adopt primarily the medical perspective in line with our research aims, but we also acknowledge the importance of the cultural-linguistic model for understanding the diversity of experiences within the DHH population².

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The quality of life of individuals with hearing dysfunctions is the subject of numerous scientific studies, which indicate a complex relationship between hearing impairment and overall well-being. Empirical findings suggest that individuals with hearing impairments may experience difficulties in various life domains, such as interpersonal communication, social relations, education, employment, and mental health⁴. Verbal and non-verbal communication is a key element of social and professional integration, and communication barriers can lead to frustration, feelings of isolation, and reduced self-esteem. Access to education and employment opportunities is often limited for individuals who are deaf or hard of hearing, which negatively impacts their financial independence and sense of agency. Additionally, individuals with hearing dysfunctions are more susceptible to emotional problems, such as depression and anxiety disorders, which consequently lowers their overall quality of life^{4–7}.

An essential aspect of research on the quality of life of individuals with hearing disabilities is the consideration of differences related to *sex*. Biological *sex* may influence the experiences and specific needs of individuals with hearing impairments, as well as their subjective perception of quality of life. Women and men may exhibit different coping strategies for stress and they may differ in social expectations, *gender* roles, and access to resources. However, it should be noted that relatively few studies analyze the quality of life of individuals who are deaf or hard of hearing, taking into account *sex* differences, which constitutes a significant gap in the current state of knowledge.

The aim of this study is to analyze the quality of life of individuals who are deaf or hard of hearing in the Polish population, considering differences arising from biological *sex*. This study aims to answer the following questions: (1) Are there statistically significant differences in the quality of life between women and men with hearing disabilities? (2) What factors determine the quality of life of women and men with hearing impairments? It is expected that the results of this study will contribute to a deeper understanding of the specific needs of individuals who are deaf or hard of hearing and will enable the development of more effective interventions aimed at improving their quality of life^{4–7}.

The results highlight the critical necessity for customised interventions to address the specific challenges women face, such as communication obstacles, relationship issues, and increased mental health risks. Prior studies seldom integrate relationship dynamics, mental health, and communication modalities within a single analytical framework, and even less frequently consider how these domains may differentially relate to quality of life (QoL) in women versus men. Furthermore, much of the existing literature adopts a predominantly biomedical lens, with insufficient acknowledgement of the cultural-linguistic model of deafness and its implications for social participation and identity. Addressing this gap is essential for informing sex-responsive public health strategies and clinical pathways for DHH populations^{1,4–7}.

Accordingly, the present study examines sex-specific differences in QoL among DHH adults in Poland, integrating biopsychosocial determinants (mental health, relationship functioning, social participation) with communication-related factors (partner's sign-language comprehension, communication difficulties). By analyzing a relatively large DHH cohort and employing validated instruments adapted for the target community, we aim to provide context-relevant evidence that can guide tailored interventions in clinical, rehabilitative, and community settings.

In this study, the term *deaf* refers to individuals with profound hearing loss (>90 dB HL), whereas the term *hard-of-hearing* denotes individuals with moderate (40–70 dB HL) or severe (70–90 dB HL) hearing loss. These thresholds follow the classification of the *Bureau International d'Audiophonologie* (BIAP), which provides internationally recognized audiometric criteria for quantitative hearing loss. By applying these definitions, we ensure terminological clarity and alignment with established standards in audiology.

Materials and methods

Participants

The study included 247 hearing impairment individuals, comprising 136 women (55.1%) and 111 men (44.9%), aged 18 to 71 years (mean age of the entire group $\bar{x} = 35.21$, $SD = 9.15$; mean age in the women's group $\bar{x} = 36.71$, $SD = 9.91$, and in the men's group $\bar{x} = 33.37$, $SD = 7.79$). Study participants were recruited from 5 Regional Branches of the Polish Association of the Deaf and 4 other institutions directly serving and associating individuals with hearing loss, as well as through online channels in closed forums and groups integrating the target study population. Inclusion criteria for the study were: (a) voluntary consent to participate in the study, (b) age 20–72 years, (c) sensory disability of the hearing organ, (d) initiated sexual activity, (e) complete and accurate completion of the survey questionnaire. Exclusion criteria for the study were: (a) withdrawal of consent to participate in the study, (b) incomplete and inaccurate completion of the survey questionnaire, (c) age below 20 years, (d) age above 72 years, (e) lack of sexual initiation, (f) diagnosed psychosomatic and mental disorders (self-reported) (h) diagnosed other type of disability. Due to failure to meet the inclusion and exclusion criteria or incomplete completion of the research tool, 77 individuals were excluded from the study. The degree of hearing loss was classified according to the *Bureau International d'Audiophonologie* (BIAP) recommendations: mild (>20–40 dB HL), moderate (>40–70 dB HL), severe (>70–90 dB HL), and profound (>90 dB HL). In this study, *hard-of-hearing* participants were defined as those with moderate or severe hearing loss, while the term *deaf* referred to individuals with profound impairment. No participants with mild hearing loss were included. All three audiological types—conductive, sensorineural, and mixed—were represented in the study population. Classification was based on each participant's previous audiological diagnosis issued by certified audiology centres and documented in their medical records. Although pure-tone audiometry was not repeated within this study, the BIAP framework (500, 1000, and 2000 Hz thresholds) underpinned the diagnostic criteria. All reported impairments reflected permanent and irreversible hearing loss. Nine respondents (3.6%) did not provide audiometric classification and were excluded from analyses involving hearing loss severity. Analyses by degree of hearing loss were thus performed on 238 participants. All participants were fluent users of Polish

Sign Language (PJM), as the questionnaire was available in both a written Polish version and a video-recorded PJM version, which formed an integrated whole. Formal data on participants' cultural self-identification (e.g., as culturally Deaf vs. as persons with hearing loss) or preferred communication mode (oral vs. signed) were not collected. This is acknowledged as a limitation of the study.

The data that support the findings of this study are not openly available due to reasons of sensitivity and are available from the corresponding author upon reasonable request. Data are located in controlled access data storage at Medical University of Silesia. The study protocol was approved by the Bioethics Committee of the Medical University of Silesia (decision No. KNW/0022/KB/311/18/19). All methods were performed in accordance with the relevant guidelines and regulations.

Measures

The following variables were included in the analysis:

- Sociodemographic variables: age, sex, education, and occupational activity.
- Sex (female/male) was self-reported by participants as part of the demographic questionnaire. Gender identity was not separately assessed.
- Hearing-related variables: degree of hearing loss (BIAP classification), type of hearing loss (conductive, sensorineural, mixed), age of onset of hearing loss (before vs. after 3 years of age), and use of hearing devices (hearing aid, cochlear implant, or none).
- Psychological variables: life satisfaction (*Satisfaction With Life Scale*—SWLS; raw score and stanine categories), composite self-reported depressive symptom index, and composite self-reported anxiety symptom index (assessed using the author's questionnaire).
- Relational and social variables include marital or partnership status, the perceived quality of the relationship, difficulties in communication with one's partner, the frequency of social gatherings, and the partner's comprehension of Polish Sign Language (PJM).

Partner communication measure

One item in the author-developed questionnaire assessed self-reported comprehension of a partner's signing in PJM. Respondents rated, on a 6-point scale, how well they understood their partner's signed messages. This was not a formal test of sign language proficiency but a subjective indicator of perceived communicative effectiveness within the relationship.

Research tools

The questionnaire was created in a dual format: a written version in Polish and a video-recorded version in Polish Sign Language (PJM). Both versions were developed simultaneously and formed an integrated whole, ensuring full accessibility for DHH participants. The PJM version was not a direct translation of the Polish text but rather a culturally and linguistically adapted rendition, created to preserve meaning and natural signed language structure.

Because PJM is a visual-spatial language with its own grammar and syntax, a verbatim transcription of the video version would not be meaningful in written form. Therefore, the questionnaire cannot be fully represented in supplementary material. Instead, the present manuscript describes its key domains and example items to make the scope of assessment transparent. The questionnaire covered:

1. Author's Survey Questionnaire: The first part of this section of the questionnaire contains proprietary questions regarding partner relationships and communication, as well as questions regarding offspring.
2. Adaptation of the Satisfaction With Life Scale (SWLS): To assess overall life satisfaction (QoL), we used an adapted version of the *Satisfaction With Life Scale* (SWLS). The scale consists of 5 items rated on a 7-point Likert scale, yielding a total score range of 5–35 points, with higher scores indicating greater global life satisfaction. The adaptation for Polish Sign Language (PJM) involved modifications of grammatical constructions and selected concepts (while maintaining the original meaning), followed by translation into PJM and presentation via video recording. In line with Polish normative data (Juczyński, 2012), raw scores were converted into stanine categories: low (5–20 points; 1–4 stanine), average (21–25 points; 5–6 stanine), and high (26–35 points; 7–10 stanine). The distribution and conversion of raw scores into stanine categories are presented in Table 1. In the present study, the adapted SWLS demonstrated excellent internal consistency (Cronbach's $\alpha = 0.94$), which exceeds the reliability reported for the Polish adaptation by Juczyński ($\alpha = 0.82$).
3. Depressive and anxiety symptom indices: Two composite indices were constructed from several items in the author-developed questionnaire addressing negative affect and tension. Respondents rated the frequency of symptoms on Likert-type scales, and item scores were summed to yield continuous indices (range approximately 6–30). Higher scores reflect greater frequency of self-reported symptoms. These indices are exploratory.

Raw score (SWLS)	Stanine range	Interpretation
5–20	1–4	Low satisfaction with life
21–25	5–6	Average satisfaction with life
26–35	7–10	High satisfaction with life

Table 1. Conversion of raw SWLS scores into Stanine categories (based on Polish norms).

tory, not standardized diagnostic instruments, and were designed to capture variation in mood and anxiety experiences in the DHH population.

Research procedure

Due to the form of the questionnaire adaptation, the study was conducted using the CAWI (Computer-Assisted Web Interview) method, applying appropriate security measures for the publication of research tools online. The adaptation of the entire questionnaire into PSL (Polish Sign Language) was performed using a transcreation procedure, which allows for greater linguistic modifications to obtain appropriate psychometric parameters. The implemented textual modifications, followed by their translation into PSL, in the standardized tools used in the study (SWLS scale) were suggested by linguistic and psychological considerations. Adaptive changes to the text were consulted with a native PSL translator and then re-evaluated. The applied transcreation adapts the text of the questionnaire to the perception and comprehension abilities of the study group, while taking into account the linguistic and cultural interference of Polish Sign Language. In the initial stage of the research, a pilot study was conducted on a group of individuals with sensory impairment in the hearing organ ($N=10$). The respondents' comments and corrections allowed for the creation of the author's part of the research set in question, in order to obtain socio-demographic data.

Statistical analysis

Descriptive statistics (means, standard deviations, and percentages) were calculated for all variables. Differences between categorical variables (e.g., sex vs. device use, sex vs. partnership status) were analysed using the chi-square test of independence (χ^2). The normality of distribution of numerical variables was verified with the Shapiro–Wilk test. Depending on the outcome, appropriate parametric or non-parametric tests were applied. To compare the means of two independent groups for normally distributed variables with homogeneity of variance (e.g., SWLS scores by sex), the Student's t-test was used; for more than two groups, analysis of variance (ANOVA) was performed. If assumptions of normality and homogeneity were not met, or for ordinal variables, the Mann–Whitney U test (two groups) and the Kruskal–Wallis test with Dunn's post hoc multiple comparison (more than two groups) were applied. In addition, cluster analysis (k-means) was performed to identify subgroups of respondents based on measured variables. To examine associations between ordinal or non-normally distributed continuous variables (e.g., life satisfaction, depression, anxiety, communication quality), Spearman's rank correlation coefficient (ρ) was calculated. Statistical significance was set at $p < 0.05$.

Results

Table 2 presents the distribution of participants according to the degree of hearing loss, classified in line with the *Bureau International d'Audiophonologie* (BIAP) recommendations. Among the 238 respondents with available audiological classification, 31 participants (13.0%) had moderate hearing loss, 38 (16.0%) had severe loss, and 169 (71.0%) had profound hearing loss. No participants reported mild hearing loss, reflecting the study focus on individuals with advanced impairment. Women were more often presented with moderate loss compared to men (15.9% vs. 9.4%), whereas men slightly more frequently reported severe loss (17.9% vs. 14.4%). In both sexes, the vast majority were classified as profoundly deaf (69.7% of women; 72.6% of men). These findings indicate that the study population was predominantly composed of individuals with profound hearing loss, which has important implications for interpreting quality-of-life outcomes.

Table 3 presents the distribution of respondents according to the declared use of hearing aids or cochlear implants. Among the total sample ($N=247$), 122 participants (49.4%) reported using hearing aids, while 125 (50.6%) did not use any hearing aid. A small subgroup of respondents reported the use of cochlear implants ($N=22$; 8.9%), whereas the vast majority ($N=225$; 91.1%) did not use this device. Women were more likely than men to report using hearing aids (53.7% vs. 44.1%) and cochlear implants (10.3% vs. 7.2%). These findings indicate that approximately half of the study group used hearing aids, while only a minority relied on cochlear implants.

		Female	Male	Total
Mild 20–40 dB HL	Count	0	0	0
	%	0%	0%	0%
Degree of hearing loss moderate—40–70 dB	Count	21	10	31
	%	15.9%	9.4%	13.0%
Significant (severe)—70–90 dB	Count	19	19	38
	%	14.4%	17.9%	16.0%
Profound—Above 90 dB	Count	92	77	169
	%	69.7%	72.6%	71.0%
Total	Count	132	106	238
	%	100.0%	100.0%	100.0%

Table 2. Distribution of respondents by quantitative hearing loss, classified according to BIAP recommendations.

		Female		Male		Total
		Count	%	Count	%	Count
Hearing aid	No	63	46.3%	62	55.9%	125
	Yes	73	53.7%	49	44.1%	122
Cochlear implant	No	122	89.7%	103	92.8%	225
	Yes	14	10.3%	8	7.2%	22

Table 3. Distribution of respondents depending on declared use of hearing aids or cochlear Implants.

Sex	Mean	Count	Standard deviation
Female	20.88	136	7.347
Male	22.95	111	7.610
Total	21.81	247	7.521

Table 4. SWLS raw score by sex.

		Female	Male	Total
SWLS norms for the total sample	Low	Count	48	31
		% of Sex	35.3%	27.9%
	Average	Count	31	28
		% of Sex	22.8%	25.2%
	High	Count	57	52
		% of Sex	41.9%	46.8%
	Total	Count	136	111
		% of Sex	100.0%	100.0%

Table 5. SWLS norms for the total sample, differentiated by sex.

Quality of life and life satisfaction by sex

Statistical analyses were conducted to compare the quality of life and life satisfaction of women and men with hearing impairments.

Satisfaction with life scale (SWLS)

The mean life satisfaction score (Table 4) in the study group was 21.81 (SD = 7.52, min. = 5; max. = 35). In the group of women, the raw score values were 20.88 (SD = 7.35; min. = 5; max. = 35), which is lower than in the group of men – 22.95 (SD = 7.61; min. = 5; max. = 35). Statistical analysis indicated that men achieved higher scores significantly more often (Mann–Whitney U test; $p < 0.001$).

According to the accepted Polish norms, a result in the range of the 1st–4th stanine is considered low, the 5th–6th stanine-average, the 7th–10th stanine-high. Men achieved high norms in the largest percentage (46.8%; $N = 111$), while women achieved low values to the greatest extent (35.3%; $N = 31$). The results obtained in the average norms were comparable in both groups. Statistical analysis did not show a significant relationship in the results of SWLS norms when divided by the grouping variable “sex” (Mann–Whitney U test; $p > 0.05$) (Table 5).

Author’s survey questionnaire (regarding quality of Life)

Analysis of the answers to the questions contained in the author’s questionnaire revealed significant differences between women and men in several areas of quality of life. Table 6 presents a comparison of the results obtained in the author’s survey questionnaire depending on sex.

Statistical analysis revealed significant differences between women and men in the following areas: difficulties in communication with a partner ($\chi^2(1) = 4.52, p = 0.03$), frequency of social gatherings ($t(245) = 3.17, p = 0.002$), composite depressive symptom index ($t(245) = 2.65, p = 0.008$), and composite anxiety symptom index ($t(245) = 2.41, p = 0.016$). Women were more likely than men to report difficulties in communicating with their partner and participated less frequently in social gatherings and social activities. Women also scored higher than men on the composite indices of depressive and anxiety symptoms, indicating a greater frequency of self-reported negative affect and tension.

The mean raw SWLS scores were higher for respondents who were in a relationship with a person with a hearing disability ($\bar{x} = 24.06; SD = 7.56$; Mann–Whitney U test; $p < 0.05$) compared to relationships with a hearing partner ($\bar{x} = 21.47; SD = 7.56$; Mann–Whitney U test; $p < 0.05$). On the other hand, no significant quantitative or statistical differences were found depending on the sex of the respondents (Mann–Whitney U test; $p > 0.05$).

Area	Women (N=136)	Men (N=111)	Test Statistic	p
Difficulties in communication with partner (%)	42%	28%	Chi-square=4.52	p=0.03
Frequency of social gatherings per month (M)	2	3.5	t-Student=3.17	p=0.002
Composite depressive symptom index (M)	15.2	12.8	t-Student=2.65	p=0.008
Composite anxiety symptom index (M)	18.5	16.1	t-Student=2.41	p=0.016

Table 6. Comparison of results in the author's survey questionnaire by Sex. *N* group size, *M* mean, *p*, statistical significance level. Indices of depressive and anxiety symptoms are derived from multiple items in the author-developed questionnaire; they are exploratory self-report measures and not validated clinical scales.

The results of the author's study also showed a significant relationship between the level of perceived understanding of partner's signing depending on the quantitative degree of hearing loss (Kruskal–Wallis test; $p < 0.05$). In the group of women, the quality of communication was rated the highest by people with a profound degree of hearing loss, while in the group of men, the respondents had moderate hearing loss, which was also the lowest among the study participants.

Correlation analysis

Correlation analysis showed that in the group of women, a higher level of education was significantly correlated with a higher level of life satisfaction ($r=0.35$, $p < 0.01$) and with better social relationships ($r=0.28$, $p < 0.05$). In the group of men, a significant correlation was observed between professional activity and life satisfaction ($r=0.42$, $p < 0.01$).

Qualitative analysis

Qualitative analysis allowed for a more profound understanding of the experiences of women and men with hearing impairments. Women more often than men emphasized the importance of social and emotional support for coping with the difficulties associated with hearing impairment. Men, on the other hand, focused more often on practical aspects, such as access to hearing aid technology and opportunities for professional development.

Discussion

The results of the study indicate significant differences in the level of life satisfaction and in experiences in various areas of life between women and men with hearing impairments. Nearly three-quarters of respondents reported having a permanent life partner, with women more frequently declaring this compared with men. Previous studies also indicate that within the Deaf community, marriages between partners with hearing impairment are relatively common, reflecting the importance of shared language and mutual understanding of life experiences associated with hearing loss. This is understandable because DHH often search for a partner who also knows sign language and understands their experiences and challenges associated with hearing loss. Marriage to a person with a hearing disability can provide greater ability to communicate and understand each other. According to Mosier, when a hearing person marries a deaf person, the changes will extend beyond just the newly formed marital system⁸.

Only a small minority of respondents reported being in a relationship with a partner who does not use sign language. Overall, most participants reported a high level of comprehension of their partner's signing, with women indicating greater ease of understanding than men. This suggests that female respondents may have stronger skills or greater sensitivity in interpreting their partners' signed communication. Studies conducted on people with normal hearing suggest that women may have greater skills in reading non-verbal messages than men. This results from differences in social development and social learning, which encourage women to be more sensitive to non-verbal cues⁹. Women more frequently reported difficulties in communicating with their partners, often linked to a perceived lack of understanding and acceptance of their communication needs. They also highlighted feelings of loneliness and misinterpretation in their relationships. Men raised these concerns less often, tending instead to focus on practical aspects of daily life. This pattern suggests that women may be more sensitive to the emotional quality of interpersonal relationships and may discover it more challenging to cope with a lack of emotional support from their partners.

Life satisfaction, assessed with the author's adaptation of the SWLS questionnaire, was analysed in relation to several variables, including sex, the degree of hearing loss, age at the onset of impairment, and the use and type of hearing devices. These findings provide a valuable point of reference when compared with previous research on life satisfaction in both the general and DHH populations. In our study, the average level of life satisfaction reported by DHH respondents was higher than that obtained in Juczyński's Polish adaptation, which was standardised on a large sample of the general hearing population. This suggests that, despite significant communication barriers and social challenges, many DHH adults may experience relatively high levels of life satisfaction, possibly linked to strong community bonds and adaptive coping strategies. On the other hand, the mean values observed in our sample were lower than those reported in the original work by Diener et al., conducted in the United States on both younger and older groups. Such discrepancies are likely to be influenced by cultural, social and historical differences between populations, including differences in living standards, educational opportunities, and systemic support for individuals with hearing loss¹⁰.

Importantly, when considering sex differences, our findings diverge from Juczyński's Polish normative study, which reported no significant variation between men and women in life satisfaction. By contrast, in our sample,

men with hearing loss reported higher levels of life satisfaction than women. This result may be understood in light of broader gender-related differences in psychosocial functioning: men may derive more satisfaction from practical and activity-based aspects of daily life, whereas women often emphasise the quality of interpersonal communication and emotional support. Consequently, barriers to effective communication and a lack of emotional reciprocity may weigh more heavily on women's assessments of life satisfaction. These observations emphasise how important it is to interpret quality-of-life outcomes in DHH populations not only through the lens of hearing status but also with attention to gender-specific psychosocial contexts.

While our analyses were based on biological sex, the observed differences may reflect broader gender-related social roles and expectations. Potential explanations for the higher scores among women on the composite symptom indices include gender-linked exposure to stressors, differences in social role expectations, and disparities in access to supportive communication environments. Prior research in hearing populations similarly documents higher self-reported internalising symptoms among women, and communication barriers specific to DHH contexts may amplify these differences. Nevertheless, given the exploratory, non-validated nature of our indices, these interpretations remain tentative. This pattern is consistent with large-scale epidemiological studies in the general population, which also report higher prevalence of depression and anxiety symptoms among women compared with men^{11,12}. The results highlight the critical necessity for customized interventions to address the specific challenges women face, such as communication obstacles, relationship issues, and increased mental health risks.

Women more often than men expressed difficulties in establishing and maintaining social relationships. They emphasized that they feel excluded from social life and have difficulty communicating with hearing people. Men, on the other hand, were more likely to engage in social and sports activities, which helped them build relationships and a sense of belonging. This may be due to differences in socialization and *gender* roles, which encourage women to pay more attention to interpersonal relationships, and men to activity and competition.

Our findings demonstrate that providing research instruments in the natural language of Deaf people (PJM) allows for the effective use of standardized psychological tools. This highlights the importance of adapting measures linguistically and culturally to ensure validity, and underscores the contribution of this study to raising awareness of the challenges faced by the Deaf community. It also points to the need for health and social care professionals to offer services that are fully accessible in both linguistic and cultural terms, in order to support the overall physical and mental well-being of DHH individuals.

The educational profile of the respondents indicates that many hearing impairment individuals achieve levels of secondary and even higher education comparable to, or in some respects exceeding, those observed in the general Polish population. This finding is encouraging, as it demonstrates that despite persistent barriers in the educational system—such as the limited availability of instruction in Polish Sign Language—people with hearing loss are able to access higher levels of education and achieve academic success. It also underlines the importance of ensuring equal educational opportunities through language-accessible teaching methods¹³.

Only a small minority of participants reported being in a relationship with a partner who does not use sign language. Among those in signing relationships, women reported a greater ability to understand their partners' communication compared with men. This pattern mirrors findings in the hearing population, where women are often described as more sensitive to non-verbal cues⁹. At the same time, it should be emphasised that such abilities vary greatly between individuals, irrespective of sex, and are shaped by personal experience and broader social context. The results of the author's study also showed a significant relationship between the level of perceived understanding of partner's signing depending on the quantitative degree of hearing loss. In the group of women, the quality of communication was rated the highest by people with a profound degree of hearing loss, while in the group of men, the respondents had moderate hearing loss, which was also the lowest among the study participants.

An intriguing pattern emerged in relation to the degree of hearing loss: participants with profound deafness tended to report higher levels of life satisfaction than those with moderate or severe loss (see Table 4). This counterintuitive finding suggests that greater acceptance of profound impairment, or stronger identification with the Deaf community, may contribute positively to well-being. As there is little comparative literature directly addressing this issue, future research should further explore the mechanisms linking the severity of hearing loss with quality-of-life outcomes.

The author's study did not include people with mild hearing loss, which is a significant proportion of the population and consists of elderly people. Cieplińska's research on the acceptance of hearing loss and the quality of life of seniors presents results that strongly indicate a direct correlation: higher acceptance of hearing loss leads to a better quality of life for the subjects¹⁴. The works present the essence of the need to conduct various activities aimed at supporting seniors with hearing impairments in their psychosocial functioning. Raising social awareness about the quality of life for older individuals with hearing impairments is necessary, as this may highlight opportunities for expanding research in this field^{15,16}. Previous international studies have also highlighted the importance of considering both medical and cultural-linguistic perspectives when analysing the lives of DHH individuals. Leigh described how Deaf identity and sign language use shape psychosocial functioning¹⁷, while the WHO *World Report on Hearing*¹ emphasised the global public health burden of hearing loss and the need for comprehensive strategies addressing communication access and social participation. In addition, population-based studies, such as Emond et al. in the UK, demonstrate that the Deaf signing community experiences distinct health challenges compared with the general population¹⁸. These findings underline the relevance of situating the present study in the broader international context of Deaf Studies, disability studies, and public health research.

The study's inferences regarding emotional well-being are constrained by measurement choices: depressive and anxiety outcomes were captured using author-constructed composite indices (self-report) rather than validated multi-item instruments. Although items were transcreated and video-translated into PJM to enhance

linguistic and cultural equivalence, the absence of formal validation limits interpretability and external comparability. Future studies should confirm these sex-specific patterns using PJM-adapted validated measures and, where feasible, triangulate self-reports with clinical assessments.

Satisfaction and quality of life among hearing devices users

Our findings also need to be interpreted in light of recent evidence on user satisfaction with hearing rehabilitation. Although almost half of our participants used hearing aids, the present study did not analyse quality-of-life differences by device type. Nevertheless, recent research shows that psychosocial factors strongly shape user satisfaction, even when modern digital hearing aids provide measurable audiological benefits. Portelli et al. found that variables such as age, sex, and concerns about personal image significantly influenced satisfaction with conventional hearing aids, with women expressing more reservations about aesthetic aspects. These results complement our findings by underscoring that the effectiveness of hearing rehabilitation should not be evaluated solely on the technical performance of devices, but also on the social and psychological context in which they are used¹⁹.

Practical implications

The results of this study have significant practical implications for health and social care. Hearing aids and cochlear implants remain the definitive clinical interventions to improve auditory functioning and quality of life among DHH adults. However, our findings suggest that the effectiveness of these medical interventions is shaped by psychosocial context and gender-specific needs.

Firstly, the study indicates the need to take sex differences into account when planning and implementing interventions to support quality of life. Women, who more frequently report difficulties in partner communication and higher levels of self-reported emotional symptoms, may particularly benefit from additional psychological support, counselling, and interventions aimed at strengthening relational and communication skills.

Secondly, the results emphasize that professional activity and education may be particularly relevant for men, who more often linked life satisfaction with social participation and practical aspects of functioning. For this group, interventions facilitating social and activity-based engagement may enhance the benefits of hearing rehabilitation.

Taken together, these findings highlight the importance of a multidimensional, gender-sensitive approach in which medical rehabilitation through hearing devices is complemented by tailored psychosocial and relational support.

Limitations of the study

This study has several limitations that should be acknowledged. First, the sample is not fully representative of the entire population of hearing impairment individuals in Poland. The questionnaire was distributed primarily in centres and organisations associated with the Deaf community, which may have influenced the composition of the study group and its limited generalisability. Another limitation is that the study did not collect data on participants' cultural self-identification (e.g., as culturally Deaf vs. as individuals with hearing loss) or on their preferred communication mode (oral vs. signed). While all respondents were fluent users of Polish Sign Language (PJM), and the questionnaire was provided in both written and PJM video formats, the lack of formal measures of identity and communication preferences limits the ability to examine potential differences related to these important factors. Future studies should incorporate such variables to better capture the diversity of experiences within the DHH population.

Second, depressive and anxiety outcomes were assessed using author-constructed composite self-report indices rather than validated multi-item instruments. Although the items were transcreated and videotranslated into Polish Sign Language (PJM) to maximise linguistic and cultural accessibility, the absence of formal validation limits comparability with other studies and precludes diagnostic inference. These findings should therefore be interpreted with caution. We recommend replication with PJM-adapted validated measures (e.g., multi-item depression and anxiety scales) in future research.

Third, device usage was considered descriptive. Approximately half of the respondents reported using hearing aids, whereas only a small minority (8.9%, $N=22$) reported using cochlear implants. The very limited number of implant users made subgroup analyses comparing quality of life across device groups (no device, hearing aid, cochlear implant) unfeasible, as such comparisons would have been underpowered and at risk of unstable estimates. Future studies with larger and more balanced samples of cochlear implant users should investigate whether quality-of-life outcomes differ systematically by device use.

Finally, the cross-sectional design and correlational analyses do not allow for causal inferences. Longitudinal studies are needed to clarify the directionality of the observed associations.

Directions for further research

Future research should focus on analyzing the quality of life of hearing impairment individuals, taking into account various socio-demographic factors, such as age, education, place of residence, and professional status. In addition, it is worth conducting comparative studies with the participation of hearing individuals to better understand the specificity of the experiences of people with hearing impairments.

Conclusions

The conducted research leads to several key conclusions. First, there is a clear difference in the level of life satisfaction and experiences between women and men with hearing impairments. Men with hearing disabilities are more likely to show a higher level of life satisfaction, while women are more likely to experience difficulties in communicating with their partner, participate less often in social gatherings, and more often experience

symptoms of depression and anxiety. Secondly, it has been shown that a higher level of education correlates with higher life satisfaction and better social relationships among women, while professional activity is associated with greater life satisfaction among men. Thirdly, it is important that people with profound hearing loss declare a higher level of life satisfaction compared to people with significant or moderate loss, which may be related to greater acceptance of their situation. These results emphasize the need to take into account sex differences in planning interventions supporting the quality of life of individuals with hearing loss, as well as the importance of emotional and social support, especially for women. In addition, providing access to education and professional activity can positively affect the life satisfaction of people with hearing impairments.

Data availability

The data that support the findings of this study are not publicly available due to privacy and sensitivity restrictions but are available from the corresponding author upon reasonable request.

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Author contributions

K.A.: designed the study, collected data, performed statistical analysis, and wrote the first version of the manuscript. V.S.-P.: made a significant contribution to the interpretation of data and the editing of the manuscript. All authors have read and approved the final version of the manuscript.

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Declarations

Ethics approval and consent to participate

According to the opinion of the Bioethics Committee of the Medical University of Silesia (decision No. KNW/0022/KB/311/18/19), this research study does not bear the hallmarks of a medical experiment, which, in light of the Act of December 5, 1996, on the professions of physician and dentist, does not require evaluation and the obligation to obtain the consent of the Committee. All study participants gave written informed

consent to participate in the study.

Consent for publication

The manuscript lacks personal data that would allow for identification, so it is not applicable.

Competing interests

The authors declare no competing interests.

Additional information

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