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ORIGINAL RESEARCH

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A validation study of the Swedish version of the Glasgow hearing aid benefit profile evaluated in otosclerosis subjects

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Abstract

Objectives: The aim of this study was to translate the Glasgow Benefit Hearing Aid Profile (GHABP) to Swedish, and to analyze its validity and reliability in patients undergoing rehabilitation with surgery or hearing aids.

Methods: The GHABP was translated to Swedish following published guidelines. One version of the questionnaire was adapted to fit the surgical intervention. A modification was made to the questionnaire by removing the answer option "not applicable" (N/A) since it was found confusing by the subjects. A prospective multicenter cohort study was performed to validate the questionnaire. One hundred and twenty-three individuals diagnosed with otosclerosis were included in the study prior to the intervention. The individuals were divided into three groups based on the intervention and previous hearing aid experience. Pure tone audiometry was performed 1 month prior and 1 year after the intervention. The Swedish version of the GHABP was completed by the individuals prior to the intervention, as well as 6 and 12 months after the intervention. Validity and reliability were assessed.

Results: The Swedish versions of the GHABP were well accepted by the included individuals. The questionnaires showed good psychometric properties, with comparable results for the two different interventions and three separate intervention groups. Initial disability was more pronounced in more challenging listening situations. Disability was reduced after the intervention. The "Use," "Benefit," and "Satisfaction" domains demonstrated beneficial results; however, a ceiling effect was noted in the same domains. The reliability was overall very high.

Conclusion: The Swedish version of the GHABP had good psychometric properties, with high validity and reliability. The same outcomes were found for the hearing aid and surgery groups. A ceiling effect was observed that can affect the questionnaire's ability to distinguish between subjects and measures over time.

Level of evidence: 2c

KEYWORDS
Glasgow hearing aid benefit profile, otosclerosis, psychometric properties, reliability

1 | INTRODUCTION

Uncorrected hearing loss has a great impact on people's quality of life. A majority of current knowledge is based on studies from cohorts with sensorineural hearing loss, predominantly age-related hearing loss.[1–3] Pure conductive or mixed hearing loss, as in otosclerosis, has been more scarcely studied.[4] In otosclerosis, the type and degree of hearing loss can change during one's lifespan depending on the affected stapes, degree of cochlear otosclerosis, and the interventions performed. There is a need to further study the patient's perspective on conductive or mixed hearing loss and the different treatment modalities, with validated patient-reported outcome measures (PROMs).

In a systematic review by Ostevik et al.,[4] it was stated that there is an underuse of PROMs in studies relating to treatment of mixed or conductive hearing loss. Only 22% of the assessed articles regarding ear surgery contained a PROM. The most prevalently used questionnaires were the Abbreviated Profile of Hearing Aid Benefit (APHAB) and the Speech, Spatial and Quality of Sounds (SSQ).[5,6] The Hearing Handicap Inventory for the Elderly (HHIE) is another frequently used questionnaire. It is translated and validated in Swedish and is predominantly used for assessing hearing impairment in the elderly.[7–9]

In this study, we chose to use the Glasgow Hearing Aid Benefit Profile (GHABP) as it is validated for longitudinal changes and analyses different listening situations that are missing in other questionnaires. The questionnaire has previously been used in the evaluation of cochlear implants, bone conduction hearing aids and middle ear implants.[10–12] The GHABP was developed by Gatehouse to be used in conjunction with hearing aid rehabilitation.[13] The questionnaire has been of great value in Great Britain in the modernization of rehabilitation for hearing impairment.[14,15] The questionnaire measures initial and residual hearing disability and handicap, hearing aid use, satisfaction, and benefit in four predefined situations, including listening in quiet and in noise.

The aim of this study was to translate the GHABP into Swedish and to examine its validity and reliability in a group of otosclerosis subjects with the interventions of either hearing aid acquisition or surgery.

2 | MATERIALS AND METHODS

2.1 | Phase 1: Translation and adaptation of the GHABP

The Swedish GHABP was developed according to international guidelines.[16] It was translated into Swedish using a formal forward-backward method. A professional translator was used, as well as two persons with professional expertise in the area. One version of the questionnaire was modified to fit subjects undergoing stapes surgery (stapedotomy). The preintervention questionnaires were identical between the different groups. The postintervention stapedotomy version of the questionnaire was modified by changing the word "hearing-aid" to "surgery" (in Swedish; "hörapparat" to "operation") in questions "e and f." In question "d", the wording was changed from "time using the hearing aid" to "time with perceived benefit."

The questionnaire was then reviewed by four clinicians with expertise in the field (two ENT-surgeons and two physicians in audiology). The GHABP was pretested on 20 subjects with otosclerosis, selected to represent different ages, sexes and interventions. Several of the subjects found the layout confusing regarding the answer option "not applicable" (N/A); hence, a modification was made and this answer option was removed from the questionnaire. After the layout change, no one found the questionnaire difficult to understand or upsetting or disturbing.

2.2 | Phase 2: Validation of the Swedish version of the GHABP

2.2.1 | Study population and procedure

The study population consisted of 123 subjects with otosclerosis included at two university hospitals and three county hospitals in Sweden. Inclusion criteria were age 20–65 years, healthy, a pure tone average (PTA_4) air conduction (AC) (mean of frequencies: 0.5, 1, 2, and 4 kHz) ≥ 30 dB HL, and a PTA_4 bone conduction (BC) threshold (mean of frequencies: 0.5, 1, 2, and 4 kHz) ≤ 40 dB HL. Impedance measurements indicated stapes fixation. The subjects were divided into three groups based on the chosen intervention and whether they had had any prior experience with hearing aids:

Group 1. Stapedotomy without any prior hearing aid rehabilitation.
Group 2. Hearing aid rehabilitation without any prior stapedotomy.
Group 3. Stapedotomy with prior hearing aid rehabilitation.

The subjects were sent the GHABP, Short Form Health Survey 36 (SF-36), and Hospital Anxiety and Depression Scale (HADS) 1 month prior to the intervention, and 6 and 12 months afterward, with the addition of the Glasgow Benefit Inventory (GBI). A mail-out/mail-back procedure was used, and the questionnaires were answered and collected online. Subjects who did not return the questionnaires within 2–3 weeks were reminded once. To test the questionnaire's reliability, a test–retest was performed. A subset of subjects ($n = 15$) completed the questionnaires within 3 weeks of the prior ones.

2.3 | Ethical considerations

This study was approved by the Regional Ethical Review Board in Gothenburg, Sweden. All included subjects signed written informed consent forms before entering the study.

2.4 | Questionnaires

2.4.1 | GHABP

The GHABP was developed by Gatehouse in 1999 to be used in conjunction with hearing aid rehabilitation.[13] The questionnaire measures

initial and residual hearing disability, as well as hearing aid use, satisfaction, and benefit in four predefined situations. The situations are (1) listening to TV with the volume adjusted for others; (2) a conversation with one person in a quiet environment; (3) a conversation in a noisy environment; and (4) a group conversation. Additional situations that are of importance to the patient can be added to the questionnaire when it is used in a clinical setting. In this study, we predefined three additional situations: telephone with an unknown voice, the ability to localize sound, and quality of voice. Each item has a Likert scale ranging from 1 to 5 points. For initial disability, initial handicap, and residual disability, a higher score indicates more difficulties. On the other hand, a higher score for use, benefit and satisfaction indicates a more favorable situation. For each situation and each question, the mean score was calculated. The domains were recalculated to a scale ranging from 0 to 100 by subtracting 1 and then multiplying by 25.

2.4.2 | SF-36

The SF-36 is a widely used generic questionnaire; it contains 36 questions distributed across eight domains, covering both physical and mental health aspects of health-related quality of life (HRQL). The eight domains cover physical functioning (FP), role limitations due to physical problems (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role limitations due to emotional problems (RE), and mental health (MH). A score for each domain is calculated with a range between 0 (worse) and 100 (best). The SF-36 has been validated in Swedish and has good psychometric properties that are comparable with the original data.[17–19]

2.4.3 | HADS

The HADS is a widely used questionnaire to detect signs of anxiety and depression; it consists of 14 items, where seven measure anxiety and seven gauge depression. The item scores range from 0 to 3, yielding a maximum score of 21 for each of the two domains. A score of >10 per domain indicates a probable emotional disorder.[20] The questionnaire has previously been validated and used in Swedish populations and demonstrated good psychometric properties.[21,22]

2.4.4 | GBI

The GBI is a generic postintervention questionnaire developed by Robinson et al.[23] to be used in otorhinolaryngology. The questionnaire comprises 18 items and is scored into three domains: general health (12 items), social support (three items), and physical health (three items).[23] The questionnaire has recently been validated in Swedish and shown good psychometric properties.[24]

2.5 | Statistical analyses

Mean values, ranges, and SDs were calculated for the descriptive statistics. For comparisons between groups, the nonparametric Kruskal–Wallis test was employed. Statistical significance was set at $p < 0.05$, and a two-sided value was used. IBM SPSS Statistics for Windows, Version 27.0. Armonk, NY:IBM Corp. was used.

Floor and ceiling effects were assessed for all domains.

Criterion validity was assessed by correlating the six domains to pure tone audiometry (PTA) prior to the intervention, specifically the PTA_4 (air and bone conduction) for the intervention ear and the ear not subjected to intervention. Construct (convergent and discriminant) validity was checked through pairwise correlating GHABP domains to the domains of the SF-36, the HADS, and the GBI using Pearson's correlation coefficient. Correlations in the range ≤0.39 were regarded as weak, 0.4–0.59 were seen as moderate and ≥0.6 were deemed strong.[25]

The test–retest reliability of the Swedish GHABP was computed using the Intraclass correlation coefficient (ICC). Reliability and internal consistency were assessed using Cronbach's alpha. To indicate the strength of agreement, ≤ 0.20 was regarded as poor, 0.21–0.40 as slight, 0.41–0.60 as moderate, 0.61–0.80 as good, and 0.81–1.00 as very high.[26]

3 | RESULTS

The study included 123 subjects with a mean age of 47 (±11.8) years at the time of the intervention. Most of the subjects were women (65%). No significant differences were encountered regarding sex or age between the different groups, as shown in Table 1.

There were no significant differences between the three groups regarding the PTA_4 (AC and BC) in the intervention ear. The mean hearing level, measured as PTA_4 in the contralateral ear, demonstrated a difference between the groups, with worse hearing in Group 3 compared with Groups 1 and 2, specifically bilateral hearing (HL) loss in Group 3 compared with unilateral HL in Groups 1 and 2, as presented in Table 2.

3.1 | Validity

The item- and domain-level descriptive statistics are outlined in Tables 3 and 4. No floor or ceiling effects were noted preintervention. Postintervention ceiling effects were present regarding the domains of use, benefit, and satisfaction; 18–28% of the subjects used the most favorable scores.

Missing items ranged from 0 to 9.0%. Highest missing numbers were present for the three supplementary situations. The domains initial disability and handicap were the domains with the highest numbers of missing items.

The postulated hypotheses were confirmed by the results regarding both listening situations and the effect of the interventions. The subjects showed more profound initial disability and handicap in more difficult listening situations, such as having a conversation with

TABLE 1 Demographic data

	All $n = 123$	Group 1 $n = 60$	Group 2 $n = 33$	Group 3 $n = 30$
Sex (% female)	65	53	73	79
Age at intervention (years) ± SD	47 (11.8)	47 (10.6)	48 (12.9)	48 (11.1)
PTA_4 AC (dB HL) ± SD				
Intervention ear	49 (11.6)	49 (11.4)	45 (10.7)	54 (11.6)
Contralateral ear	19 (16.0)	15 (14.5)	14 (10.3)	32 (17.3)

Note: Group 1: Stapedotomy without any prior intervention. Group 2: Hearing aid rehabilitation in one ear. Group 3: Stapedotomy with hearing aid rehabilitation prior to intervention. PTA_4 Pure tone average calculated as a mean of frequencies 0.5, 1, 2, and 4 kHz.
Abbreviations: AC, air conduction; dB HL, decibel hearing level.

TABLE 2 Pure-tone audiometry pre- and postintervention

	Preintervention			Postintervention, 12 months		
Group	PTA_4 AC dB HL (±SD)	PTA_4 BC dB HL (±SD)	ABG dB (±SD)	PTA_4 AC dB HL (±SD)	PTA_4 BC dB HL (±SD)	ABG dB (±SD)
All						
Intervention ear	49 (11.6)	21 (8.4)	26 (8.8)	32 (13.2)	18 (8.8)	13 (10.5)
Contralateral ear	19 (16.0)	14 (10.9)	8 (10.6)	20 (16.3)	15 (10.3)	8 (10.9)
Group 1						
Intervention ear	49 (11.4)	21 (8.7)	26 (8.9)	27 (9.5)	17 (9.2)	8 (5.4)
Contralateral ear	15 (14.5)	12 (10.6)	4 (8.8)	15 (14.5)	13 (11.5)	5 (9.2)
Group 2						
Intervention ear	45 (10.7)	20 (6.7)	24 (8.7)	48 (11.2)	20 (8.3)	28 (10.0)
Contralateral ear	14 (10.3)	11 (8.3)	6 (8.6)	16 (12.8)	14 (5.2)	6 (10.2)
Group 3						
Intervention ear	54 (11.6)	23 (9.1)	29 (8.3)	28 (9.9)	18 (8.5)	8.8 (5.7)
Contralateral ear	32 (17.3)	21 (10.3)	17 (10.1)	31 (17.9)	21 (9.2)	17 (10.4)

Note: Group 1: Stapedotomy without any prior intervention. Group 2: Hearing aid rehabilitation in one ear. Group 3: Stapedotomy with hearing aid rehabilitation prior to intervention. PTA_4: Pure tone average calculated as a mean of frequencies 0.5, 1, 2, and 4 kHz.
Abbreviations: ABG, air bone gap; AC, air conduction; BC, bone conduction; dB HL, decibel hearing level.

several people in a group, in a shop, or on a busy street. Disabilities were reduced after the intervention in all situations and for all groups. The benefit, use, and satisfaction domains had mean scores implying that the intervention had positive effects.

3.2 | Known group validity

Group 3, with bilateral HL, perceived significantly higher degrees of initial disability and handicap than the other groups, as would be expected. One exception was in the situation "conversation with several people in a group", which was equally difficult for all. Postintervention, Group 3 showed a higher degree of satisfaction and use in the situation "conversation in quiet" and in the telephone situation when compared with the other groups.

The hearing aid group derived less benefit and satisfaction in the telephone situation than the other groups (see Tables 3 and 4 and Figure 1).

No statistically significant differences were encountered between the responses from the 6- and 12-month questionnaires (Table 4).

3.3 | Criterion validity

A correlation analysis was conducted to evaluate whether hearing level was correlated with the domains of the questionnaire.

TABLE 3 Item-level descriptive statistics grouped by GHABP items (a–f)

	Initial disability (a)	Initial handicap (b)	Residual disability (c)	Use (d)	Benefit (e)	Satisfaction (f)
1. Listening to television						
All	3.1 ± 1.14	2.8 ± 1.10	1.8 ± 0.84	4.0 ± 1.33	4.0 ± 1.10	4.1 ± 1.11
Group 1	3.0 ± 1.20	2.8 ± 1.15	1.8 ± 0.81	4.1 ± 1.29	3.9 ± 1.25	4.0 ± 1.23
Group 2	3.0 ± 1.03	2.7 ± 1.14	1.8 ± 0.95	3.7 ± 1.58	4.0 ± 1.02	3.9 ± 1.10
Group 3	3.6 ± 1.05	3.1 ± 1.13	1.7 ± 0.78	4.4 ± 0.97	4.4 ± 0.74	4.5 ± 0.75
2. Having a conversation with one person in quiet						
All	2.0 ± 0.99	2.0 ± 1.23	1.4 ± 0.73	3.9 ± 1.43	3.9 ± 1.26	4.1 ± 1.22
Group 1	1.8 ± 0.97	1.8 ± 1.15	1.4 ± 0.75	3.8 ± 1.46	3.8 ± 1.41	3.9 ± 1.35
Group 2	2.0 ± 1.02	2.1 ± 1.25	1.5 ± 0.84	3.4 ± 1.56	3.6 ± 1.24	3.9 ± 1.26
Group 3	2.6 ± 1.21	2.8 ± 1.45	1.3 ± 0.54	4.4 ± 1.02	4.3 ± 0.77	4.6 ± 0.62
3. Having a conversation on a busy street or in a shop						
All	3.4 ± 1.08	3.1 ± 1.22	2.4 ± 1.00	3.8 ± 1.41	3.8 ± 1.20	4.0 ± 1.14
Group 1	3.3 ± 0.97	3.0 ± 1.10	2.2 ± 0.92	3.9 ± 1.38	4.0 ± 1.17	4.0 ± 1.17
Group 2	3.3 ± 1.15	2.9 ± 1.24	2.7 ± 1.14	3.4 ± 1.68	3.4 ± 1.38	3.6 ± 1.31
Group 3	3.9 ± 1.15	3.6 ± 1.31	2.1 ± 0.89	4.1 ± 1.05	4.0 ± 0.94	4.2 ± 0.70
4. Having a conversation with several people in a group						
All	3.3 ± 1.08	3.3 ± 1.19	2.1 ± 0.93	4.0 ± 1.24	4.1 ± 1.05	4.1 ± 1.06
Group 1	3.2 ± 0.98	3.1 ± 1.18	2.0 ± 0.84	3.9 ± 1.24	4.1 ± 1.07	4.1 ± 1.15
Group 2	3.2 ± 1.03	3.2 ± 1.15	2.3 ± 1.12	3.8 ± 1.39	3.9 ± 1.16	3.9 ± 1.09
Group 3	3.6 ± 1.24	3.7 ± 1.22	2.0 ± 0.82	4.2 ± 1.04	4.3 ± 0.85	4.3 ± 0.81
5. Telephone, unknown voice						
All	2.0 ± 1.07	2.0 ± 1.14	1.5 ± 0.84	3.6 ± 1.66	3.4 ± 1.61	3.7 ± 1.55
Group 1	1.8 ± 1.01	1.8 ± 1.11	1.3 ± 0.60	3.5 ± 1.64	3.6 ± 1.53	3.9 ± 1.51
Group 2	1.6 ± 0.85	1.6 ± 0.86	1.8 ± 1.26	3.2 ± 1.89	2.2 ± 1.56	2.8 ± 1.78
Group 3	2.6 ± 1.17	2.8 ± 1.27	1.4 ± 0.73	4.2 ± 1.27	4.2 ± 0.99	4.4 ± 0.78
6. Localization of sounds						
All	2.9 ± 1.93	2.6 ± 1.25	2.0 ± 1.08	3.8 ± 1.45	3.7 ± 1.27	3.9 ± 1.20
Group 1	2.6 ± 1.28	2.4 ± 1.24	1.8 ± 0.90	3.8 ± 1.50	3.9 ± 1.36	3.9 ± 1.28
Group 2	2.6 ± 1.37	2.2 ± 1.23	2.3 ± 1.37	3.8 ± 1.57	3.5 ± 1.33	3.7 ± 1.30
Group 3	3.7 ± 1.16	3.4 ± 1.15	2.1 ± 1.01	3.8 ± 1.23	3.8 ± 0.99	4.1 ± 0.89
7. Quality of voice						
All	1.7 ± 0.96	1.7 ± 1.03	1.4 ± 0.66	3.7 ± 1.62	3.6 ± 1.49	3.8 ± 1.37
Group 1	1.6 ± 0.79	1.5 ± 0.80	1.3 ± 0.60	3.8 ± 1.59	3.9 ± 1.49	4.0 ± 1.36
Group 2	1.3 ± 0.68	1.3 ± 0.73	1.4 ± 0.71	3.6 ± 1.70	3.1 ± 1.43	3.4 ± 1.45
Group 3	2.6 ± 1.25	2.7 ± 1.34	1.4 ± 0.73	3.4 ± 1.62	3.6 ± 1.45	4.0 ± 1.21

Note: Mean scores and standard deviations are presented. Group 1: Stapedotomy without any prior intervention. Group 2: Hearing aid rehabilitation in one ear. Group 3: Stapedotomy with hearing aid rehabilitation prior to the intervention. Likert scale (1–5): Initial and residual disability: 1: No difficulty, 2: Only slight difficulty, 3: Moderate difficulty, 4: Great difficulty, 5: Cannot manage at all. Initial handicap: 1: Not at all, 2: Only a little, 3: A moderate amount, 4: Quite a lot, 5: Very much indeed. Use: 1: Never/not at all, 2: About ¼ of the time, 3: About ½ of the time, 4: About ¾ of the time, 5: All the time. Benefit: 1: No use at all, 2: Some help, 3: Quite helpful, 4: A great help, 5: Hearing is perfect with the hearing aid/after surgery. Satisfaction: 1: Not satisfied at all, 2: A little satisfied, 3: Reasonably satisfied, 4: Very satisfied, 5: Delighted with hearing aid/surgery.

Only weak correlations were detected. Weak correlations were noted for PTA_4 for the best ear and the domains of initial disability ($r = 0.329$) and handicap ($r = 0.326$). Six months after the intervention, residual disability had a weak correlation with a worse preintervention PTA_4 BC ear ($r = 0.335$).

3.4 | Construct validity

Convergent and discriminant validity were assessed to determine whether the domains of the GHABP were correlated with the domains of the SF-36, HADS, and GBI. As predicted, moderate

TABLE 4 Domain-level descriptive statistics grouped by GHABP domain

	All $n = 123$	Group 1 $n = 60$	Group 2 $n = 33$	Group 3 $n = 30$
Preintervention				
Initial disability (a)	42 ± 17.1(4–79)	37 ± 16.3(7–79)	38 ± 18.6(4–75)	57 ± 21.9(11–100)
Initial handicap (b)	38 ± 19.9(0–96)	34 ± 19.5(0–96)	34 ± 19.4(0–100)	54 ± 24.2(11–100)
Postintervention 6 months				
Residual disability (c)	19 ± 15.3(0–64)	17 ± 13.7(0–53)	25 ± 17.5(0–64)	18 ± 14.8(0–50)
Use (d)	71 ± 28.6(0–100)	71 ± 27.6(0–100)	64 ± 35.2(4–100)	77 ± 20.3(33–100)
Benefit (e)	70 ± 23.8(0–100)	72 ± 27.1(0–100)	59 ± 20.3(18–96)	77 ± 15.8(43–100)
Satisfaction (f)	74 ± 25.0(0–100)	74 ± 28.2(0–100)	64 ± 22.8(14–100)	83 ± 16.1(50–100)
Postintervention 12 months				
Residual disability (c)	20 ± 17.1(0–75)	17 ± 16.5(0–68)	25 ± 20.4(0–75)	22 ± 14.5(0–50)
Use (d)	69 ± 30.2(0–100)	69 ± 30.5(0–100)	63 ± 33.7(0–100)	76 ± 26.0(7–100)
Benefit (e)	68 ± 27.1(0–100)	67 ± 29.3(0–100)	62 ± 26.5(0–100)	75 ± 22.0(25–100)
Satisfaction (f)	74 ± 27.3(0–100)	76 ± 29.6(0–100)	65 ± 26.5(0–100)	78 ± 21.7(29–100)

Note: Group 1: Stapedotomy without any prior intervention. Group 2: Hearing aid rehabilitation, one ear. Group 3: Stapedotomy with hearing aid rehabilitation prior to the intervention. The domains were calculated based on a scale ranging from 0 to 100 by subtracting 1 and then multiplying by 25. Mean values, SDs, and range are presented.

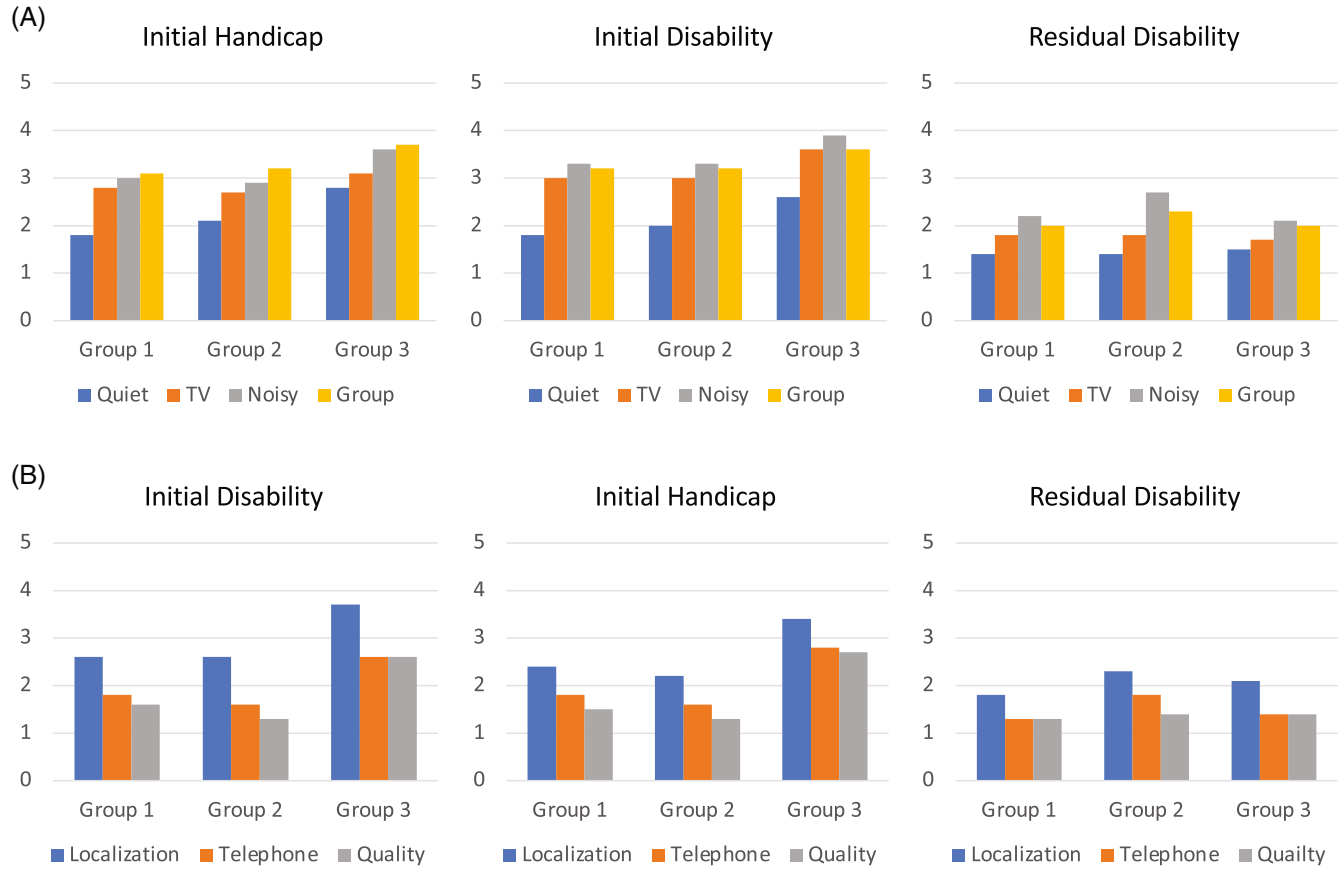

FIGURE 1 The figures represent initial disability, initial handicap, and residual disability, divided into Groups 1–3. Group 1: Stapedotomy without any prior intervention. Group 2: Hearing aid rehabilitation, one ear. Group 3: Stapedotomy with hearing aid rehabilitation prior to the intervention. Likert scale1–5: Initial and residual disability: 1: No difficulty; 2: Only slight difficulty; 3: Moderate difficulty; 4: Great difficulty; 5: Cannot manage at all. Initial handicap: 1: Not at all; 2: Only a little; 3: A moderate amount; 4: Quite a lot; 5: Very much indeed. Listening situations: (A) Having a conversation in quiet (*quiet*), listening to television (*TV*), having a conversation on a busy street or in a shop (*noisy*), having a conversation with several people in a group (*group*). (B) Localization of sounds (*localization*), telephone with unknown voice (*telephone*), and quality of voice (*quality*). Mean scores are presented

TABLE 5 Reliability tests ($n = 15$)

Domain	ICC (95% CI)[a]	Internal consistency reliability (95% CI)[b]
Initial disability (a)	0.80 (0.49–0.93)	0.85 (0.80–0.89)
Initial handicap (b)	0.63 (0.18–0.86)	0.87 (0.82–0.90)
Residual disability (c)	0.97 (0.92–0.99)	0.81 (0.77–0.87)
Use (d)	0.94 (0.82–0.98)	0.90 (0.86–0.92)
Benefit (e)	0.91 (0.75–0.97)	0.85 (0.81–0.89)
Satisfaction (f)	0.96 (0.90–0.99)	0.90 (0.88–0.93)

[a]Intraclass correlation coefficient.
[b]Cronbach's α.

TABLE 6 Reliability tests ($n = 15$), Internal consistency reliability, group level

	Internal consistency reliability[a]			
Domain	Total	Group 1	Group 2	Group 3
Initial disability (a)	0.85	0.75	0.80	0.91
Initial handicap (b)	0.87	0.81	0.82	0.90
6 months' postintervention				
Residual disability (c)	0.81	0.83	0.76	0.85
Use (d)	0.90	0.88	0.95	0.76
Benefit (e)	0.85	0.91	0.75	0.72
Satisfaction (f)	0.90	0.94	0.81	0.87
12 months' postintervention				
Residual disability (c)	0.85	0.84	0.90	0.74
Use (d)	0.91	0.91	0.94	0.87
Benefit (e)	0.91	0.92	0.92	0.87
Satisfaction (f)	0.94	0.95	0.93	0.90

Note: Group 1: Stapedotomy without any prior intervention. Group 2: Hearing aid rehabilitation in one ear. Group 3: Stapedotomy with hearing aid rehabilitation prior to intervention.
[a]Cronbach's α.

correlations were demonstrated between the GHABP domains of use, benefit, and satisfaction and the GBI general health domain (use $r = 0.411$, benefit $r = 0.533$, satisfaction $r = 0.483$). The correlations were weak between the physical and social domains, as was hypothesized. Residual disability was correlated with the same domain on the GBI, with moderate correlations for the hearing aid group ($r = -0.560$) and weak correlations for the stapedotomy group ($r = -0.383$). Weak correlations were detected with the GBI social support and physical domains, as well as between the preoperative GHABP domains and the GBI.

As posited, the HADS depression domain had weak, negative correlations with GHABP postoperative domain use ($r = -0.381$), benefit ($r = -0.312$), and satisfaction ($r = -0.305$). Further, the domains of SF-36 were relatively unrelated to GHABP, and the correlations were very weak (see Appendix S1).

3.5 | Reliability

The reliability, measured by the ICC and Cronbach's α, demonstrated very high agreement, as presented in Table 5. One exception was the ICC for initial handicap with an ICC of 0.63. Strong results with very high agreement were also demonstrated for the three subgroups regarding internal consistency (Cronbach's α; see Table 6).

4 | DISCUSSION

The aim of the study was to translate the GHABP into Swedish, and to analyze its validity and reliability in a group of otosclerosis subjects with the interventions of hearing aid acquisition or stapes surgery.

The GHABP questionnaire was well accepted and easy to understand once the answer option "not applicable to me" was removed. One reason why this modification was needed may be that our subjects completed the survey online rather than in an interview situation. The adjustment might have affected the scores, since individuals with less initial disability (in a specific situation) may have been included compared with other study populations. However, the results in the present study were comparable, with few exceptions, to the original study by Gatehouse.[13] Our study population showed higher degree of initial handicap and higher values regarding the benefit and satisfaction domains. Since there were no mandatory questions, situations that were unclear or irrelevant have probably been left without an answer. Missing items ranged from 0 to 9.0%. Highest missing values were found in the initial disability and handicap domains.

No floor effects were observed. However, ceiling effects were present in the postintervention domain use, benefit, and satisfaction (18–28%). If >15% of the respondents were to choose the most favorable alternative, this would be considered a ceiling effect.[27] The ceiling effect can have negative consequences for the questionnaire's ability to distinguish between subjects, as well as its ability to measure responsiveness (changes over time). However, a questionnaire that is intended to measure outcomes after stapes surgery will probably show a ceiling effect, since it is well known that a high number of the subjects are very satisfied after stapedotomy.[28]

The questionnaire had overall excellent test–retest reliability (>0.80), with one exception regarding the initial handicap calculated with the ICC (0.63). This finding is difficult to explain, but a possible factor could be that the question includes different alternatives. "How much does this situation worry, annoy, or upset you"? This makes it possible to interpret the question differently at the retest. However, in the study by Gatehouse 1999, minimal test retest reliability was 0.86.[13] Internal consistency reliability showed good to very high correlations, and did not differ between the versions addressing surgery compared with hearing aid rehabilitation.

The results of the questionnaires confirmed our hypothesis, with more pronounced initial disability, the more challenging listening situations. After the intervention, the disability was reduced in all situations and for all groups. Group 3, with bilateral HL, indicated more advanced initial handicap and disability regarding the localization of sounds, telephone with an unknown voice, and quality of voice compared with the groups with unilateral hearing loss, as was predicted.

When assessing criterion validity, a gold standard should be used, aiming at a correlation coefficient of at least 0.70.[27] However, there is currently no gold standard to gauge the impact of hearing loss or the effects of hearing rehabilitation.[29,30] In this study, hearing impairment, measured as PTA_4, was used to assess criterion validity, and negligible to weak correlations were observed. This is in line with other studies indicating low correlations between hearing impairment and perceived disability. Hearing disability involves many aspects other than hearing impairment, such as social, psychological, and environmental factors.[6,31] On the GHABP, some environmental factors are captured with different listening situations. This was demonstrated by Whitmer et al.,[15] where initial and residual disability were correlated with hearing level, and worse hearing implied more pronounced disability.

Analyses of convergent and discriminant validity followed the proposed hypothesis, with the highest correlations to the general and total domains of the otolaryngology intervention-specific GBI questionnaire.[24] Weak, negative correlations with the depression domain of the HADS were noted, indicating that depression signs were correlated with a lower degree of satisfaction, use, and benefit after the intervention. This finding corresponds to the knowledge that psychological factors affect perceived and reported disability. Based on previous studies, weak correlations with the generic questionnaire SF-36 were posited; this was confirmed in the study.[32]

One strength of the study was the prospective design, with the same time intervals prior to and after the intervention, thus minimizing the effect of recall bias. The study design also had weaknesses, such as not being a randomized trial. The participants chose the intervention themselves, which could have affected the outcomes. However, if the study had been randomized, only participants eligible for surgery would have been included, and hearing aid acquisition would have been a second-hand choice. Another possible limitation is the modification of the questionnaire with the answer option "not applicable" (N/A) removed. This should be taken into account when comparing the outcome of the present GHABP with other studies.

5 | CONCLUSION

The Swedish version of the GHABP is well accepted and shows overall good psychometric properties, with high reliability and validity. The same results were found for the hearing aid and surgery groups. A ceiling effect was noted that can affect the questionnaire's ability to distinguish between subjects and measures over time. The questionnaire can be an option for surgical interventions aimed at hearing improvement.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

1. Chia EM, Wang JJ, Rochtchina E, Cumming RR, Newall P, Mitchell P. Hearing impairment and health-related quality of life: the Blue Mountains hearing study. *Ear Hear*. 2007;28(2):187-195.
2. Dalton DS, Cruickshanks KJ, Klein BE, Klein R, Wiley TL, Nondahl DM. The impact of hearing loss on quality of life in older adults. *Gerontologist*. 2003;43(5):661-668.
3. Arlinger S. Negative consequences of uncorrected hearing loss: a review. *Int J Audiol*. 2003;42 Suppl 2:2S17-2S20.
4. Ostevik AV, Hill-Feltham P, Johansson ML, et al. Psychosocial outcome measures for conductive and mixed hearing loss treatment: an overview of the relevant literature. *Int J Audiol*. 2021;60(9):641-649.
5. Cox RM, Alexander GC. The abbreviated profile of hearing aid benefit. *Ear Hear*. 1995;16(2):176-186.
6. Gatehouse S, Noble W. The speech, spatial and qualities of hearing scale (SSQ). *Int J Audiol*. 2004;43(2):85-99.
7. Ventry IM, Weinstein BE. The hearing handicap inventory for the elderly: a new tool. *Ear Hear*. 1982;3(3):128-134.
8. Granberg S, Dahlstrom J, Moller C, Kahari K, Danermark B. The ICF Core sets for hearing loss: researcher perspective. Part I: systematic review of outcome measures identified in audiological research. *Int J Audiol*. 2014;53(2):65-76.
9. Oberg M. Validation of the Swedish hearing handicap inventory for the elderly (screening version) and evaluation of its effect in hearing aid rehabilitation. *Trends Hear*. 2016;20:233121651663923.
10. Louza J, Hempel JM, Krause E, Berghaus A, Muller J, Braun T. Patient benefit from Cochlear implantation in single-sided deafness: a 1-year follow-up. *Eur Arch Otorhinolaryngol*. 2017;274:2405-2409.
11. Olsen SO, Glad H, Nielsen LH. Comparison of two bone anchored hearing instruments: BP100 and Ponto pro. *Int J Audiol*. 2011;50(12):920-928.
12. Edfeldt L, Stromback K, Grendin J, et al. Evaluation of cost-utility in middle ear implantation in the 'Nordic School': a multicenter study in Sweden and Norway. *Acta Otolaryngol*. 2014;134(1):19-25.
13. Gatehouse S. Glasgow hearing aid benefit profile: derivation and validation of a client-centered outcome measure for hearing aid services. *J Am Acad Audiol*. 1999;10:80-103.
14. Davis A, Smith P, Ferguson M, Stephens D, Gianopoulos I. Acceptability, benefit and costs of early screening for hearing disability: a study of potential screening tests and models. *Health Technol Assess*. 2007;11(42):1-294.
15. Whitmer WM, Howell P, Akeroyd MA. Proposed norms for the Glasgow hearing-aid benefit profile (Ghabp) questionnaire. *Int J Audiol*. 2014;53(5):345-351.
16. Guillemin F, Bombardier C, Beaton D. Cross-cultural adaptation of health-related quality of life measures: literature review and proposed guidelines. *J Clin Epidemiol*. 1993;46(12):1417-1432.
17. Stewart AWJ. *Measuring Functioning and Well-Being: The Medical Outcomes Study Approach*. Duke University Press; 1992.

18. Gandek B, Sinclair SJ, Kosinski M, Ware JE Jr. Psychometric evaluation of the SF-36 health survey in Medicare managed care. *Health Care Financ Rev*. 2004;25(4):5-25.
19. Sullivan M, Karlsson J, Ware JE Jr. The Swedish SF-36 health survey: I. Evaluation of data quality, scaling assumptions, reliability and construct validity across general populations in Sweden. *Soc Sci Med*. 1995;41(10):1349-1358.
20. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand*. 1983;67(6):361-370.
21. Lisspers J, Nygren A, Soderman E. Hospital anxiety and depression scale (HAD): some psychometric data for a Swedish sample. *Acta Psychiatr Scand*. 1997;96(4):281-286.
22. Djukanovic I, Carlsson J, Arestedt K. Is the hospital anxiety and depression scale (HADS) a valid measure in a general population 65-80 years old? A psychometric evaluation study. *Health Qual Life Outcomes*. 2017;15(1):193.
23. Robinson K, Gatehouse S, Browning GG. Measuring patient benefit from otorhinolaryngological surgery and therapy. *Ann Otol Rhinol Laryngol*. 1996;105(6):415-422.
24. Redfors YD, Jonsson R, Tideholm B, Finizia C. Psychometric properties of the Swedish version of the Glasgow benefit inventory in otosclerosis subjects. *Laryngoscope Invest Otolaryngol*. 2019;4(6):673-677.
25. Cohen J. *Statistical Power Analysis for the Behavioral Sciences*. Vol XXI. 2nd ed. L. Erlbaum Associates; 1988:567.
26. Fayers PMD. *Quality of Life: the Assessment, Analysis and Interpretation of Patient-Reported Outcomes*. 2nd ed. John Wiley & Sons Ltd; 2007.
27. Terwee CB, Bot SD, de Boer MR, et al. Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol*. 2007;60(1):34-42.
28. Stromback K, Lundman L, Bjorsne A, Grendin J, Stjernquist-Desatnik A, Dahlin-Redfors Y. Stapes surgery in Sweden: evaluation of a national-based register. *Eur Arch Otorhinolaryngol*. 2017;274(6):2421-2427.
29. Vas V, Akeroyd MA, Hall DA. A data-driven synthesis of research evidence for domains of hearing loss, as reported by adults with hearing loss and their communication partners. *Trends Hear*. 2017;21:2331216517734088.
30. Akeroyd MA, Wright-Whyte K, Holman JA, Whitmer WM. A comprehensive survey of hearing questionnaires: how many are there, what do they measure, and how have they been validated? 4th meeting of the Core outcome measures in effectiveness trials (COMET) initiative. *Trials*. 2015;16(Suppl 1):P26.
31. Manchaiah V, Granberg S, Grover V, Saunders GH, Ann HD. Content validity and readability of patient-reported questionnaire instruments of hearing disability. *Int J Audiol*. 2019;58(9):565-575.
32. Chew HS, Yeak S. Quality of life in patients with untreated age-related hearing loss. *J Laryngol Otol*. 2010;124(8):835-841.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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