





Healthcare Professionals' Knowledge, Skills, and Information Needs Pertaining to Hearing Loss and Hearing Aids in Swedish Nursing Homes: A Cross-Sectional Study and Psychometric Evaluation

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Background: Hearing loss increases with age and due to increased life expectancy there is an increase in the number of individuals living with hearing loss. Older people with hearing loss residing in nursing homes are often dependent on healthcare professionals to help them with their hearing aids.

Objective: The aim of the study was to translate and test the psychometric properties of a Swedish version of a Norwegian questionnaire and to assess healthcare professionals' self-reported knowledge, experience, skills, competence, and information needs pertaining to residents' hearing loss and hearing aids in the Swedish context.

Materials and Methods: A Norwegian questionnaire was translated and adapted, and thereafter distributed to healthcare professionals in nine nursing homes in mid Sweden between 2020 and 2021, and 313 questionnaires were returned.

Results: An exploratory factor analysis demonstrated adequate factorial structure in six factors, satisfying construct validity and internal consistency for the Swedish version. A confirmatory factor analysis showed a satisfactory model fit. Healthcare professionals reported having the skills required for handling hearing aids, but reported lower scores for having received information about hearing aids, taking initiatives to refer residents to hearing healthcare units, and checking for earwax. Registered nurses generally reported lower perceived knowledge and practical skills concerning hearing aids. Seventy-seven percent of the total group reported a need for information regarding hearing aid maintenance.

Conclusion: Healthcare professionals reported that the majority of nursing home residents need help with their hearing aids, but only a minority of these professionals had received education on hearing loss and training in hearing aid maintenance. Enrolled nurses and care assistants demonstrated higher levels of competence in handling hearing aids compared to registered nurses. In order to ensure safe and effective care, as well as facilitate communication among older adults with hearing loss, healthcare professionals need appropriate education and training.

Keywords: hearing loss, nursing homes, health care professionals, competence, instrument translation, psychometric testing

Introduction

Hearing Loss

Hearing is a fundamental function for communication and interaction with the environment. Based on the latest estimations made by the World Health Organization (WHO),¹ approximately 430 million people have disabling hearing

loss globally. This number is expected to increase to 700 million in the year 2050. Consequently, hearing loss is about to become one of our major endemic health issues. Improved living conditions and developments in healthcare have contributed to a growing number of people reaching an older age. Hearing loss is prevalent among older adults, and its occurrence increases with age.²⁻⁴ An American study reported that 55% of the population between 70 and 79 years of age have some degree of hearing loss.⁵ Hearing loss has been associated with multiple negative consequences, including depression, social isolation, and impairment of cognitive abilities.⁶⁻⁹

Hearing Aids

The most common form of rehabilitative intervention to alleviate hearing loss is fitting hearing aids. Despite the high prevalence of hearing loss, studies have shown a generally low degree of hearing aid use (<10%) among older adults,¹⁰ specifically among those residing in nursing homes.^{11,12} A recent study showed that almost half of the participants (41.7%), with a bilateral asymmetric hearing loss, choose unilateral hearing aids and higher age was a factor of the choice.¹³ In a Swedish study of 346 participants aged 85 years, 124 individuals (36%) reported hearing difficulties, and of these, 59% owned hearing aids.¹⁴ However, there is a lack of a complete national register of hearing aid usage in Sweden.

A hearing aid amplifies sound to an audible level, which makes it easier for their user to distinguish various nuances in sounds, including speech.¹⁵ In order to stimulate the hearing organ and acclimate to hearing with hearing aids, it is important that they are used frequently.^{16,17} Being able to manage hearing aids in everyday life is also important for their optimal function.¹⁸ Users must be able to manage tasks such as insertion, removal, cleaning and changing batteries. In cases where older individuals cannot manage these responsibilities, healthcare professionals in care of older adults play a crucial role, and need to have knowledge about hearing loss and competence in handling hearing aids.

Nursing Homes

As a consequence of the demographic shift, the need for adequate geriatric care services has increased.^{19,20} As of January 2023, approximately 86,000 people were living in nursing homes in Sweden²¹ that vary in type but share similar designs. The residents typically have their own room with a kitchenette and there is usually a shared lounge that often is also used as a dining room. Another type of accommodation is sheltered housing, where residents live in their own homes, but healthcare professionals are readily accessible in the same building. The most commonly found healthcare professionals in nursing homes include care assistants, enrolled nurses, and registered nurses. Registered nurses are responsible for identifying care needs, formulating care plans, and coordinating other professionals. Enrolled nurses and care assistants are primarily involved in providing personal care directly to the residents.²²

Although older adults might need assistance with their hearing aids and hearing situations, there is limited research focusing on the knowledge and competence of healthcare professionals in nursing homes regarding hearing aids. Existing studies have shown a low level of knowledge of hearing loss among healthcare professionals and some inappropriate use of hearing aids for older people.²³⁻²⁵ A Norwegian survey by Solheim et al²³ found that 83% of healthcare professionals reported that many older adults in nursing homes needed help with their hearing aids, yet only a third of them felt that they had sufficient knowledge to be able to provide assistance.²³ Furthermore, a study from Scotland found that 91% of older adults in a nursing home needed help with their hearing aids, while only 40% of the healthcare professionals had received training in the care and maintenance of hearing aids.²⁴ A recent survey conducted in South Korea involving 453 healthcare professionals working in dementia residences found that respondents were lacking hearing-related knowledge.²⁵ In another study from England, the majority of healthcare professionals reported a lack of knowledge about hearing loss.²⁶ It is of importance to study the competence among healthcare professionals in nursing homes as they play an important role in helping residents with these matters. However, no previous study has been found that evaluates the level of knowledge regarding hearing loss and hearing aids among healthcare professionals in a Swedish context. There is also a lack of instruments designed to measure healthcare professionals' self-rated competence on hearing loss and hearing aids. However, Solheim et al²³ have constructed a questionnaire in Norwegian, and, as the health care systems in Norway and Sweden are quite similar, this questionnaire was regarded as potentially useful for measuring the self-assessed competence of healthcare professionals caring for older adults in Sweden. The aim of the study was to translate and test the psychometric properties of a Swedish version of the Norwegian

questionnaire, and to assess healthcare professionals' self-reported knowledge, experience, skills, competence, and information needs pertaining to residents' hearing loss and hearing aids in the Swedish context.

Materials and Methods

Measurements

The Norwegian questionnaire²³ covering the following areas: *Knowledge and experiences*, *Skills and competence*, and *Need for information* was identified as being suitable for assessing self-reported competence. It has 27 items with five response options; for items regarding *Knowledge and experiences* and *Skills and competence* the response options are: 5=totally agree, 4=slightly agree, 3=neutral opinion, 2=slightly disagree, and 1=totally disagree, and for items regarding *Need for information* the response options are: 5=great need, 4=moderate need, 3=neutral, 2=little need, and 1=no need. One open-ended question concerning healthcare professionals' opinions on challenges when working with older adults who have been fitted with hearing aids is also included. In addition, there are six questions about respondents' demographic characteristics.

The translation, cultural adaptation, and testing of the instrument were carried out in accordance with the methodology recommended by the International Society For Pharmacoeconomics and Outcomes Research (ISPOR) Task Force For Translation and Cultural Adaptation.²⁷ All researchers in the research group participated in the translation process. Permission to use the questionnaire and translate it was obtained from the main author of the questionnaire. Two of the authors (KB, MBA) did the forward translation individually and thereafter compared their Swedish formulations, which were discussed in the research group. Thereafter, one native Norwegian speaker, fluent in the Swedish language, and also a specialist in the care of older adults conducted the back-translation, which thereafter was compared with the original Norwegian version and discussed by the research group. Some minor cultural adaptations were made, primarily concerning employment and type of workplace. A senior university lecturer with experience in instrument development, ten nurses with experience from both hospital and municipal care and five audiologists carried out a critical review of the translation which resulted in minor corrections and two items were merged into one as they were very similar. Thereafter, all members in the research group agreed upon the translated version of the questionnaire. The Swedish version of the questionnaire contains 26 items with the same response options as the Norwegian original, the same open-ended question, and the same questions regarding demographic characteristics of participants such as age, gender, and occupational category.

Data Collection and Procedure

The questionnaire was distributed to 510 healthcare professionals working at nine nursing homes and sheltered housing facilities in two counties in central Sweden. For simplicity, all types of healthcare facilities will be collectively referred to as nursing homes henceforth. All healthcare professionals, regardless of their profession, professional experience, level of education, and form of employment, were invited to participate in the study. The healthcare professionals at the participating nursing homes were informed about the study through a pre-recorded information film shown at a staff meeting. Thereafter, the questionnaires in paper-form were handed out to the healthcare professionals together with written information about the study and voluntary participation. The respondents filled in the questionnaire during staff meetings. Completed questionnaires were considered to provide informed consent. For registered nurses and occupational therapists who were unable to attend staff meetings, a web-questionnaire was sent to their work Email addresses. Reminders for the web-questionnaire were sent twice. Data collection took place in two phases due to the increased workloads placed on healthcare professionals during the Covid-19 pandemic. The paper-form questionnaires were distributed and returned from January to February 2020, with a response rate of 77%. The web-questionnaires were distributed and returned from March to April 2021 with a response rate of 21%. A total of 326 responses were collected, resulting in a total response rate of 64%.

Data Analysis

Data were analyzed using SPSS for Windows (IBM corp., SPSS Statistics for Windows, version 26.0. Armonk, USA) software. Out of the collected questionnaires, 13 responses were excluded due to internal missing data or because respondents did not interact with older adults in their work. Data from a total of 313 respondents were included in the statistical analysis. One of the items, no. 20, was written as a negative statement in the original version of the questionnaire “I often cannot help residents with their hearing aids” while the other questions were presented as positive statements, for example “I can turn hearing aids on and off”. Therefore, the response alternatives for this item were reversed. Exploratory factor analysis using principal component analysis (PCA)²⁸ was conducted, for exploration of the underlying structure among the items, as the questionnaire had not been psychometrically tested previously. The suitability of the data for the factor analysis was assessed by using Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO) test as the measure of the proportion of variance among variables. An eigenvalue of >1.0 was used. Missing values were excluded pairwise. To support the extraction of items, varimax rotation with Kaiser normalisation was used. Items loading 0.4 or higher were considered as acceptable Pearson correlation was used to test the internal consistency of the factors. Confirmatory factor analysis (CFA) was carried out by using IBM SPSS AMOS to confirm the factorial structure of the questionnaire using the six factors identified in the PCA. The following fit indices were used; the ratio of Chi-square and degrees of freedom (CMIN/DF) to test the impact of the sample size on the hypothetical model, where values ≤ 3 are acceptable.²⁹ Further, Normed fit index (NFI), the Incremental index of fit (IFI); Tucker-Lewis index (TLI); Comparative fit index (CFI), which is a revised form of the NFI taking into account sample size,³⁰ were also used. Values for these tests range from 0 to 1 where a value closer to 1 represents a very good fit while 1 represents a perfect fit. Values greater than 0.90 indicating a good fit. The Root mean square error of approximation (RMSEA) was also used where values between 0.06–0.08 indicate an acceptable model fit, and values ≤ 0.05 are considered excellent.³⁰

Descriptive statistics were used to describe participants' characteristics (Table 1). One occupational therapist was among the respondents, and was included in the same professional group as the registered nurses, as both professions require a university degree. The respondents' statements regarding their knowledge, experience, skills, competence, and information needs were dichotomized as a proportion of agreement (totally agree or slightly agree) or disagreement (neutral, slightly disagree, or totally disagree) as shown in Figures 1–3. To explore differences between groups, One-way ANOVA with Tukey's HSD and Hochberg's GT2 post-hoc-test were used. Both post hoc tests were used due to unequal

Table 1 Demographic Characteristics of the Study Population n=313

Characteristics	n	%
Age (years)		
18–29 years	46	15
30–39 years	66	21
40–49 years	79	25
50–59 years	78	25
60–68 years	35	11
Unknown	9	3
Sex		
Female	291	93
Male	22	7
Employment		
Employed until further notice	261	83
Temporary position	28	9
Employed by the hour (casual)	22	7
Unknown	2	1

(Continued)

Table 1 (Continued).

Characteristics	n	%
Working hours		
Daytime/evening	249	80
Night	51	16
Mixed	11	3
Unknown	2	1
Percent of fulltime working hours		
100%	158	51
75%	73	23
50%	24	8
Varying working hours	54	17
Unknown	4	1
Workplace		
Sheltered housing	96	31
Nursing home	91	29
Nursing home with focus on dementia	97	31
Rotation between several workplaces	29	9
Profession		
Care assistant	48	15
Enrolled nurse	227	73
Registered nurse/occupational therapist	38	12

sample sizes in some groups. In these cases, Hochberg's GT2 is recommended instead of Tukey's HSD.³¹ All tests were two-sided and p-values of <0.05 were considered to be statistically significant.

Ethics

This study was granted ethical approval by the Regional Ethical Review Board. The participants were informed of the study aim and procedure via an information film recorded by two of the authors (KB and MBA) and via an information letter, which also informed potential participants of voluntariness and confidentiality. The act of participants answering of the questionnaire was considered as them providing informed consent.

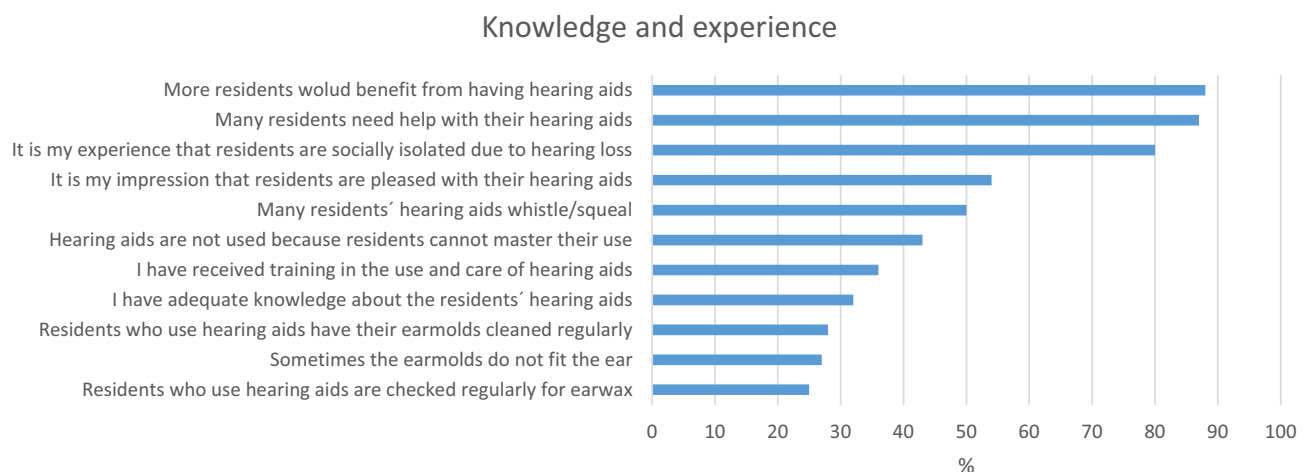


Figure 1 Proportion of agreement on knowledge and experience (n=313).

Skills and competence

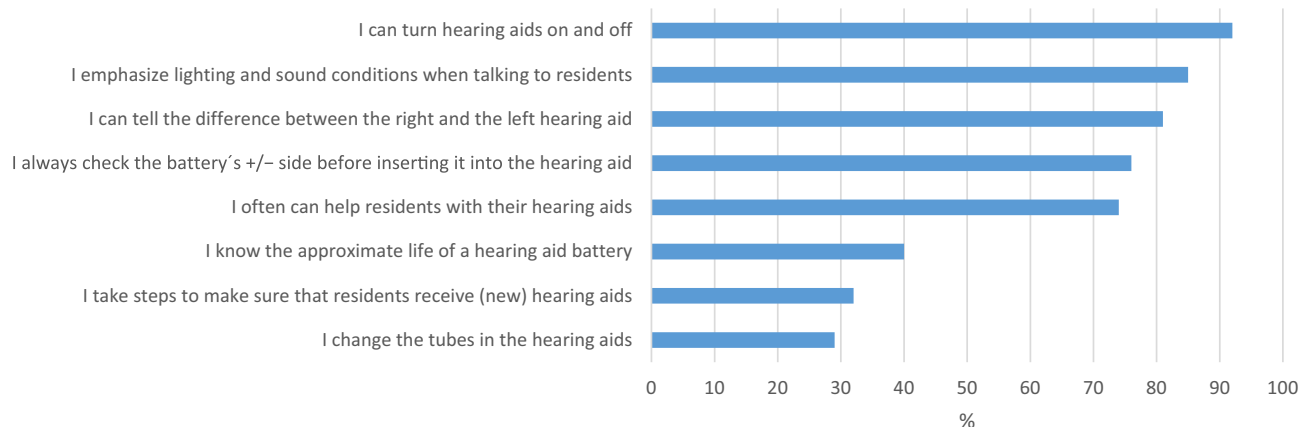


Figure 2 Proportion of agreement on skills and competence (n=313).

Information needs

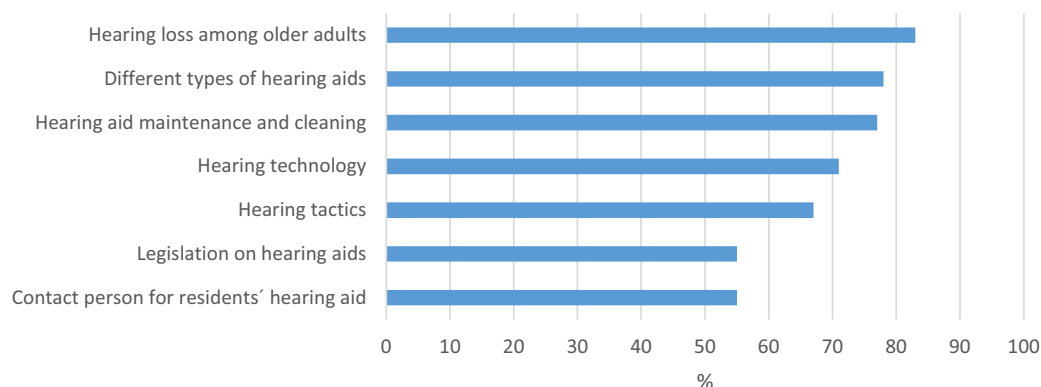


Figure 3 Proportion of agreement on information needs (n=313).

Results

A total of 313 respondents were included in the study. The average age was 43.8 years (SD 12.4 years) with a range spanning from 18 to 68 years. Demographic characteristics of the study population are presented in [Table 1](#).

Psychometric Properties

Before measuring construct validity, Bartlett's test of sphericity was found significant ($p < 0.001$) indicating that data was suitable for a factor analysis. The result of the KMO test was 0.76 which indicates that the sample can produce a reliable factor solution. Eight items were removed from the analysis as they showed a different pattern from the other items in the questionnaire, and loaded lower than 0.4. For the remaining eighteen items, the PCA was conducted using a varimax rotation method with Kaiser normalization. Factors with an eigenvalue of > 1.0 were obtained for further analysis. The PCA resulted in six factors which explained 68.12% of the total scale variance. The six factors were: 1. *Information needs*, 2. *Skills required to handle hearing aids*, 3. *Received information on hearing aids*, 4. *Takes initiative regarding hearing aids*, 5. *Regular follow-ups*, and 6. *Problems hindering hearing aid use*. Extracted factors are shown in [Table 2](#). Significant correlations ($p < 0.01$) between included items were found by using Pearson correlation within all factors and ranged between 0.320 and 0.640 ([Table 2](#)). The six-factor solution was then further tested by using CFA, conducted with all participants in the sample who had complete data ($n = 277$). The CFA

Table 2 Factor Loadings of Principal Component Analysis After Varimax Rotation

Item Number	Factor and Included Items	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Correlations* r
	Information needs							0.320–0.640**
28	Hearing loss among the elderly	0.682						
29	Different types of hearing aids	0.792						
30	Hearing aid maintenance and cleaning	0.669						
31	Hearing technology	0.798						
32	Contact person for residents' hearing aid	0.704						
33	Legislation on hearing aids	0.761						
34	Hearing tactics	0.792						
	Skills required to handle hearing aids							0.327–0.487**
15	I can turn hearing aids on and off		0.814					
16	I can tell the difference between the right and the left hearing aid		0.793					
17	I always check the battery's ± side before inserting it into the hearing aid		0.669					
	Received information on hearing aids							0.622**
9	I have received training in the use and care of hearing aids			0.895				
11	I have adequate knowledge			0.791				
	Takes initiative regarding hearing aids							0.454**
21	I take step to make sure that residents receive hearing aids				0.805			
22	I change the tubes in the hearing aids				0.784			
	Regular follow-ups							0.504**
25	Residents who use hearing aids are checked regularly for earwax					0.873		
26	Residents who use hearing aids have their earmolds cleaned regularly					0.835		
	Problems hindering hearing aid use							0.393**
19	Many residents' hearing aids whistle/squeal						0.609	
23	Hearing aids are not used because residents can not master their use						0.959	
Number of items		7	3	2	2	2	2	
Explained variance***		21.99	14.72	11.89	7.67	6.40	5.45	

Notes: Factor 1, Information needs; Factor 2, Skills required to handle hearing aids; Factor 3, Received information on hearing aids; Factor 4, Takes initiative regarding hearing aids; Factor 5, Regular follow-ups; Factor 6, Problems hindering hearing aid use. *Correlations between items within each factor, test: Pearson correlation. **p <0.001. ***Explained variance in percentage for respective factor. Total variance explained in percentage=68.12% for 6 factors.

confirmed the six-factor model and showed acceptable values; the ratio for chi-2 and df (CMIN/DF) was found to be 2.383 for the model structure (chi-2=285.963, df=120), indicating an acceptable fit for the tested model. Fit indices were NFI =0.826, IFI =0.891, TLI =0.858, CFI =0.888, and the RMSEA value was 0.071 (90% CI – 0.060–0.081) showing an acceptable fit for the model. Detailed result of the CFA are displayed in the path diagram (Figure 4).

Knowledge and Experience

The agreement proportions regarding knowledge and experience are shown in Figure 1. Eighty-eight percent of the responding healthcare professionals had the opinion that more residents would benefit from having hearing aids, while 87% stated that many residents need help with their hearing aids. Forty-three percent reported that hearing aids are not used because residents cannot master their use. Thirty-six percent of the respondents reported that they had received training in the use and care of hearing aids, and 32% considered themselves to have adequate knowledge about hearing

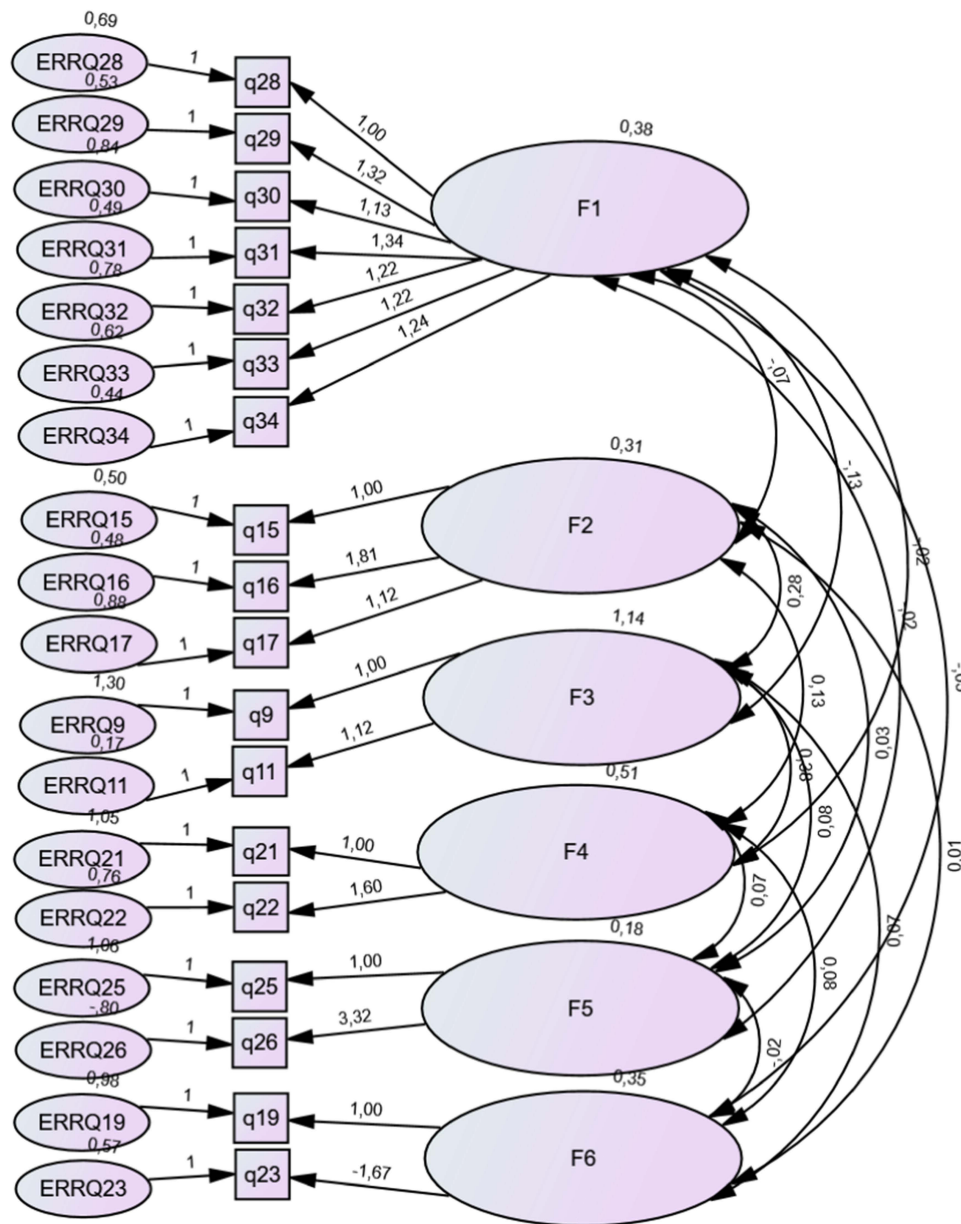


Figure 4 Detailed results of the CFA.

aids. One in four respondents reported that residents who use hearing aids undergo regular checks for earwax, and 28% believed that the residents' earmolds were regularly cleaned from earwax.

Skills and Competence

The skills and competence agreement proportions are shown in Figure 2. The vast majority of respondents, 92%, reported knowing how to turn hearing aids on and off. Additionally, 76% stated that they always check the batteries' sides (\pm) before inserting them into the hearing aid. Nearly three out of four (74%) of the respondents stated that they are able to help residents with their hearing aids most of the time.

Information Needs

The agreement proportions in information needs are shown in Figure 3. Eighty-three percent of respondents reported a need for information about hearing loss among older adults. Additionally, 78% reported a need for information about different types of hearing aids, and 77% wanted more information about hearing aid maintenance and cleaning.

Differences Between Subgroups

Differences between subgroups are presented based on the six factors identified in the PCA (Table 3). There were statistically significant differences in mean values between age categories regarding *Information needs* ($p=0.033$),

Table 3 Healthcare Professionals' Self-Reported Competence Regarding Hearing Loss and Hearing Aids Among Older Adults for the Total Group in Relation to Demographic Characteristics and Identified Factors* (n=313)

	Information Needs	Skills Required to Handle Hearing Aids	Received Information on Hearing Aids	Takes Initiative Regarding Hearing Aids	Regular Follow-ups	Problems Hindering Hearing Aid Use
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Total group	3.85 (0.82)	4.32 (0.85)	2.64 (1.28)	2.75 (1.14)	2.88 (0.98)	3.23 (1.02)
Age						
18–29 years	3.87 (0.81)	4.10 (1.07)	2.29 (1.24)	2.46 (1.16)	2.98 (0.91)	2.96 (0.98)
30–39 years	3.57 (0.82) ^a	4.43 (0.70)	2.29 (1.28)	2.50 (1.11)	2.80 (0.89)	3.17 (1.07)
40–49 years	3.87 (0.75)	4.31 (0.85)	2.48 (1.21)	2.90 (1.18)	2.84 (0.99)	3.27 (0.96)
50–59 years	3.91 (0.84)	4.29 (0.89)	2.90 (1.35)	2.81 (1.10)	2.95 (1.01)	3.33 (1.04)
60–69 years	4.07 (0.80) ^a	4.43 (0.77)	3.01 (1.25)	2.99 (1.16)	2.76 (1.08)	3.36 (1.08)
p-value	0.033		0.021 ^c			
Employment						
Employed until further notice	3.83 (0.82)	4.38 (0.80) ^a	2.70 (1.30)	2.79 (1.14)	2.86 (1.00)	3.26 (1.02)
Temporary position	3.97 (0.83)	4.15 (0.88)	2.18 (1.12)	2.52 (1.21)	3.06 (0.85)	3.00 (0.84)
Employed by the hour (casual)	3.92 (0.81)	3.82 (1.21) ^a	2.39 (1.24)	2.43 (1.07)	2.82 (0.82)	2.95 (1.23)
p-value		0.007				
Working hours						
Daytime/evening	3.90 (0.81)	4.30 (0.86)	2.65 (1.32)	2.82 (1.15)	2.85 (1.02)	3.22 (1.05)
Night	3.64 (0.88)	4.40 (0.75)	2.54 (1.21)	2.55 (1.07)	2.96 (0.80)	3.23 (0.92)
Mixed	3.92 (0.54)	4.33 (1.08)	2.86 (1.03)	2.45 (1.35)	3.14 (0.87)	3.23 (0.68)
p-value						

(Continued)

Table 3 (Continued).

	Information Needs	Skills Required to Handle Hearing Aids	Received Information on Hearing Aids	Takes Initiative Regarding Hearing Aids	Regular Follow-ups	Problems Hindering Hearing Aid Use
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Percent of fulltime						
100%	3.91 (0.80)	4.35 (0.86)	2.73 (1.30)	2.87 (1.23)	2.89 (1.07)	3.29 (0.98)
75%	3.80 (0.80)	4.42 (0.69)	2.62 (1.25)	2.65 (1.04)	2.93 (0.88)	3.02 (1.00)
50%	3.77 (0.82)	4.03 (1.20)	2.08 (1.23)	2.46 (1.01)	2.85 (0.80)	3.60 (0.98)
Varying working hours	3.86 (0.85)	4.25 (0.85)	2.63 (1.31)	2.63 (1.05)	2.82 (0.93)	3.14 (1.15)
p-value						
Workplace						
Sheltered housing	3.81 (0.78)	4.29 (0.79)	2.65 (1.22)	2.82 (1.10)	2.68 (0.94)	3.30 (0.94)
Nursing home	3.88 (0.77)	4.42 (0.85)	2.70 (1.37)	2.79 (1.20)	3.03 (1.06)	3.16 (1.09)
Nursing home with focus on dementia	3.91 (0.92)	4.32 (0.85)	2.58 (1.30)	2.79 (1.13)	2.94 (0.94)	3.20 (1.01)
Rotation between several workplaces	3.70 (0.78)	4.13 (1.06)	2.57 (1.27)	2.28 (1.16)	2.91 (0.92)	3.26 (1.13)
p-value						
Profession						
Care assistant	3.88 (0.87)	4.26 (0.97)	2.58 (1.24)	2.57 (1.12)	2.90 (0.92)	3.24 (1.08)
Enrolled nurse	3.85 (0.83)	4.43 (0.75)	2.81 (1.30)	2.92 (1.14)	2.86 (1.04)	3.17 (1.00)
Registered nurse/occupational therapist	3.84 (0.72)	3.74 (1.03) ^b	1.68 (0.81) ^b	1.97 (0.89) ^b	2.97 (0.63)	3.51 (1.04)
p-value		0.001	0.001	0.001		

Notes: The higher score, the better self-reported competence. *The six factors identified in the PCA. ^astatistically significant difference between two groups, ^bstatistically significant difference with all the other groups, ^cno differences were revealed by the Post-Hoc tests.

specifically between the age categories 60–68 and 30–39 years. The oldest age group reported a higher mean score ($m=4.07$) compared to the age group 30–39 years ($m=3.57$). There were statistically significant differences in mean values between forms of employment regarding *Skills required to handle hearing aids* ($p=0.007$), specifically between permanent employees and casual employees. The group of casual employees reported a lower mean score ($m=3.82$) compared to permanent employees ($m=4.38$). Regarding the variable of profession, there were statistically significant differences in mean values for *Skills required to handle hearing aids* ($p=0.001$) between the registered nurse/occupational therapist group and the enrolled nurse and care assistant groups. The group of registered nurses/occupational therapists reported a lower mean score ($m=3.74$) than the other two groups (Table 3).

Significant differences were found particularly between two age groups regarding *Received information on hearing aids* ($p=0.021$). The two youngest age groups had the lowest mean score ($m=2.29$), while the oldest age group had the highest mean score ($m=3.01$). There were also statistically significant differences concerning *Received information on hearing aids* ($p=0.001$) and *Taking initiatives regarding hearing aids* ($p=0.001$) between the registered nurse/occupational therapist group and the enrolled nurse and care assistant groups. The registered nurse/occupational therapist group reported lower mean scores ($m=1.68$ and 1.97 , respectively) than the other two groups (see Table 3). There were no statistical differences shown between any of the variables and *Regular follow-ups* or *Problems hindering hearing aid use*.

Regarding the variables of working hours, percentage of full-time working, and workplace, no statistical differences were shown for any of the factors.

Discussion

The aim of the study consisted of two parts. The first part aimed to translate and test the psychometric properties of a Swedish version of the Norwegian questionnaire. The results of the psychometric testing indicate that the questionnaire is a reliable instrument for measuring health care professionals' self-rated competence regarding hearing loss and hearing aids. The exploratory factor analysis showed a stable six-factor solution with a total variance of 68.12%, which is considered satisfactory.³² Using Cronbach alpha was deemed unsuitable due to four of the six factors containing only two items,²⁸ so reliability was assessed using Pearson correlation between the items within each factor. This was considered to be a suitable method for assessing the internal consistency.³³ Nevertheless, the fact that these factors contained only two items can be seen as a weakness, but at the same time they showed sufficient correlations that were on the same level as the other factors. In addition, all items showed strong loadings in each factor (0.609–0.959). CFA was conducted to validate the factorial structure identified in the exploratory factor analysis. However, to perform a CFA ten respondents per item are recommended.³⁴ This was achieved, as we could include 277 participants in the CFA. The construct validity analyzed with CFA showed an acceptable model fit with values ranging from 0.826–0.891 and RMSEA= 0.071 ($p=0.001$) which is considered to be satisfactory levels of fit indices.^{29,30} This confirms that the questionnaire is suitable to use to measure healthcare professionals' self-reported knowledge, experience, skills, competence, and information needs pertaining to residents' hearing loss and hearing aids.

However, based on the psychometric testing, some minor modifications have been suggested to further strengthen the questionnaire. Further, the response alternatives are on a 5-point scale with response option number 3 being a “neutral opinion”, which can be seen as a weakness as this response option could be understood as “cannot decide”, however, few participants in this study selected the neutral option. This response option needs to be discussed when the questionnaire is revised, with one alternative being to replace it with “no opinion” as suggested by Krosnick et al.³⁵

The second part of the aim was to assess healthcare professionals' self-reported knowledge, experience, skills, competence, and information needs pertaining to residents' hearing loss and hearing aids in the Swedish context. Previous studies have found that older people in nursing homes often need help with their hearing aids.^{23,24} Similar results were found in the present study, with the majority of the healthcare professionals reporting that many residents need help with their hearing aids. In addition, the respondents also stated that more residents could benefit from having hearing aids, which also has been found in other studies.^{10,11} In the current study, nearly half of the healthcare professionals reported instances where hearing aids were not used due to users' lack of knowledge. Only a minority of the healthcare professionals in this study reported that they had received training in the use and care of hearing aids, and a minority considered themselves to have enough knowledge about residents' hearing aids. These results correspond well with results from previous international studies.^{23–26} It is important to recognize that while healthcare professionals are responsible for the everyday care of nursing home residents, they cannot be expected to have extensive knowledge about specific hearing aids maintenance without previous education and training. The results from the present study also reveal that half of the respondents reported issues with residents' hearing aids whistling during use. Whistling is often caused by acoustic feedback, which may be influenced by earwax in the ear canal, incorrect insertion of the earmold, or a poor fit.¹⁵ If healthcare professionals lack sufficient knowledge in addressing a whistling hearing aid, there is the risk that the user's hearing ability will be further impeded. Despite this, the present study shows that a low proportion of the residents are regularly checked for earwax and few have their earmolds cleaned regularly. Hence, it is of importance that healthcare professionals have the knowledge required so these tasks can be carried out on a regular basis.

Despite the fact that only a minority of the healthcare professionals in this study reported receiving training in the use and care of hearing aids, almost three out of four stated they could help the residents with their hearing aids most of the time. The majority of the healthcare professionals reported that they had the skills and competence required to turn hearing aids on and off, tell the difference between the right and left hearing aid, and to always check the side (\pm) of the batteries before putting them into the hearing aid drawer. While healthcare professionals may gain practical experience in these skills through the daily handling of hearing aids, there is a risk that without formal training, they may handle them

incorrectly. A non-functioning hearing aid leaves hearing loss untreated, which has been associated with multiple negative outcomes such as difficulties in communication, social isolation, depression, and cognitive decline.^{6,8,9} Appropriate training for healthcare professionals in nursing homes could contribute to improved hearing health and communication among residents. In addition, this may reduce the number of unnecessary visits to audiological departments.

Although the respondents in the present study reported satisfactory levels of knowledge and skills, they expressed a generally high need for information across different areas covered in the questionnaire. The greatest needs for more information were identified in areas concerning hearing loss among older adults, different types of hearing aids, and hearing aid maintenance, all of which is in accordance with previous studies.^{23,26} The oldest age group of healthcare professionals in the study (60–68 years) reported a significantly higher need for information compared to the age group of 30–39 years, despite having had more work experience, which is in line with the findings of Solheim et al.²³ We also found a significant difference between the age groups concerning received information on hearing aids, even if post hoc tests could not reveal which specific groups that differed for this factor. These results are surprising given that older respondents often had more work experience compared to their younger colleagues. It emphasizes the importance of all skills being transferred to younger colleagues, combined with formal training and education, in order to effectively support the residents in their hearing environment.

In this study, the registered nurses and occupational therapists scored significantly lower in skills required to handle hearing aids, having received information on hearing aids, and taking initiative regarding hearing aids compared to care assistants and enrolled nurses. This indicates that the registered nurses and occupational therapists perceived themselves as lacking the required skills and competence in the maintenance and handling of hearing aids, in comparison to the other professional groups. The registered nurses and occupational therapists also reported having insufficient knowledge about residents' hearing aids and were less likely to take the initiative in changing the tubes on residents hearing aids compared to the other two groups of professionals. These results are not surprising, considering that registered nurses in Swedish nursing homes are less involved in residents' everyday care, including that of hearing aids, compared to enrolled nurses and care assistants who work more closely with residents on a daily basis. However, registered nurses have the responsibility to assess the needs of residents and to plan appropriate care based on those needs. They also coordinate care with other professionals.²² Thus, registered nurses need to have sufficient knowledge, as they are the ones who care assistants and enrolled nurses turn to when they need advice or support.

Strengths and Limitations

There are some limitations of this study. Data collection was carried out at two different times due to the high workload experienced by healthcare professionals during the Covid 19 pandemic, which may have influenced the results of the survey. The first data collection was carried out using paper and pen questionnaires at staff meetings, with very low numbers of registered nurses participating. In consultation with facility managers, a decision was taken to send out the questionnaire digitally to registered nurses but this step in the data collection had to be postponed due to the pandemic. It is important to note, however, that no changes in working methods or training regarding hearing loss or hearing aids were implemented during the total data collection period, meaning that we were able to pool the results. The response rate to questionnaires completed during staff meetings was high (77%), but it was much lower for the digital questionnaires (21%), which means that the proportion of nurses who responded is low as they did not participate in staff meetings to the same extent as other professions did. The response rate for the total group was 64%. If all eligible professionals had been present at staff meetings, the response rate would most likely have been higher, and we do not know what impact this might have had on the results. The response rate needs to be taken into account when interpreting the descriptive results of the study and for generalization of the findings to a wider population. Furthermore, in the analysis of healthcare professionals' self-reported competence in relation to demographic characteristics and *Received information on hearing aids*, the post hoc tests did not reveal which age categories had significant differences. This might be explained by the fact that the post hoc tests, such as Tukey's HSD and Hochberg's GT2, are stricter and more conservative compared to the one-way ANOVA.³¹ However, the study was conducted in both rural and urban areas in Sweden and several groups of professionals participated in the study, which strengthens the transferability of the results. The data collection were

carried out with the unrevised version of the questionnaire, which can be considered as a weakness. The psychometric testing showed satisfactory results, but further testing in a larger sample after revision of the questionnaire is recommended in order to obtain a valid questionnaire for further use.

Further studies are needed to learn more about the differences between staff groups and how to effectively address the lack of knowledge and competence in hearing and hearing aids among healthcare professionals working in nursing homes. Studies with larger sample sizes as well as studies with qualitative designs are required to establish a deeper understanding of these matters.

Conclusion

A Norwegian questionnaire was successfully translated, and the Swedish version psychometrically evaluated in a sample of healthcare professionals caring for older adults. An exploratory factor analysis demonstrated adequate factorial structure, satisfying construct validity and internal consistency. The reliability and validity testing confirmed that the tool can measure healthcare professionals' self-reported competence, but revision and further testing of the questionnaire is recommended in order to further strengthen its validity and reliability. Healthcare professionals reported that the majority of the residents in nursing homes need help with their hearing aids, but a minority of the professionals had received education on hearing loss and training in hearing aid maintenance. It is crucial that all categories of healthcare professionals have sufficient knowledge about hearing aids and are aware of the importance of hearing ability among older people in nursing homes. The results from this study provide an important basis for planning national educational interventions tailored to the specific needs of healthcare professionals working in nursing homes.

Data Sharing Statement

Author elects to not share data. The data used to support the findings of this study have not been made available because there is no ethical approval from the Swedish Ethical Review Authority for sharing the data.

Ethics

This study was granted ethical approval by the Regional Ethical Review Board, Uppsala, Sweden, Dnr: 2019-02396.

Acknowledgments

The authors want to thank all the participants in the study, Jorunn Solheim for permission to translate and use the questionnaire and statistician Jari Appelgren for statistical advice.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Funding

This work was supported by the Regional Research Council Mid Sweden [RfR-930550] and Region Värmland Sweden [LIVFOU-930300].

Disclosure

The authors report no conflict of interest in this work.

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