D-6-2: Feasibility of a more unified approach to hearing aid fitting and rehabilitation: views of professional end-users in Germany, the Netherlands, and the UK

Contractual Date of Delivery: 30 June 2006 (+45 days)
Actual Date of Submission: 7 August 2006
Editor: Matthias Vormann and Andrew Faulkner
Sub-Project/Work-Package: SP3/WP6
Version: 2.0 Submitted for EC review
Total number of pages: 180

Dissemination Level

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Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)
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Deliverable D-6-2

VERSION DETAILS

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<th>Version</th>
<th>Date</th>
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<tr>
<td>2.0</td>
<td>07/08/2006</td>
<td>Draft/Under review/Submitted</td>
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CONTRIBUTOR(S) to DELIVERABLE

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DOCUMENT HISTORY

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<td>0.1</td>
<td>26-Jun-2006</td>
<td>M. Vormann</td>
<td>First draft</td>
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<tr>
<td>0.2</td>
<td>11/07/2006</td>
<td>A Faulkner</td>
<td>1st combined draft</td>
</tr>
<tr>
<td>1.0</td>
<td>16/07/2006</td>
<td>A Faulkner</td>
<td>Version submitted for internal review</td>
</tr>
<tr>
<td>2.0</td>
<td>05/08/2006</td>
<td>A Faulkner</td>
<td>Revised after internal review and submitted for EC review</td>
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DELIVERABLE REVIEW

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<th>Conclusion*</th>
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<tr>
<td>1.0</td>
<td>20/07/2006</td>
<td>S. Arlinger, N. Dillier</td>
<td>Make minor revisions</td>
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* e.g. Accept, Develop, Modify, Rework, Update
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**Acknowledgement**

Supported by grants from the European Union FP6, Project 004171 HEARCOM. The information in this document is provided as is and no guarantee or warranty is given that the information is fit for any particular purpose. The user thereof uses the information at its sole risk and liability.
Pre-Amble

This is the 2nd report from HEARCOM WP6 “Technical rehabilitation procedures and individualised fitting methods”. The workpackage as a whole examines a range of current issues in rehabilitation with hearing aids and cochlear implants. The focus is on technical approaches rather than on the more psychological aspects of rehabilitation. One line of activity in the workpackage, which runs through tasks 1, 2 and 4, addresses the possibility of greater European harmonization of the assessments and procedures that are used in adult hearing aid provision. A second aim, currently addressed in task 3 of the workpackage, is to research selected novel methods of individualized fitting for hearing aids and for cochlear implants.

The workpackage description was revised in March 2006. This deliverable corresponds to the revised workpackage description.

1 Executive Summary

One main outcome of task 1 was a HearCom perspective on a pathway for hearing aid fitting that could draw on best practice in NL, DE and the UK, three countries that represent well the most advanced good practice in the field. We do not seek to recommend a specific and detailed process for the management of hearing aid provision since such a process must be designed to suit the specific conditions operating in each country. Rather we aim during the life of this workpackage to set out more general guidelines for appropriate procedures that can be adopted within the process of hearing aid provision.

The procedures and tests considered in the task 1 review included both those in common use in each of the three countries, and also recently developed procedures that HearCom WP6 partners consider likely to be appropriate for widespread use, including procedures under development in other project workpackages. Examples of such procedures include the adaptive speech recognition threshold methods and psychoacoustic tests of auditory information reception that are in development in WP2.

Task 2 represents an important next step, in which the procedures we have considered are the subject of user evaluation. The users consulted are primarily the professionals involved in the fitting of hearing aids in the three partner countries (DE, NL, UK), but attention is also paid to the views of hearing aid users themselves, and those of persons with a hearing impairment who have chosen not to wear hearing aids.

An online survey was completed by over 100 professionals from Germany the Netherlands, and the UK. The data collected addressed the frequency of use of some 83 specific procedures, and professionals’ views on whether these procedures were acceptable in their current form, or whether they were in need of improvement. For most of the procedures
considered, professionals were accepting of the recommendations of the project. Some of the HearCom proposals are for less familiar procedures (e.g. psychoacoustic tests) or are in areas where there are many different ways to carry out procedures (speech tests, disability and benefit questionnaires). In these areas professional users showed limited evidence of willingness to shift to more novel approaches. In view of this there is a clear need for both well-targeted educational materials and for the development of time-efficient methods of administration if a change in practice is to be achieved. Benefit and disability questionnaires are not part of the activity of HearCom at present, and it may not be possible to do more than provide educational information in this area. For speech and psychoacoustic tests, however, HearCom is actively working on time-efficient methods, and the educational materials to support more widespread use are part of the planned work of WP6 and WP12.

The next phase of activity in WP6 to follow task 2 is in task 4. “Prepare materials (procedures and guidelines) for use on Internet”, scheduled from month 30 on. Detailed planning for this task will take full account of the findings of task 2. There is scope for a more detailed analysis of the data presented in this report to guide that planning. The workpackage will also consider whether there is a need to gather data from professional users in other European countries and will continue to evaluate the feasibility and the expected benefits of the development of common procedures for use across Europe.

The main body of this report consists of sections 2 through 7. The remainder of the document is annexed material for additional reference. The figures in the report make use of colour and important information will be obscured if the report is printed in monochrome.
2 Introduction

A main result of task 1, as reported in D-6-1, was a proposal for a model of good practice in the procedures and evaluations associated with hearing aid fitting. One ultimate goal of the workpackage is to set out this model in a form that can be disseminated widely throughout Europe on the internet (WP12). The D-6-1 proposal was aimed towards a definition of appropriate procedures at each stage from initial contact, through hearing aid fitting, evaluation of benefit, and follow up. The procedures reviewed in D-6-1 are detailed in the annex of section 8.

The main aim of task 2 is to consider the feasibility of a more common approach to hearing aid fitting in Europe in respect of the willingness of professional users to accept the changes that would be involved. There will, of course, be some limits to a common approach because individual countries may operate very different systems for the provision and fitting of hearing aids. But these constraints can be separated from general considerations of good practice. Further, there are a number of countries within and soon joining the EC that presently lack well-developed procedures for hearing aid provision and evaluation. Beyond this, even in countries with sophisticated systems in place, it is of particular interest for HearCom to consider new or improved assessments associated with hearing aid fitting that may be brought into much more widespread use by the application of information technology and where appropriate, internet support.

If changes to the procedures used in practice are to be achieved, it is important to discover the attitudes of the target user groups to the proposals. To this end, task 2 has performed a user evaluation of the proposed good practice procedures with hearing aid audiologists and dispensers in the three involved countries (DE, NL, UK), which represent well the most advanced good practice in the field. The procedures presented include those in current use and assessments drawn from WP2 and WP7. We recognized the need to also take into account the views of hearing-impaired people, and the views of a sample of hearing-impaired persons in Germany were also surveyed.

The questions posed in the user evaluations considered the usage and applicability of procedures both in current practice, and also in an alternative scenario in which conditions were ideal, without the present constraints of time and facilities.

2.1 Survey of common procedures

Some of the procedures included in the questionnaire are very well known in the three countries surveyed. Responses for these procedures are important for several reasons
• To check our expectation of common usage
• To discover if professional users find the procedure of limited use, and would prefer that it be excluded from the standard set of procedures
• To discover if professional users felt the need for the procedure to be improved

2.2 Procedures that are novel or less standard

For the HearCom project as a whole, the main interest is in users’ attitudes to procedures that are not standard practice, but have been identified within the project as valuable assessments that can be made widely available and cost/time effective through the application of information technology.

D-6-1 made a comparison of the proposals made by DE-HZO, NL-AMC, and UK-RNID for more ideal procedures to the procedures used in current practice in these three countries. The major areas where the HearCom proposals go beyond standard practice, and where the views of professional users are hence of particular interest were as follows.

2.2.1 Benefit Questionnaires.

While these are part of standard UK practice for NHS provision (as part of the standards set by the recent state-funded “Modernising NHS Hearing Aid Services” programme) there is no consistent use of this approach in Dutch and German practice. The NL-AMC proposal matches the procedures already used in the UK NHS in the use of the Glasgow Hearing Aid Benefit Profile (Gatehouse, 1999).

2.2.2 Speech audiometry.

Standards for speech tests vary greatly. German and Dutch practice involve simple word and number-based speech audiometry in the quiet. UK standards make no use of speech testing. Two of the three HearCom partners recommend standards for speech testing in noise and specific methods for speech tests in quiet that are not generally used at present. While UK standards do not provide for any speech testing, it seems likely that practice in the UK could be extended to make use of standard speech testing methods in cases where routine fitting and evaluation seem to give less than ideal results. For example, there will be some cases where subjective benefit is less than expected, or where there is a need to choose between several alternative hearing aids or fits of one hearing aid.
2.2.3 Insertion gain measures.

Indications are that insertion gain measures are not standard in the Netherlands, while they are part of the routine procedures in the UK and Germany. Common standards throughout Europe would be desirable.

2.2.4 Loudness scaling.

Loudness scaling measures (Brand & Hohman, 2002) are not presently in standard use, but were advocated in D-6-1 by both DE-HZO and NL-AMC.

2.2.5 Sound Localisation.

Measures of binaural hearing are part of standard practice at present in the Netherlands and Germany. A sound localisation procedure was advocated by NL-AMC that may be of particular importance in optimizing the fitting of binaural hearing aids.

2.3 Focus on professional users.

This evaluation is largely concerned with the views of the professionals who are involved in the day-to-day management of hearing aid provision. Their willingness to adopt new procedures is a key factor in any future harmonization, both in directly determining the likely uptake of new or revised procedures, or for procedures that are less familiar to these users, by signalling the degree to which education and explanation would be needed to introduce changes in practice.

2.4 Main study and preliminary pilot work

The main user evaluation dataset discussed in this report was collected from an internet questionnaire completed by professionals directly involved in the provision of hearing aids across the three countries involved. The questionnaire design was informed by a prior and more detailed evaluation using focus group methodology that was performed only in Germany.

2.5 Study of views of hearing impaired persons

While the views of professionals are of key importance to any shift in practice, we cannot contemplate major changes without also having some insight into the views of hearing impaired people. We have, therefore, also employed a focus group approach to elicit the views of a group of hearing-impaired people. This data was collected only in Germany.
2.6  **Professional user groups**

There are significant national differences in the roles and titles of the professionals engaged in hearing aid provision and the execution of the associated procedures.

2.6.1  Germany

In the German system, the hearing impaired person has to visit an ENT doctor for diagnosis. Subsequently they go to a hearing aid dispenser (HAD) to get hearing aids fitted and fine-tuned. The hearing aid dispenser is responsible for the full range of assessments and other procedures involved in hearing aid provision. The last step for the hearing impaired person is to go back to the ENT doctor who does a final evaluation to check the success of fitting. After that the hearing aids will be paid in total or partly by the medical insurance.

The qualifications required of a hearing aid dispenser in Germany are to pass an apprenticeship lasting 3 years with theoretical lessons in vocational schools and practical shares. The requirements are determined and the final examinations are controlled by the chamber of handicrafts.

Unlike the Dutch and English systems, there are no persons in Germany with the profession of audiologist. ENT doctors and hearing aid dispensers are the only professionals involved in hearing aid provision. ENT doctors were not considered for this survey as they do not make any use of the technical procedures involved in hearing aid fitting.

2.6.2  The Netherlands

In the Netherlands, the hearing impaired person goes to a medical audiological centre for diagnosis and prescription of a suitable hearing aid or aids (covering both type of aid and a first pass at the setting of the aid for the individual). Then they go to a professional hearing aid dispenser who issues and fine-tunes the hearing aid(s). The hearing-impaired person returns to the audiological centre for evaluation measurements.

There are around 90 professionals in the Netherlands with an advanced level of training in biophysics and audiology who are based in state-funded hospitals or audiological centres. Their title is “audiologist” or “audiologist in training”.

From 2004 on, clients have been allowed to bypass the audiological centre and go straight to a hearing aid dispenser. Hearing aid dispenser qualification requires an MBO-4 level practical qualification, which has no scientific element, and is to a much more basic level than the training of Dutch audiologists. The qualification is broadly similar to that required by German hearing aid dispensers.
2.6.3 The UK

Hospitals within the state sector have responsibility for about 80% or more of hearing aid provision in the UK. The procedures used in the state sector are nationally determined, and have been developed from a Health Services Research base reflecting both scientific and medical views and the views of audiologists working in the NHS. The professionals managing and executing hearing aid fitting are known as audiologists or audiological scientists, a position which (after recent changes to the education system) requires a degree level qualification in clinical Audiology, with further in-work training. Here we simply call them audiologists. There are at present around 2000 audiologists working in the UK (Sanderson et al, 2003).

There is in addition a private sector system. Here, hearing aid provision is by independent hearing aid dispensers. The national regulating body for UK dispensers (www.thehearingaidcouncil.org.uk) reports that there are about 1300 active dispensers in the UK. No scientific training is required, but dispensers are required to meet professional standards. There is a nationally agreed code of practice for professionals in the private sector, but this concentrates more on professional conduct than specifics of rehabilitation tests and procedures. In future, all hearing aid dispensers will also have to have a degree qualification.

3 User Evaluation Study

3.1 General Methodology

The preceding report, D-6-1, proposed that professional user evaluations would be performed using the focus group approach. Focus group discussions were subsequently performed in Germany (DE-HZO) with 8 Hearing Aid Dispensers. These discussions were, because of their open nature, well suited to identifying the points of special interest and concern to the selected sample. This methodology was not, however, well suited to use in a number of different countries, as the required skilled manpower was not available, and the focus group approach is very laborious if larger groups of informants are desired.

It was therefore decided to collect the main body of data using an internet-based online questionnaire, which could readily be implemented in a comparable way in different countries, with the main manpower for data collection and analysis located with a single partner. Furthermore, a very important advantage of this approach is that it can be extended afterwards to further countries should this prove desirable.

The focus group investigations with German Hearing Aid Dispensers are presented in full in the appendix at section 13.
The DE-HZO partner also carried out focus group discussions with hearing impaired people. Although these users are not the main topic of our investigation, their views have undeniable significance, and these discussions are presented in full in the appendix at section 13. The main outcomes of these discussions are summarised in section 4 of the main report.

### 3.2 Online questionnaire

The questionnaire was addressed to professionals involved in the provision of hearing aids. Based upon the D-6-1 proposals for procedures and informed also by the focus group discussions performed in Germany (DE-HZO) we developed an online questionnaire to be targeted at professionals in Germany, The Netherlands, and the UK.

The questionnaire was structured into three stages: 1) procedures prior to fitting, 2) procedures related to fitting, 3) evaluation and benefit measurements (aided measurements). Care was taken that questions were framed sufficiently generally to be usable in all three countries.

The questions put at each stage of the questionnaire are shown in the annex at section 10 with the country-specific translations added. Where applicable, related items were grouped together. For instance this was useful for the speech test items, which were structured into four groups: “in quiet at fixed level”, “in quiet, adaptive”, “in noise at fixed S/N” and “in noise, adaptive”. The same was done for the various elements of important audiological questionnaires.

### 3.3 Design and course of the online questionnaire

Once participants had connected to the initial web link for the questionnaire, they were shown a starting page where they got general information about HearCom and the online-questionnaire (see Figure 11-1). After that they were led to the next page that introduced the course of the online questionnaire and were given instructions in their respective mother language (see Figure 11-2 for the English version). Participation was anonymous, with basic background information about the participant collected to enable classification of their responses. This information comprised; their profession; whether they worked in the state or private sector; a confirmation of the country in which they worked (for the UK this was divided into England, N. Ireland, Scotland, and Wales).

After that the first stage started with an explanatory introduction on top of the page and the questions beneath that (Figure 11-3 and Figure 11-4).

The task of the participants was to rate the frequency of use of each procedure in their current practice using 4 categories; “always”, “often”
“sometimes” and “never”. There was also the possibility to indicate that the respective procedure was unknown.

If the participants were making frequent use of procedures that we had not listed on the web questionnaire, they were able to add information on up to 3 additional procedures. If they chose to do this, they also had to indicate how often these procedures were being used. Data collection was controlled to prevent questions being left unanswered. If the respondent submitted a set of incomplete answers, they were instructed to go back and complete all of the questions.

Once participants had completed their ratings of frequency of use for the Stage 1 procedures, they moved on to a series of evaluative questions for these same procedures. Procedures that had already been rated as “never used” or “unknown” were not included in these evaluative questions.

Participants were asked, for each procedure, if they felt the procedure should be included in the set of procedures in use in their practice, considering two different conditions, 1) in “the real world”, i.e., given current time constraints within appointments and 2) in an “ideal world” without these constraints (Figure 11-5 and Figure 11-6). Participants had 3 response choices in each case:

- “stay in as it is” which means that the respondent does not think the procedure needs any change;
- “stay in but improve” which means that the respondent desires to see some improvement in the tool or procedure (rather than in frequency of use);
- “remove” indicating the participant does not think the procedure has any value

Finally, for procedures whose frequency of use had been rated as “never used” or “unknown” in the first step, respondents were able to indicate that in their view these procedures should be added into the set of procedures that they use (see wording in lower part of Figure 11-6). This rating was made for both the “real situation” and “ideal situation”.

Once the participants had completed both frequency of use and evaluative ratings for the Stage 1 procedures, they were directed to the next set of pages, first for the Stage 2 (hearing aid fitting) procedures, and then for the Stage 3 procedures.

At the end of all stages the participants were able to give comments in free text on the online questionnaire itself and the fitting procedures covered. Finally, four much more general closing questions were presented, to be answered with “yes” or “no” (Figure 11-7):
1) Would you be interested in using tests or questionnaires that are standardised across Europe, to enable large data sets to be obtained for comparative purposes?

2) Would you be interested in allowing your patients/clients to assess benefit from fitting in the comfort of their own home by using properly designed and controlled tests or questionnaires that can be run on the Internet?

3) Do you think it is possible to develop a procedure which would allow your patients/clients to adjust the settings of their hearing aid(s) themselves using safe and appropriately calibrated tools on their own (maybe over the Internet) in the future?

4) If such a procedure did exist, would you use it?

The participants were also requested to give their reasons for their responses to these 4 questions in a box below.

### 3.4 Descriptive statistics of the sample

A total of 1380 hearing aid dispensers (from all 3 countries) and 244 audiologists (UK and NL) were invited to participate in the online questionnaire. The questionnaire web pages were open to responses for a period of one month. Table 3-1 presents the numbers invited and responding by country and professional status. All of the German participants had the status of Hearing Aid Dispenser. Invitation in Germany was by printed and mailed letter sent to a random sample of 1000 dispensers drawn from a national database of 2300. Although 1000 letters were sent out, only 70 of the invited German hearing aid dispensers took part in this survey.

In the UK, 159 audiologists were invited to take part via email, from a list of contacts held by the partner UK-RNID. Written letters of invitation were sent to a similar list of 295 hearing aid dispensers. The response rate from the UK audiologist group was good (52 of 159) considering the time that was required to complete the questionnaire. The response rate from UK hearing aid dispensers was low (6 of 295), but as the audiologists are the group responsible for the great majority of UK hearing aid provision, this was not considered a serious problem. A further 4 respondents indicated that they worked as both an audiologist and a hearing aid dispenser. Two UK respondents gave their occupation as “NHS service manager” and can be considered here as audiologists. Finally, there was one respondent who gave the occupation of “hearing therapist”. Hearing therapists work in the state (NHS) sector and usually perform extended rehabilitation with patients who need extra assistance.

For the Netherlands an invitation to all Audiologists and all independent hearing aid dispensers was sent via email. Hearing aid dispensers working for larger organisations were contacted by an email sent to the head
office, with the request to send it to five of their local offices. In total 85 audiologists and 85 hearing aid dispensers received the invitation in the Netherlands. For both groups about 20 invitees participated which is a very satisfactory response rate.

Table 3-1. Number of persons invited and participating in the online-questionnaire

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<td>Invited</td>
<td>Partici-</td>
<td>Invited</td>
<td>Partici-</td>
<td>Partici-</td>
<td>Partici-</td>
</tr>
<tr>
<td>UK</td>
<td>295 6</td>
<td>159 52</td>
<td>4</td>
<td>3</td>
<td>65</td>
</tr>
<tr>
<td>NL</td>
<td>85 22</td>
<td>85 24</td>
<td>-</td>
<td>1</td>
<td>47</td>
</tr>
<tr>
<td>DE</td>
<td>1000 70</td>
<td>- -</td>
<td>-</td>
<td>-</td>
<td>70</td>
</tr>
<tr>
<td>Total</td>
<td>1380 98</td>
<td>244 76</td>
<td>4</td>
<td>4</td>
<td>182</td>
</tr>
</tbody>
</table>

An overview of participants per country is shown in Table 3-1. In total 182 persons filled some information into the survey. About one third (70) of them began but did not complete the first stage. Most of the participants who finished the first stage (112) also finished the complete survey (101). A breakdown of the participants completing each stage is shown in Table 3-2.

Table 3-2. Number of participants completing each stage of the questionnaire

<table>
<thead>
<tr>
<th></th>
<th>First Page</th>
<th>Stage 1</th>
<th>Stage 2</th>
<th>Stage 3</th>
<th>Final Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom (UK)</td>
<td>65</td>
<td>40</td>
<td>38</td>
<td>35</td>
<td>34</td>
</tr>
<tr>
<td>Netherlands (NL)</td>
<td>47</td>
<td>27</td>
<td>25</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Germany (DE)</td>
<td>70</td>
<td>45</td>
<td>45</td>
<td>44</td>
<td>44</td>
</tr>
<tr>
<td>Total</td>
<td>182</td>
<td>112</td>
<td>108</td>
<td>102</td>
<td>101</td>
</tr>
</tbody>
</table>

The numbers completing the questionnaire in Germany represented a small proportion of those invited (44 of 1000). It would be unreasonable to regard this sample as representative of German dispensers in general; rather we assume that the German respondents represent those dispensers who have a strong interest in the procedures used in their work. The response rate among UK hearing aid dispensers was also low, but this can be accepted given that dispensers play a minor role in UK hearing aid provision, and further, at the present time, their professional practice is not governed by external standards applied by agencies that wholly or partly fund their services.

A total of 30 UK audiologists completed stages 1, 2 and 3 of the survey, representing about 20% of the 159 who were invited. Fourteen Dutch audiologists completed stage 3 of the 85 invited (16% - in this case all known Dutch audiologists were invited). The response rates from audiologists can be considered reasonable although it must again be
assumed that our respondents are those with a strong interest in fitting and assessment procedures.

Nine Dutch hearing aid dispensers completed stage 3 (of 85 invited – 10.5%). While somewhat low, this is considerably higher than the response rates from German and UK dispensers.

Both the German and UK dispensers were contacted by mailed letter, while the other groups of respondents in the survey (UK audiologists and all of the Dutch respondents) were contacted by email. Email contact has the likely advantage that the recipient has immediate access to the survey web pages through the embedded URL link in the email, and this is likely to be a contributory factor in the levels of response achieved.

3.5 Results

3.5.1 Stage 1

Stage 1 was composed of 41 questions. In the following only the English version is presented, see the annex, section 10 for the exact text in each language.

Data of the questionnaire is displayed as follows (see Figure 3-1 as an example): There are 3 illustrations in every figure. The first on the left upper corner shows the frequency of use in the “current situation”, that is the conditions under which the participants are working now. They had to rate how often they used each procedure using the 4 categories “always”, “often”, “sometimes”, “never”. If they did not know the test they could select “unknown”. The leftmost column in the diagram is the cumulative rating for all participants, regardless of their origin (Tot). The three columns to the right are the separated results for the three countries: United Kingdom (UK), The Netherlands (NL) and Germany (DE). The numbers in the diagrams are the absolute numbers of participants who chose the respective category. The numbers behind the countries (N=...) indicate the sum of participants in the particular country (or in total, leftmost column). All four columns are normalized to that sum (N), so that the height of the bar section represents the proportion of respondents choosing each response category.

The two lower diagrams show how the participants would like to see things changed for the “real situation” (left diagram) and for the “ideal situation” (right diagram). Otherwise the presentation of these results is the same as for the frequency of use ratings.

The questions used in stage 1 were concerned with procedures that might be carried out prior to fitting. The topics covered were the following and
were all based on the D-6-1 survey of procedures proposed for pre-fitting use:

- Discussion about hearing loss and hearing aids
- Medical history
- Information for the family of the patients
- Otoscopy
- Tuning fork tests
- Tympanometry
- Pure tone audiometry
- Uncomfortable loudness measures (ULL)
- Most comfortable loudness measures (MCL)
- Questionnaire ratings – to assess hearing difficulties, expectations, quality of life, speech intelligibility, hearing difficulties rated by family members and impact on daily life
- Speech tests – speech intelligibility in quiet and noise, adaptive testing in quiet and in noise
- Comparison between speech audiogram and tone audiogram
- Loudness scaling tests
- Sound localisation tests
- TEN test to find dead regions in the cochlea (Moore et al., 2000)
- Frequency and temporal resolution tests
- Binaural intelligibility level difference test
- Tests above threshold

The complete results for Stage 1 can be found in the Annex, and a summary of the most interesting points is given here. The summary focuses on variation in practice between the different countries or the different situations and on reactions to the more novel procedures.

Results for the topics not summarised here, such as pure tone audiometry were unsurprising in that professionals were currently using the procedures and would also want to in an ideal world situation. These types of results were very similar to those obtained in D-11-1.

Procedures that were not included in the online questionnaire but which were added by respondents as part of their normal practice are listed in the annex, along with any comments made about each one. For stage 1, the situation prior to fitting, several additions to the procedures were of tests with hearing aids. These additions are not shown here since they
could be interpreted as tests for a previous hearing aid, or as a misunderstanding of the structure of the questionnaire.

3.5.1.1 Information for family members

Professionals in the Netherlands and Germany were asked whether they currently provide any information for the family of the patient (Figure below). All participants provided this information, however they stated that they would like to see improvements in an ideal world situation. A likely improvement would be the availability of more time to speak to the family of the patient.

Figure 3-1. Stage 1, question 3: Information for family of hearing impaired person
3.5.1.2 Tuning fork tests

Professionals were also asked their opinions on tuning fork tests. It is clear from the Figure below that this is not a test done by all professionals in the three countries surveyed, where about 60% of professionals overall never use the test.

![Figure 3-2. Stage 1, question 5, Tuning fork tests](image)

D-11-1 also asked their survey participants whether they carried out tuning fork tests, but their questions were worded in a way that does not allow direct comparison. However, in that survey, tuning forks were also not used by many professionals in their current work, with 33% of UK professionals using them, 13% of German professionals and 26% (hearing and dispensers) and 4% (audiologists) of Dutch professionals. This difference between Dutch audiologists and hearing aid dispensers was not present in our data: 47% of the audiologists and 42% of the hearing aid dispensers indicated that they used the tuning fork tests ‘sometimes’, ‘often’ or ‘always’.

3.5.1.3 Tympanometry

The figure below shows the results for tympanometry. It is clear that the professionals in the three countries have slightly different roles. More professionals in the UK are carrying out tympanometry, compared to the Netherlands or Germany. This is most likely due to the fact that other professionals, such as ENT surgeons, in the other countries would usually perform these kinds of tests and any aspect of the tympanometry results of significance for hearing aid fitting would be available to the hearing aid fitting professional.

Professionals surveyed in D-11-1 were also asked whether they carried out tympanometry and a similar pattern was seen, where more UK professionals were carrying out this type of procedure compared to the other countries. However there was a group of Dutch audiologists (83%) who did use tympanometry more than their dispenser colleagues (26%). The same trend is present in our data: all of the audiologists (100%) use it ‘sometimes’, ‘often’ or ‘always’, and only 1 of the hearing aid dispensers (8%). This is most likely caused by the fact that in the Netherlands tympanometry is regarded a more medically-oriented diagnostic task and is therefore not a task of the hearing aid dispenser. Moreover, most hearing aid dispensers do not have tympanometers.
3.5.1.4  ULL and MCL measures

There was also a difference in practice in terms of ULL and MCL measures, between countries. Both of these were more popular currently in Germany than in the UK or the Netherlands. However, for both measures, professionals in the UK and Netherlands would like to use them in an ideal world situation. Professionals in the Netherlands and the UK noted that the ULL measures needed improvement (but they did not detail this in the comment section of the questionnaire), whereas the German professionals who wished for improvements more often made this comment about the MCL measures. Ratings for these measures are shown in Figure 3-4 and Figure 3-5.

Figure 3-4. Stage 1, Uncomfortable Loudness Level (ULL)
Current Situation

Real Situation

Ideal Situation

3.5.1.5 Questionnaires

It was clear from initial discussions amongst partners that the professionals in the three countries surveyed would be using different questionnaires in their hearing aid services. In order to gain information that was relevant to all professionals, regardless of country, the partners decided to survey professional opinion on audiological questionnaires classified by their aims rather than in terms of specific named questionnaires. It would then be possible to list the purposes of audiological questionnaires that were regarded as important to professionals and also to inform researchers of the questionnaires that professionals felt needed improvement.

The results for the various audiological questionnaires in the Stage 1 questions can be found in the Annex. The professionals in the three countries varied in their current use of the different questionnaires and the future potential use. Table 3-3 summarises the current use and projected use in an ideal world by the professionals in the three countries totalled together. The least used questionnaires in current practice were those completed by family members about the client’s hearing difficulties. The most popular questionnaires in current use address the client’s hearing difficulties in different situations (e.g. the COSI questionnaire or the Oldenburg Inventory). The ideal world picture is interesting in that most professionals would want to use a wide range of questionnaires.
However, large numbers of professionals wanted to see improvements in the questionnaires.

<table>
<thead>
<tr>
<th>Questionnaire ratings prior to fitting</th>
<th>Current use</th>
<th>Use in an ideal world</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing difficulties in different situations</td>
<td>87.5%</td>
<td>93%</td>
</tr>
<tr>
<td>Expectations of hearing aid fitting</td>
<td>74%</td>
<td>92%</td>
</tr>
<tr>
<td>Quality of life</td>
<td>75%</td>
<td>87%</td>
</tr>
<tr>
<td>Speech intelligibility in different situations</td>
<td>79%</td>
<td>93%</td>
</tr>
<tr>
<td>Hearing difficulties rated by family member</td>
<td>62.5%</td>
<td>84%</td>
</tr>
<tr>
<td>Impact on daily life of hearing loss</td>
<td>84%</td>
<td>95%</td>
</tr>
</tbody>
</table>

Table 3-3. Percentage of respondents who currently use questionnaires and those who would use them in an ideal world.

Seven UK participants specifically mentioned the GHABP (Glasgow Hearing Aid Benefit Profile) as a questionnaire in current use, which reflects its prominence in the procedures recommended for use on the UK state sector. One German participant also specifically mentioned use of a modified version of the GHABP, while none of the Dutch participants mentioned any specific questionnaires. One UK participant commented that “existing questionnaires are often badly worded and too long. I would not expect to perform all procedures on all patients, but would select appropriate procedures based on patient history and expectations of the aid, together with patient ability, given that a lot of elderly patients are not able to reliably complete questionnaires and tests and are not necessarily accompanied by family or carers who would be able to give information”.

The use of questionnaires was also surveyed in D-11-1. Although the wording of the questions was different and the participants were not asked to consider the different aims of available questionnaires, many respondents, as here, rated questionnaires as valuable. About 90% of UK professionals felt that questionnaires were ‘very important’ or ‘important’ in their current work. About 65% of German professionals also selected those categories. Professionals from the Netherlands gave scores of 65% and 80% for Audiologists and HADs respectively. It is clear from both surveys that questionnaires are seen by professionals as an important part of the process of hearing aid provision.

3.5.1.6 Speech testing

There is a great deal of potential for variation in speech testing in terms of the conditions used to test. It was clear from discussions amongst partners that, similarly to the questionnaires, it was important to find out about the types of tests used and preferred rather than the specific names of tests, which may not be relevant to all countries. The topic was therefore divided into 4 specific areas – speech intelligibility tests in quiet, speech intelligibility tests in noise, adaptive speech audiometry in quiet
and adaptive speech audiometry in noise. Each of those specific areas were also divided into sub-questions according to the type of speech material - single words, open-set sentences, closed-set sentences, nonsense words and multiple digits. The professionals in the three countries were asked which tests they currently used and which ones they would use in an improved real world and ideal world situations.

The full results for the speech tests can be found in the Annex. A summary is given below.

For stage 1 the main purpose of speech testing would normally be to identify problems in speech understanding without use of a hearing aid, or with an older hearing aid fitting that may need to be changed. A discussion of findings that apply to speech tests in general, rather than to their specific role on the stage 1 procedures, can be found in the general discussion at section 3.6.

The commonest speech materials in use at stage 1 are those using single word materials. These materials presented in quiet at a fixed level were reported as in use “always” or “often” by 100% of the German participants, by 26 of the 27 Dutch participants, and by 27 of 40 UK participants (see Figure 3-6). Single word materials were also the most often used materials for fixed level testing in noise (53 of the 112 participants reported use “always” or “often”, with 42 of these being in Germany, see Figure 3-7). Single word materials were also the most
common materials used for adaptive testing in noise and in quiet, but adaptive testing was not as common as testing at fixed levels.

![Graph showing current, real, and ideal situations for speech intelligibility in noise at a fixed S/N ratio for different countries.](image)

**Figure 3-7.** Stage 1, Question 12C: Speech intelligibility in noise at a fixed S/N ratio: Single Words

### 3.5.1.7 Loudness scaling and sound localisation tests

Table 3-4 below shows a summary of the results for loudness scaling and sound localisation tests. Loudness scaling seems to be more popular currently in Germany than in the Netherlands and is very rarely used in the UK. However it is popular in an ideal world for professionals in Germany and the Netherlands, with lower favour in the UK.

Sound localisation tests are more popular currently in Germany and the Netherlands than in the UK. They are also popular in an ideal world for Germany and the Netherlands, and were reasonably popular for UK professionals.

<table>
<thead>
<tr>
<th>Test</th>
<th>Current use</th>
<th>Use in an ideal world</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UK</td>
<td>NL</td>
</tr>
<tr>
<td>Loudness Scaling</td>
<td>7.5%</td>
<td>37%</td>
</tr>
<tr>
<td>Sound localisation</td>
<td>22.5%</td>
<td>74%</td>
</tr>
</tbody>
</table>

Table 3-4. Summary statistics for current use and use in an ideal world of loudness scaling and sound localisation tests for all three countries.
D-11-1 also asked professionals about sound localisation tests and whether they felt they were important for their work. The wording of the question was very different to that used here and so a direct comparison is not possible. However the overall picture of results seems to be slightly different. D-11-1 stated that “professionals do not see testing of sound localisation skills as an important task in their work with patients.” Less than 30% of UK professionals felt it was ‘very important’ or ‘important’ for their work, while the proportion giving these responses was somewhat higher at 40% among German respondents. The picture for the UK seems to be similar in both surveys, whereas more German respondents in our survey seem to be interested in localisation tests, compared to those in the D-11-1 survey. For Dutch professionals in the D-11-1 survey, about 70% of HADs felt it was important compared to less than 40% of Audiologists. The picture for the Dutch HADs in that study is similar to that in our study.

3.5.1.8 TEN, frequency and temporal resolution tests and the BILD test

Table 3-5 shows the results for these tests in terms of current use and use in an ideal world situation. These tests are not currently used very much by professionals in any of the three countries, with the exception of the BILD test which is used by a fifth of UK respondents and 56% and 62% of professionals from the Netherlands and Germany, respectively. All of the tests were more popular in an ideal world situation, in particular the BILD test, where over 72.5% of professionals would use the test in this condition.

<table>
<thead>
<tr>
<th>Test</th>
<th>Current use</th>
<th>Use in an ideal world</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UK</td>
<td>NL</td>
</tr>
<tr>
<td>TEN test</td>
<td>5%</td>
<td>18.5%</td>
</tr>
<tr>
<td>Frequency resolution tests</td>
<td>10%</td>
<td>4%</td>
</tr>
<tr>
<td>Temporal resolution tests</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>BILD test</td>
<td>20%</td>
<td>56%</td>
</tr>
</tbody>
</table>

Table 3-5. Summary results for the TEN test, frequency and temporal resolution tests and the BILD test for all three countries, in terms of current use and use in an ideal world.

One German hearing aid dispenser commented on the usefulness of these tests: “What profit do these tests have if they don’t have any influence on the fitting of the hearing aids? With this we only can show that the hard of hearing can not understand better, because his brain won’t function free from error. For the fitting this has absolute no effect.” This comment reflects a difference of opinion with the scientists who advocate the use of some of these tests, pointing to the need for educational material for professionals if tests such as these are to be adopted widely.
3.5.2 Stage 2

Stage 2 of the questionnaire covered all procedures (tests, decisions and questionnaires) that are related to the fitting of hearing aids. The ten topics covered were the following:

- Choice of ear(s), choice of hearing aid(s), selection of earmould (or open fitting)
- Prescriptive fitting of one model of hearing aid(s) according to manufacturer fitting rules
- Prescriptive fitting of one model of hearing aid(s) according to generic fitting rules
- Interactive optimising of the fitting for the individual using new techniques being researched currently
- Prescriptive fitting of alternative hearing aid(s) for comparative purposes
- Fine tuning of hearing aid(s)
- Real-ear measures to verify fitting
- Test of at least one hearing aid in daily-life (trial period) – DE and NL only
- Rating of hearing aid benefit at fitting (DE only)
- Explanation of the functionality, handling and care of the hearing aid to the user

The procedures surveyed in Stage 2 tried to cover practice in the three countries, which varies considerably at this stage in the provision process. In Germany and the Netherlands, patients are given more than one hearing aid per ear and the preferred one is chosen for long-term use. In the UK, this is not done routinely, but rather, only one hearing aid model per ear is usually fitted.

The results for Stage 2 questions can be found in the Annex (section 9.1.2). Some of the main points to note from this analysis are summarised below. Results not discussed here were unremarkable in that, for example for the discussion about hearing loss and hearing aids, most professionals were currently doing this and would like to do it in an ideal world.

3.5.2.1 Use of generic and proprietary fitting methods

When professionals were asked about manufacturer’s proprietary and generic fitting rules, the generic rules seemed to be slightly more popular in current practice, especially for professionals in Germany, as can be seen in Figure 3-8 and Figure 3-9. For the three countries overall, 20 professionals never used the manufacturer fitting rules compared to only 11 professionals never using the generic fitting rules. In an ideal world situation, professionals in all three countries stated that they would like to see improvements in both types of fitting rules (20 out of 86 professionals
for manufacturer fitting rules and 29 out of 97 professionals for the generic fitting rules).

Figure 3-8. Stage 2, Question 2, Prescriptive fitting of one model of hearing aid(s) according to manufacturer fitting rules

Figure 3-9. Stage 2, Question 3, Prescriptive fitting of one model of hearing aid(s) according to generic fitting rules
3.5.2.2 Methods for the interactive optimisation of hearing aid fitting

The professionals were also asked about techniques which involve the interactive optimising of the hearing aid fitting. The results can be seen below in Figure 3-10. It can be seen that more than half of the sample of professionals are currently using this type of technique.

In the “real” world situation, most professionals are happy to use these methods without improvement, but there is a significant interest in improvements to the procedures in the ideal world situation (39 out of 90).

![Figure 3-10](image)

Figure 3-10. Stage 2, Question 4, Interactive optimising of the fitting for the individual using new techniques being researched currently

3.5.2.3 Comparison of alternative hearing aids

Another interesting result from Stage 2 was the topic of fitting alternative hearing aids for comparative purposes. This is common practice in the Netherlands and Germany, but is not in the UK. However when we look at the results shown in Figure 3-11, it is clear that there are a number of UK professionals who are currently using this technique (20 out of the 38 respondents). Most of that number use the technique only “sometimes” but it is surprising to the authors that this is being used at all. Most of the UK respondents work in the public sector, which is a free of charge service at the point of delivery, to the patient. The hearing aids remain the property of the NHS and are on loan to the patient. Because of this, it is
unlikely that professionals will be able to give patients more than one hearing aid per ear to trial, due to cost implications. This type of technique is also not considered best practice in the UK, due to constraints within the service. However it is possible that a situation may arise when a patient is not happy with the initial choice of aid and the professionals feel that they would like to trial another hearing aid to see if it an improvement. There were no specific comments made that mentioned this technique, so further investigation of this is not possible at this stage.

In terms of numbers of professionals who would use the technique in an improved situation, the picture for the Netherlands and Germany stays nearly the same for the real and ideal world situations, although there are some professionals who would like to see improvements in this technique, especially in an ideal world. However, it is also interesting that there are more UK professionals who would like to use this technique in an ideal world (30 out of 38 respondents) than in the real world.

Figure 3-11. Stage 2, Question 5, Prescriptive fitting of alternative hearing aid(s) for comparative purposes
3.5.2.4 Fine tuning of hearing aid

The results for fine-tuning a hearing aid (see Figure 3-12) were not surprising in that all of the professionals surveyed currently use the technique. However there were large numbers who would like to see improvements in this technique in an ideal world (39 out of 108 respondents).

3.5.2.5 Real-ear measures to verify fitting

Professionals were also asked whether they used real ear measures to verify the hearing aid fitting and the results as shown in Figure 3-13 were fairly similar between the three countries. Most professionals are currently using the technique, with more professionals in the UK using the technique more often than in Germany and the Netherlands. It is however surprising that there are some UK professionals who are not using the technique all of the time. It is part of the recommended procedures in the public sector service that real ear measures are carried out most if not all of the time. One professional commented that they attempt real ear measures all the time but sometimes the patient will not tolerate the probe tube and so the test cannot continue. No other comments about real ear measures were made to explain the difference in use in the UK to the recommended guidelines. For the Netherlands and Germany, this procedure is not part of the standard measures and this is reflected in the lower use of real ear measurements than in the UK. Most of the
professionals would also use the technique in an ideal world, although 44 out of 103 professionals would like to see improvements in this condition.

![Figure 3-13. Stage 2, Question 7, Real-ear measures to verify fitting](image)

### 3.5.2.6 Explanation of use and care of hearing aids

Professionals were also asked about when they explain how to use and look after the hearing aid(s) to the patient (see Figure 3-14). All the professionals do this regularly and all would do this in both real and ideal world situations. It is surprising that 25 out of the 108 respondents would like to see improvements in this technique in an ideal world. It is unclear what type of improvements they would like to see. Professionals might want to improve the way in which these things are explained or spend more time on them in an ideal world. No comments were made to explain this further.
3.5.3 Stage 3

The time at which post-fitting procedures are carried out (either straight after the hearing aid(s) are fitted or after a period of time) was not surveyed or stated in the questionnaire since we expected that there would be large variations simply related to the different service structures in the three countries.

Similar procedures were listed to those in Stage 1, so that professionals could use them for comparison purposes before and after fitting. The results of all of the questions are given in the Annex. Some of the more important points are discussed here.

3.5.3.1 Speech testing

In a similar way to Stage 1, there was great variation in opinions on speech tests. The speech tests were divided into 4 main areas – speech intelligibility testing in quiet, speech intelligibility testing in noise, adaptive testing in quiet and adaptive testing in noise. Within these subgroups, professionals were asked about various speech materials.

A similar pattern was seen for all types of speech testing, in that the open-set sentence and single word materials were the most popular in
practice currently, and tended to also be the most popular in an ideal world situation. As for pre-fitting speech tests, the most commonly used test at present used single words in quiet at a fixed level. This was reported as used “always” or “often” by 66 of the 102 participants who answered, and by 43 of 44 German respondents, 20 of 23 Dutch respondents, but by only 3 of 35 UK respondents – see Figure 3-15.

![Figure 3-15. Stage 3, Question 2C: Speech intelligibility in quiet at fixed level: Single Words](image)

3.5.3.2 Loudness scaling and sound localisation tests

The results for loudness scaling at Stage 3 (shown in Table 3-6) are very similar to those from Stage 1, where more professionals in Germany are currently using this test after fitting, compared to the Netherlands and the UK. More professionals in the three countries would use these tests in after fitting in an ideal world.

<table>
<thead>
<tr>
<th>Test</th>
<th>Current use</th>
<th>Use in an ideal world</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>UK</td>
<td>NL</td>
</tr>
<tr>
<td>Loudness Scaling</td>
<td>9%</td>
<td>30%</td>
</tr>
<tr>
<td>Sound localisation</td>
<td>20%</td>
<td>78%</td>
</tr>
</tbody>
</table>

Table 3-6. Summary statistics for percentage of professionals in the three countries who are currently using loudness scaling and sound localisation tests and those who would use them in an ideal world.
The results for the sound localisation tests (also shown in Table 3-6) are again similar to those at Stage 1. These procedures are currently being used more by professionals in Germany and the Netherlands than in the UK, but professionals in all three countries are interested in using the test in an ideal world.

3.5.3.3 Questionnaires

A wider range of possible questionnaires was presented for evaluation for use after fitting than was presented at the pre-fitting stage. The table below shows the overall percentage of professionals in the survey who are currently using the different ratings and those who would like to use them in an ideal world.

It is clear that the most popular questionnaires currently being used address hearing difficulties post fitting, sound quality and satisfaction. The least used of those presented is a questionnaire for completion by family members. In an ideal world, all of the presented questionnaires are popular, which is a similar picture to that seen in Stage 1. Again, it is clear that professionals value the use of questionnaires and feel they are an important part of the patient pathway, both before and after fitting. It is also clear that questionnaires completed by family members, although not currently used as much as other ratings, are viewed as important in an ideal world and this could be an area of development for the countries involved.

<table>
<thead>
<tr>
<th>Questionnaire Rating</th>
<th>Current Use</th>
<th>Use in an Ideal World</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing difficulties in different situations</td>
<td>85%</td>
<td>93%</td>
</tr>
<tr>
<td>Sound quality in different situations</td>
<td>85%</td>
<td>83%</td>
</tr>
<tr>
<td>Quality of life measures</td>
<td>68%</td>
<td>82%</td>
</tr>
<tr>
<td>Speech intelligibility in different situations</td>
<td>74%</td>
<td>89%</td>
</tr>
<tr>
<td>Success of fitting rated by family member</td>
<td>59%</td>
<td>76%</td>
</tr>
<tr>
<td>Impact on daily life of hearing loss</td>
<td>75%</td>
<td>87%</td>
</tr>
<tr>
<td>Use of hearing aid(s)</td>
<td>80%</td>
<td>88%</td>
</tr>
<tr>
<td>Satisfaction with hearing aid(s)</td>
<td>83%</td>
<td>91%</td>
</tr>
<tr>
<td>Benefit of hearing aid fitting</td>
<td>78%</td>
<td>91%</td>
</tr>
</tbody>
</table>

Table 3-7. Percentage of professionals overall in the three countries who are currently using questionnaire ratings and those who would like to use them in an ideal world.

3.5.3.4 Daily diaries

Daily diaries were included to see if professionals were currently using them and whether they would be interested in such a tool. The figure below shows that the current use overall of this tool is about 59% of professionals, with more professionals in Germany using the tool currently than in the other two countries. However in an ideal world, the tool is very
popular in all countries with an overall percentage of 78% of professionals interested in using the tool, with the German respondents having the highest percentage of interest, being 86%.

Figure 3-16. Stage 3, Question 9, Daily diary of hearing aid use
3.5.4 General Questions

After the three fitting stages the participants had to answer the last four general questions. These questions do not reflect the three stages but other aspects that concern the HearCom project. Question 1 investigates the attitude of professionals toward standardization of tests and questionnaires across Europe. Question 2 addresses the interest in fitting procedures that can be used over the internet. Question 3 and 4 investigate the opinion of the professionals to let hearing aid users adjust their fitting themselves.

**Question 1: Would you be interested in using tests or questionnaires that are standardised across Europe, to enable large data sets to be obtained for comparative purposes?**

This topic was included because one of the goals of HearCom is to standardize audiological practice across Europe. The data can be interpreted as an indication of the interest of professionals in the field to use internationally standardized materials. For research purposes such standardization would simplify comparisons. Moreover, standardization could facilitate large prospective field studies with high statistical power.

![Figure 3-17. Interest in tests and questionnaires standardized across Europe.](image)

As the ratings in Figure 3-17 demonstrate, the professionals in the field are apparently interested in using standardized procedures for evaluation purposes. This was the case for both public health professionals (UK: NHS, NL: Audiologist) and private professionals (UK: private, NL: HAD, DE: HAD): the differences between the two profession groups were small and statistically insignificant.
The results seem to indicate that standardization alone is a sufficient incentive for the professionals to use newly developed standardized procedures. They made only few additional remarks (see annex section 12.3).

For instance, one participant from the UK (NHS) thought that standardization could benefit patients by increasing accuracy. In contrast, a German colleague (HAD) thought the opposite:

UK: “Standardisation of assessments of whatever form obtained from a larger patient sample drawn from more different backgrounds should produce more reliable information.” In contrast, the German participant wrote: “No, because of often encountered regional and user-specific differences”.

The German comments further indicated that many participants were weary of more paper work. Such objections would be obviated if tests are administered under computer control.

Question 2: Would you be interested in allowing your patients/clients to assess benefit from fitting in the comfort of their own home by using properly designed and controlled tests or questionnaires that can be run on the Internet?

This second question was included because one of the goals of HearCom is the application of internet technology to audiology. Such a facility may be particularly useful for clients requiring a fitting service that can only be offered at a specialist centre remote from their home.

HearCom Workpackages 11 and 12 have conducted a combined survey in which they investigated the needs of audiologists and hearing aid dispensers concerning websites and internet services. They asked (their questions 9 and 10) the professionals if they would use certain procedures (e.g., threshold measurements, speech intelligibility tests, etc.) over the internet. Both questions targeted the delivery method of the test only and did not assume that the patient would use the test in their own home. The audiologists and hearing aid dispensers were only moderately enthusiastic about the idea of carrying out screening or diagnostic tests that are delivered to them via the internet (D-11-1, D-12-1). For instance, for pure-tone audiometry 79% of the Dutch audiologists stated that they would not use a test that would be delivered to them over the internet (see D-12-1, page 26). This unwillingness was attributed to several reasons; for instance, to the professionals’ preference for standardized equipment over web-based applications (D-11-1) or to the view that access to the internet is unnecessary and not important as it is likely that many professionals already have accessible tests (D-12-1). Of course, the professionals might have been unaware of the potential of internet
services, which was not explained in the surveys used in WP11 or WP12 (D-12-1).

Our question goes a significant step further in assuming that the measurement process can be conducted remotely whilst the patient is at home. This is a completely different situation and the objections of the professionals might be absent or entirely different. The results are presented in Figure 3-18.

![Figure 3-18. Interest in remote use of assessment procedures](image)

The figure indicates that about half of the participants are interested in using the new tools if available. For the Netherlands there was no clear distinction between public health professionals (Audiologists) and private professionals (HAD) (not shown in the figure). For the UK the NHS professionals were slightly more interested (61% yes, 39% no) than the private professionals (50% yes, 50% no). The German HADs were the least enthusiastic.

Compared to the results from WP11/12, our results show a relatively large interest in using the internet. One of the reasons for the difference might be that the professionals do not see added value in obtaining the test itself over the internet, whilst they do see added value in remote testing.

This is further clarified by the comments of the participants. The full list is presented in the Annex (see annex section 12.3).

Positive benefits that were mentioned included: better use of time, less burden for the patient, or even better diagnostic results because it can be done in the patient’s own pace at home, and beneficial for patients that are unable to travel to the clinic. Negative points were: worse or wrong results due to lack of personal contact, and such procedures could make some tasks of the professionals superfluous.
It should be noted that the lack of face-to-face contact was most often mentioned by the German HADs.

**Question 3: Do you think it is possible to develop a procedure which would allow your patients/clients to adjust the settings of their hearing aid(s) themselves using safe and appropriately calibrated tools on their own (maybe over the Internet) in the future?**

**Question 4: If such a procedure did exist, would you use it?**

One motivation for the inclusion of these two questions is that the development of such procedures for cochlear implants is being considered as a future part of Task 3 of Workpackage 6. It is therefore useful to know whether professionals think the development of such procedures to be possible, and desired.

![Figure 3-19 Feasibility of remote hearing aid adjustments](image)

The results (see Figure 3-19) clearly indicate that the professionals are very sceptical about the possibility of developing safe and good tools for the self-fitting of hearing aids. For the Netherlands there was no clear distinction between public health professionals (Audiologists) and private professionals (HAD). For the UK the NHS professionals were slightly more sceptical (32% yes, 68% no) than the private professionals (50% yes, 50% no).

Not surprisingly, the results from Question 4 are similar to those from Question 3. They are shown in Figure 3-19. Many participants who thought such procedures are not possible also declined to use them if they were indeed possible and available.
Some professionals were interested in using such procedures, although they thought such procedures not to be feasible (UK: 5, NL: 8, DE: 2). And some vice versa; self-fitting procedures might possible but the participants were not interested in using them, (UK: 2, NL: 1, DE: 6).

Overall, many professionals are not inclined to let users adjust their hearing aids themselves. This is especially the case for the German HADs. For the UK and the Netherlands, no difference in interest between private and public professionals was present.

The objections voiced to self-fitting mostly concerned the lack of contact with the patient and doubt that self fitting can lead to optimally fitted hearing aids. Moreover, the large number of comments indicates that this is a controversial topic. The comments from the German HADs were mostly negative and reflect the distribution of the German answers (84% answered ‘no’).

Several participants noted that self-fitting procedures might be beneficial for some patients, but not necessarily for all.

As a positive effect of self-fitting it was mentioned that if used for fine-tuning this would give people more influence over their final fitting. Furthermore, this would give the possibility to adjust the hearing aid in the actual relevant environment, as opposed to the clinic. And self-fitting would be useful for people who have trouble reaching a clinician (for instance patients living in remote areas). It was also mentioned that more and more patients will have internet/computing skills, which will make it easier to instruct them.

Several negative points were noted. Several participants remarked that self-fitting can lead to less personal contact with the patient, which is thought undesirable. The fitting and, more importantly the follow up
appointments can disclose problems that are not always apparent to the hearing-aid wearer. Personal encouragement to actually use the aids cannot be done by such procedures.

Furthermore, elderly patients might have trouble using such procedures and some patients could start fiddling with the controls. The quality of fitting is not ensured because the user might select an inappropriate or non-optimal fitting. It may be difficult to benchmark the success of the fitting because users have different levels of education and understanding and may not fully understand the instructions. Moreover, there can be liability issues regarding legislation for medical devices. And finally, several HADs voiced their concern that self fitting will make tasks of hearing aid dispensers obsolete, which is not in the interest of the HADs.

3.6 Discussion of online questionnaire findings

3.6.1 Summary of the results

The variations of current practice between countries are more or less to be expected based on the differences in service structure between the countries. For instance, the Dutch hearing aid dispensers do not use tympanometry, and the UK professionals make little use of speech tests.

HearCom Workpackages 11 and 12 have also conducted questionnaires regarding internet applications. Their questionnaire included questions to professionals about their current practice, and where these questions were similar to ours, the results were generally similar.

By and large, the professionals in all three countries showed surprisingly similar levels of interest in specific procedures. Apparently the different (historical) philosophies in practice and service structures are not reflected in differences in the views of the professionals between these three countries.

3.6.1.1 Questionnaires

Questionnaires were popular in current practice in the three countries, but especially in an ideal world. The three countries were together in their favour of these tools and wanted to see improvements in them. The questionnaires used prior to fitting and post fitting were all considered to be important in the patient pathway. From the final questions it was clear that many professionals are interested in using European-wide standardized questionnaires. We therefore strongly recommend the HearCom portal to investigate the possibility to present currently available questionnaires to the professionals. The prospect of standardizing such questionnaires might serve possible future European projects.
3.6.1.2 Speech tests

Speech tests were also popular, but interest varied somewhat between countries. It was clear that professionals did want to use speech tests in an ideal world both before and after fitting and the open-set sentence and single word materials were the most popular for most of the types of speech test. The different test conditions and preferred materials are set out below. There was little difference in users’ views for pre-fitting compared to post-fitting speech tests.

Speech intelligibility in quiet

For speech in quiet, professionals in the Netherlands and Germany are currently using mostly single word materials. In an ideal world situation, the open-set sentence and single word materials seemed to be the most popular for all countries and German professionals were also interested in closed set sentence materials. There was less interest in the use of nonsense word tests.

Speech intelligibility in noise

For speech in noise, currently professionals seem to be using the open-set sentence materials as well as the single words and numbers. In an ideal world most professionals were interested in using the open-set sentences and single words, with professionals in Germany also being interested, as for tests in quiet, in the closed-set sentences, and also showing interest in the use of digit materials. Lower favour was given to the nonsense materials.

Adaptive speech audiometry in quiet

Professionals in the Netherlands are currently using mostly the open-set sentence and single words materials whereas those in Germany were mostly using the single words. In an ideal world, most professionals favoured the open-set sentence and single word materials. Lower favour was given for closed-set sentences and nonsense words.

Adaptive speech audiometry in noise

Professionals in the Netherlands were currently using the open-set sentence materials, whereas some German professionals were using single words and digit materials. In an ideal world, the use of open-set sentences was favoured by professionals, especially those in NL. The single words and closed-set sentence materials were also favoured by those in DE. Lower favour was given to the nonsense materials in an ideal world.

The results also show that professionals in Germany and the Netherlands are currently using speech tests more often than those in the UK. This is to be expected, as speech testing is not part of the recommended
procedures for the adult NHS hearing aid service. However it was encouraging that UK professionals were interested in using certain speech tests in an ideal world. Overall, single words and open-set sentence materials were the most popular in an ideal world for most of the types of speech test.

Speech testing was also surveyed in the D-11-1 study, however the tests were not divided into as many categories as in this study and so the results cannot be easily compared. It was clear however that there was variation in the use of different speech tests between the countries, although they were currently being used.

We conclude that professionals in all three countries are likely to be willing to adopt speech tests as these become available in forms that are easy and quick to use. However, we need to bear in mind that preferences for speech materials and test conditions may reflect the familiarity of particular types of materials and testing conditions. While single word materials and fixed level tests are currently most popular, this most likely represents practice based on older technology such as recorded tapes or audio CDs. There are good scientific reasons to propose the routine use of other speech test approaches, for example, using sentence materials in adaptive signal-to-noise conditions. It is likely, though, that some education of hearing aid professionals will be needed to ensure a good uptake of these methods. The focus group discussions with hearing impaired people (see annex at section 13 and section 4 below) indicate that speech tests using sentences in noise are likely to be well-accepted by clients as these have an obvious relevance to their everyday hearing difficulties.

3.6.1.3 Psychoacoustic tests

Sound localisation tests were popular already in Germany and the Netherlands and popular for all countries in an ideal world. It is clear that professionals in the UK were not as enthusiastic about this type of test, but this could be because very few currently use the test and might not be aware of its benefits. A similar picture was seen for testing before and after fitting.

Loudness scaling tests were also more popular in an ideal world in Germany and the Netherlands than in the UK – but again this test is hardly used in the UK at present and so people may not be aware of its benefits. A similar picture was seen before and after fitting.

Even though there is low use of the TEN test and temporal and frequency resolution tests, they were popular in an ideal world, especially in the Netherlands. The BILD test was popular in all countries in an ideal world. It is surprising that even though the UK professionals do not seem to be using this test at present, they were very enthusiastic about it in an ideal world and so are obviously aware of its benefits.
Fitting techniques were also important to professionals. They wanted to see improvements in the fitting rules and were enthusiastic about interactive fitting tools, which is encouraging because of further work in WP6. It is also noteworthy that UK professionals were interested in fitting alternative hearing aids for comparison purposes although this is not standard practice. Real ear measures were also popular but many professionals wanted to see improvements.

Half of professionals would be interested in allowing patients to assess benefit via the internet on their own. They are sceptical about patients adjusting their hearing aids. However this scepticism does not mean that we should not pursue this line of research. Both the answers and the comments for these questions indicate that some professionals have outspoken problems with remote testing and with self-fitting of hearing aids. This can become an important aspect if such procedures are developed or introduced.

3.6.2 Comparison between real and ideal worlds

The respondents were asked to select which procedures they would like to use in both real world and ideal world situations. The real world allowed them to select changes to their current practice, given the time and other constraints within appointments that they face currently. Professionals were also asked to select procedures for an ideal world situation, which was a situation without any constraints. Differences between these two worlds give a picture of the types of tests that professionals do not feel they have the time and resources to do, but would like to.

When comparing the results from the two situations in the annex, for the three countries as a whole, it is clear that there are differences between the two worlds for certain procedures. For Stage 1 procedures, there are differences between the two worlds (more use of procedures in an ideal world than in the real world) for most of the procedures listed. The procedures that did not have any or large differences between the two worlds were procedures such as the discussions about hearing loss, medical history and otoscopy, which were all considered important currently, as well as in the two improved worlds. Tuning fork tests also showed no difference between real and ideal worlds, although less than half of respondents favoured these. All of the questionnaires would be used more in an ideal world than in an improved real world except the hearing difficulties in different situation prior to fitting, as the two values were very high in both worlds as well as the current situation. Most of the speech tests would be used more in an ideal world, except the speech intelligibility testing in quiet for single words (high favour in both worlds), the adaptive tests in quiet for closed set and single words (high favour in both worlds) and the adaptive tests in noise for numbers. Psychoacoustic procedures such as loudness scaling, sound localisation, temporal and frequency resolution, TEN and BILD tests were all favoured more in an ideal world than in the real world.
For stage 2, most of the procedures were similarly rated for the real and ideal situations, except the interactive fitting procedures and using an alternative hearing aid for comparison, where more professionals would want to use them in an ideal world than in the real world. This was mainly due to an increase in the number of UK professionals interested in using such approaches in an ideal world, compared to those in the Netherlands and Germany, since professionals in the latter two countries were already using such procedures.

For stage 3, about two thirds of the procedures would be used more in an ideal world without time constraints than in the real world where time is constrained as in current practice. The questionnaire procedures were mostly favoured more in an ideal world than in the real world, with the exception of those addressing “hearing difficulties after fitting” and “sound quality and satisfaction” which all had similar values in both worlds. The use of a daily diary for patients was also seen as more favourable in an ideal world, given more time. Overall the largest differences between real and ideal worlds were seen in Stage 1. The open-set speech materials seemed to have the largest differences for each type of speech test. In addition large differences were seen for the frequency and temporal resolution tests and the BILD test.

However, some procedures were favoured as much in the real world as in the ideal one. These included: comparing more than one hearing aid with speech or loudness scaling tests, speech intelligibility tests in quiet with single worlds (high favour in both worlds), speech intelligibility tests in noise with closed set, nonsense and single words (high favour in both worlds), adaptive tests in quiet for single words and numbers.

It is therefore clear that many of the procedures listed in the survey would be used more in an ideal world than in the real world. This may be due to time constraints in current patient pathways. It is clear however that there are many procedures that professionals would like to use, and presumably would see benefiting their patients, if they had the time to do them. It was also clear as is noted in the main results section that for many procedures in an ideal world, in particular the questionnaires, professionals would like to see them improved. These results are important as they allow professional bodies and service developers to see the types of procedures that professionals would a) view as important in any situation (high numbers in both real and ideal world situations) and b) view as important if more resources and time were available.
3.7 Summary of procedures for which professionals identified a need for improvement

The survey revealed several specific procedures where professionals considered that improvements were desirable.

Information for family members: Only Dutch and German participants were asked about this procedure. A moderate proportion (12 of 72) would wish to improve the procedure even in the present time constraints of the “real world”. In the “ideal world”, 50% of the respondents wanted improvements in this procedure. Our interpretation is that they would like to have more time to speak to family members.

MCL/ULL measures: There was some interest in improvement in the ULL procedures from Dutch and UK professionals, but mainly in the “ideal” rather than the “real” world. German professionals routinely use ULL procedures and only one noted a need for improvement. However German professionals did want to see improvements in MCL measurements.

Questionnaires: Even in the “real” world situation, some 20% of professionals expressed interest in improved questionnaire procedures for users before fitting of hearing aids. There was a smaller level of interest in the “real” world for improvements to questionnaires used to evaluate hearing aid benefit. In the “ideal” world situation, some 50% of professionals were interested in improvements in questionnaire procedures, both before and after fitting hearing aids.

Proprietary and generic methods of hearing aid fitting and interactive methods of fitting: In the “real” world, few professionals expressed a need for improvements in fitting methods, but there was significant interest in improvements in the “ideal” situation (from 20 out of 86 respondents).

Fitting and comparison of alternative hearing aids: This was clearly signalled as an issue for UK professionals, who already make more use of such comparisons than would be expected from the NHS recommendations, which stipulate the fitting of only one hearing aid (to each ear).

Tuning fork test: the survey indicates that this test is rather little used, and while there is no demand for improvements to the procedure itself, we could well consider the removal of this procedure from an overall set of recommendations for good practice.

In summary, most of the call for improved procedures applied to the “ideal” rather than the “real” world situation. There are two conclusions that can be taken from this. Firstly, for procedures that are in common use, professionals are for the most part happy with the procedures that they use. Secondly, for those procedures that are not in common use,
professionals cannot foresee any improvements that would make them more likely to use these procedures. This is clearly an area where well-targeted education could encourage change of practice.

3.7.1 Implications of sampling

Where we find evidence that professionals involved in hearing aid fitting are open to changes in their practice, any conclusions must be tempered by a consideration of the relatively low numbers responding, and by the likelihood that those who have responded are likely those who are more interested in and open to change. If similar detailed surveys of professionals are to be performed in the future, it would be worthwhile to enlist the support of the national organisations of professionals, although this would undoubtedly require a considerably longer timescale of preparation for data collection.

4 Summary of outcomes of focus group discussions with hearing-impaired persons

Complete details of the focus group method and questions are given in the annex at section 13. Here we highlight some of the comments of the sample of German hearing-impaired adults recruited into the focus groups.

There were 6 participants who had used hearing aids for periods of between 4 and 40 years, and a further 8 participants who have had hearing impairments for up to 15 years, but have not made regular use of hearing aids.

- Non-users of hearing aids attached little importance to interviews aimed at “gathering individual problems/objectives” and “integrating the family”.

- This same group appeared to attach high importance to psychoacoustic measures of loudness scaling and sound localisation, and to speech tests in noise. This might be due to the fact that in this group some participants have considerable problems with spatial hearing and hope for better diagnostics through these procedures.

- The hearing aid users attributed high importance to pure-tone audiometry. Presumably they consider this procedure as a basic entrance into hearing aid fitting.

- We thought it very important that both hearing aid users and non-users rated the importance of checking the intelligibility of speech in noise or in quiet much higher than did the hearing aid dispensers
taking part in comparable focus group discussions. We conclude that this relates to the obvious fact that the ability to communicate is very important for the hearing impaired, and that they regard the direct assessment of this to be of great significance.

- In hearing aid fitting, hearing-impaired persons attached high importance to the “subjective selection of preferred hearing aid”. The non-users of hearing aids placed much emphasis on the search for the best hearing aid (a number of them have searched without success). All of the hearing-Impaired participants estimated the possibility to test at least 3 hearing aids as especially important. “Finding” the right hearing aid seems to be very important, more important than verifying if the fitted aid is right or to optimally fit a “first-guess” hearing aid.

- Rating hearing aids with questionnaires was ranked relatively low in importance by the hearing-impaired participants. This may reflect the view that finding the right hearing aid seems more important than verifying if the selected aid is actually the right one. Experienced hearing aid users estimated the test of the hearing aids in everyday life as very important.

- When the time taken for hearing aid provision was discussed, the hearing impaired participants generally would readily invest “all time of the world” if it led to an improved result.

5 Dissemination and Exploitation

The survey results can also be used and expanded upon elsewhere in HearCom. Other partners in other countries may be interested in rehabilitation procedures and the survey can be made available to them for their use. WP6 will consider making further use of the online questionnaire to gather views on additional countries within task 4.

Another future use of the focus group and survey results outside HearCom will be publishing the results on the HearCom website as part of the work of WP12, which links in to Task 4 of WP6. In this task, any work from WP6 that can be put on the website will be adapted for that purpose, working with WP12 partners. Results of the survey can be placed on the HearCom website for all professionals in all countries to view. This will then act to educate professionals in all countries as to the views of some of their colleagues. It might also prompt professionals to think about their current practice and how they might change it, by looking at what other professionals in other countries are currently doing. It might also inform future service developers and professional bodies as to what types of procedures professionals would like to use in an ideal world, which they may be able to investigate and include in any future developments.
The partner DE-HZO plans to present the results of this work to appropriate professional meetings and international conferences, for example:

- International Congress of Hearing Aid Acousticians (organised by EUHA - European Union of Hearing Acousticians)
- Deutsche Gessellshaft für Audiologie (DGA)
- International Congress of Audiology (run by the International Society of Audiology)

### 6 Conclusions

The proposed set of procedures considered in this user evaluation can be said for the most part to be well-accepted by professionals. There was less difference than expected between the views of professionals in UK and those in Germany and the Netherlands despite the differences in the systems of provision and required standards (German and Dutch practice are already fairly well-aligned with each other).

There are two broad areas, in the use of speech tests and of questionnaires, where the views of professionals underline the need for a clearer scientifically-led consensus. The professionals we have surveyed are often conservative in their views. Both for speech tests and questionnaires, there are many possible options. With speech tests in particular it is very evident that professionals prefer methods that are familiar. In this and other novel areas, there is much to be done to educate professionals into the advantages of taking up new approaches, and this should be an important part of the future activities of HearCom, particularly in WP6 and WP12. It is also crucially important, if standardisation is to be improved, to reduce the range of alternatives that are potentially able to be used.

Some progress in the introduction of improved and more standard procedures may be possible by making a case that results are more accurate. However the impact of time constraints on current practice is powerful. Professionals are interested in change, but primarily in the "ideal" world. This signals that procedures that give better information are only likely to be accepted if they involve no additional time and effort from the professional. This is in contrast to the views of hearing-impaired people, who are very willing to invest time in improved results from hearing aid fitting. It may well be that major changes in professionals' practice require not only education but also external pressure, for example, from quality standards required by health insurance bodies or, where provision is state-funded, from national standards bodies. In addition, the best approach to this must include the widespread provision
of very easily used implementations of procedures that are selected for sound scientific reasons.

In the consideration of remote hearing aid fitting and evaluation, professionals had widely varying opinions. Only half of the respondents were positive about patients assessing benefit remotely. Fewer professionals were positive about patients adjusting their hearing aids remotely. It is clear that one of the disadvantages of a survey is that a full explanation or discussion of topics is not possible. However it is a good indicator of the first impressions of professionals.

As with other novel approaches, professionals will need further education as to the benefits of remote fitting and benefit evaluation procedures in order for them to be happy to use them with their patients. In addition to the benefits, professionals will most likely need full explanations concerning how the technique is carried out and how much control the professional may have over what the patients does remotely. There may be particular safety measures that would make professionals happier about such a technique and it is clear that those developing these tools should take note of the reservations noted in the survey. This is also important for any other areas of HearCom that are developing Internet-based procedures for professionals. The same information may be needed to enable professionals to be happy about using any such procedures.

7 Reference list


HearCom deliverable D-6-1: Report on the analysis and evaluation of current fitting procedures used throughout Europe

HearCom deliverable D-11-1: Requirements specifications for screening and diagnostic tests

HearCom deliverable D-12-1: Requirements research and initial proposals for the Internet rehabilitation service


## 8 Proposed good practice procedures – taken from D-6-1

<table>
<thead>
<tr>
<th>Pre-fitting</th>
<th>Shared views on optimal procedures</th>
<th>DE-HZO</th>
<th>NL-AMC</th>
<th>UK-RNID</th>
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</thead>
<tbody>
<tr>
<td><strong>Counselling and preliminary audiological talk</strong></td>
<td>Counselling/information about course of hearing aid provision. General information about assets and drawbacks of hearing aids, specific characteristics, possible applications. Open interview about problems and expectations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Anamnesis and otological examination</strong></td>
<td>Structured interview about medical history and complaints (e.g. sudden deafness, otitis media, ear pain, ear surgery, tinnitus, congenital hearing loss, dizziness). Otoscopy, Tuning fork testing (optional), Tympanometry (optional)</td>
<td></td>
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</tr>
<tr>
<td><strong>Questionnaire</strong></td>
<td>Collecting individual problems and aims</td>
<td>HörTech inventory &quot;Oldenburg Inventar I&quot; or COSI + if necessary HörTech inventory &quot;Oldenburg Inventar R&quot; (can be completed at home)</td>
<td>Glasgow Hearing Aid Benefit Profile (GHABP: Gatehouse, 1999) initial assessment; Speech, Spatial and Qualities of Hearing Scale (SSQ).</td>
<td>Glasgow Hearing Aid Benefit Profile Part 1</td>
</tr>
<tr>
<td><strong>Standard audiometry in quiet (headphones)</strong></td>
<td>Pure tone audiogram air and bone conduction with adequate masking</td>
<td></td>
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<td>Pre-fitting continued</td>
<td>Shared views on optimal procedures</td>
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<td>NL-AMC</td>
<td>UK-RNID</td>
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<tr>
<td><strong>Speech audiometry in quiet</strong></td>
<td>Test of patient’s ability to recognise speech unaided in a quiet situation. Specific tests and parameters vary.</td>
<td>Hearing loss for numbers; UCL for numbers/speech; with masking of better ear. Performance-intensity function, intelligibility at 65 dB SPL, optimal intelligibility; left/right. Comparison with predictions based on pure tone thresholds</td>
<td>Speech audiogram with monosyllabic words (complete performance intensity functions from threshold to uncomfortable loudness level, materials from Bosman and Smoorenburg (1995). Comparison of pure tone audiogram and speech audiogram.</td>
<td>No proposals to use speech tests prior to fitting</td>
</tr>
<tr>
<td><strong>Speech audiometry in noise</strong></td>
<td>Test of patient’s ability to recognise speech unaided in a noisy situation. Specific tests and parameters vary.</td>
<td>1 sentence test S0N90 or S0N-90 (whichever side would be aided monaurally). Set-up: Adaptive Göttingen (Kollmeier &amp; Wesselkamp, 1997) or Oldenburg (Wagener, Kuhnel, &amp; Kollmeier, 1999) sentence test. Noise presentation level 65 or 75 dB SPL depending on hearing loss (noise has to be perceived) Stationary speech shaped noise + (additionally) one measurement with speech simulating fluctuating noise</td>
<td>Assessment of the critical signal to noise ratios for sentences per ear in both stationary and fluctuating noise with the same long-term average spectrum as the speaker. We use sentence materials from Plomp and Mimpen (1979), or Versfeld et al. (2000) with an adaptive procedure.</td>
<td>No proposals to use speech tests prior to fitting</td>
</tr>
<tr>
<td><strong>Loudness scaling</strong></td>
<td>Vary</td>
<td>Adaptive loudness scaling (ACALOS: Brand &amp; Hohmann, 2002) left/right narrow band at 0.5, 1.5 &amp; 4 kHz (if 4 kHz not measurable, 3 kHz) &amp; left/right/binaural broad band (sentence). Plug ear not in use in sound field measurements</td>
<td>Adaptive loudness scaling per ear using the ACALOS-procedure for the following signals: narrow band Low-Noise Noise (Pumplin, 1985) at 0.75 and 3 kHz; broad-band low-noise noise (speech spectrum). Preferred setting through headphones. In case of sound field measurements, earplug in ear contralateral to test ear.</td>
<td></td>
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</table>
Goals and options | Shared views on optimal procedures
---|---
Defining goals | Defining goals for rehabilitation based on anamnestic and otological data, the unaided measurements, and the questionnaire results. Counseling about realistic expectations
Technical options | Choice of ear(s) to be fitted. Choice of type of hearing aid(s). Specification of type of earmould

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<tr>
<th>Hearing aid fitting</th>
<th>Shared views on optimal procedures</th>
<th>DE-HZO</th>
<th>NL-AMC</th>
<th>UK-RNID</th>
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<tbody>
<tr>
<td>Earmould</td>
<td>Taking ear impression; creation of earmould or earshell. Final fitting of earmould</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fitting and fine tuning</td>
<td>Prescriptive fitting according manufacturer or current fitting rules. Verification of hearing aid fitting using Real Ear Measurements. First rating of speech intelligibility, sound quality.</td>
<td>Trial fitting of at least 3 hearing aids at least one without available without extra payment.</td>
<td>Prescriptive fitting of one or two hearing aids according to manufacturer or generic fitting rules (usually one basic aid with full reimbursement of the costs and one more complex hearing aid with an own financial contribution).</td>
<td>Often only one hearing aid model is selected and fitted per ear in UK.</td>
</tr>
<tr>
<td>Handover fitted aid</td>
<td>Explain handling and care of the hearing aid to the user. Arrange regular checkups. Present information about accessories to the user</td>
<td></td>
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<tr>
<td>Trial use period</td>
<td>Trial period in everyday listening situations and counselling during trial period. Fine tuning of at least one hearing aid (in several sessions). If necessary. Real Ear measurements if necessary, gradual build-up of amplification to adapt new users to hearing aid.</td>
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<tr>
<td>Selection</td>
<td>Vary</td>
<td>The subjectively favoured hearing aid is measured. If several hearing aids are rated subjectively the same, a sentence test in noise or a loudness scaling can be comparatively performed.</td>
<td>As HZO</td>
<td>In NHS service, generally only one aid fitted to each ear at a time. This is constrained by state funding of hearing aid provision.</td>
</tr>
<tr>
<td>Speech audiometry in quiet (sound field)</td>
<td>Single words measured for each individual aided ear (contra-lateral ear blocked) and for both ears bilaterally fitted</td>
<td>Propose testing at 65 and 80 dB SPL; the hearing aids are used in the preferred gain setting. Freiburg test (one syllable words) at 65 and 80 dB SPL</td>
<td>CVC-words (Bosman and Smoorenburg, 1995) at 65 dB SPL, with hearing aids used in the preferred gain setting.</td>
<td>Not likely to be adopted for routine use in UK, but could be adopted as a valuable investigative tool.</td>
</tr>
<tr>
<td>Speech audiometry in noise (sound field)</td>
<td>Adaptive sentence testing to determine speech-to-noise ratio at intelligibility threshold</td>
<td>Monaural fitting: 1 sentence test S0N90 or S0N-90. Bilateral fitting: 3-5 sentence tests S0N90 or S0N-90. Adaptive Göttingen or Oldenburg sentence test. Noise presentation level 65 or 75 dB SPL (same as unaided). Stationary speech shaped noise + (additionally) one measurement with speech simulating fluctuating noise</td>
<td>Both stationary and fluctuating noise with the same long-term average spectrum as the speaker. Sentence materials from Plomp and Mimpen (1979), or Versfeld et al. (2000).</td>
<td>Not likely to be adopted for routine use in UK, but valuable as investigative tool. Adaptive sentence intelligibility similar to USA HINT protocols (Nilsson, Soli, &amp; Sullivan, 1994) likely to be well accepted in UK (NB HINT based on well-established UK BKB sentence materials, Bench, Kowal and Bamford, 1979).</td>
</tr>
<tr>
<td>Loudness scaling (sound field)</td>
<td>Adaptive loudness scaling (ACALOS) left/right. Plug ear not in use in sound field measurements</td>
<td>Stimuli: narrow band noise at 0.5, 1.5 &amp; 4 kHz (if 4 kHz not measurable, 3 kHz) &amp; left/right/binaural broad-band speech (sentence).</td>
<td>Stimuli: narrow band &quot;Low-Noise&quot; Noise (Pumplin, 1985) at 0.75 and 3 kHz; broad-band low-noise noise (speech spectrum).</td>
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<td>Evaluation measurements continued</td>
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<tr>
<td>Horizontal localization (sound field)</td>
<td>Short noise bursts are presented from different azimuths (usually presented by nine to thirteen loudspeakers in half a circle from -90 to +90 degrees). The measurements are performed both aided and unaided.</td>
<td></td>
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<tr>
<td>Insertion gain measurements</td>
<td>The selected hearing aids are characterised with real ear measurements using broadband speech noise at 55, 65, and 80 dB SPL. The hearing aids are used in the preferred gain setting. The hearing aids are measured after deactivation of noise reduction circuitry in an omni-directional mode. The curves obtained are compared with generic prescription rules for non-linear hearing aids (usually NAL-NL1 or DSL i/o).</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Documentation of settings</td>
<td>Print and save settings, if necessary coupler measurements. Hearing aid with trimpots: test box results</td>
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<td></td>
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<tr>
<td>Evaluation measurements continued</td>
<td>Shared views on optimal procedures</td>
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<tr>
<td>Questionnaire</td>
<td>The hearing aid benefit is rated by questionnaires.</td>
<td>HörTech inventory &quot;Oldenburg Inventar I&quot; or COSI+ optional HörTech inventory &quot;Oldenburg Inventar R&quot; &amp; &quot;Hörgeräte-Bewertung&quot; (rating of hearing aid system) Overall rating by means of International Outcome Inventory for Hearing Aids (IOI-HA: Cox, Alexander, &amp; Beyer, 2003) proposed for 6 months after fitting</td>
<td>Inventory of hearing aid benefit in real life with Glasgow Hearing Aid Benefit Profile. Comparison of the GHABP results with a reference group of users in terms of use, benefit, residual disability, and satisfaction. Overall rating by means of International Outcome Inventory for Hearing Aids (IOI-HA: Cox, Alexander, &amp; Beyer, 2003). For more detailed measures of auditory disability and handicap, the Amsterdam Inventory of Auditory Disability and Handicap (AIADH) can be used (optional).</td>
<td>Glasgow Hearing Aid Benefit Profile part 2. UK philosophy is that the most important evaluation measure is of the real-life benefit as an outcome of the entire rehab process (including counselling etc) - since ultimate benefit depends on how well device is used as well as how well it is fitted.</td>
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<th>Follow-up</th>
<th>Shared views on optimal procedures</th>
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<tr>
<td>Additional rehabilitation needs</td>
<td>Counselling about other training (speech-reading, hearing strategies and communication training). Strategies to encourage the client to wear the hearing aids. Determine need of other action (compare expectation with achieved aims), e.g. audiological therapy, psychosocial consulting.</td>
</tr>
<tr>
<td>Closing of provision</td>
<td>Remind clients about handling and care of the hearing aid and respond to problems raised. Arrange future care and support. Present information about accessories to the user. Complete formal fitting documentation</td>
</tr>
<tr>
<td>Open access repair service</td>
<td>Users may come without an appointment if they are having any problems</td>
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</table>
9 Complete data from online questionnaire

9.1.1 Stage 1

Stage 1 was composed of 41 questions. In the following only the English version is presented, see the annex, chapter 10 for the exactly used phrases.

Data of the questionnaire is visualized as follows (see Figure 9-1 as an example): There are 3 illustrations in every figure. The first on the left upper corner shows the "current situation", that is, the conditions under which the participants are working now. Participants were asked to rate the frequency of use of the procedure (which was named in the respective question) using the 5 categories “always”, “often”, “sometimes”, “never” and “unknown” (refer to the upper legend). The leftmost column in the diagram is the cumulative rating for all attendees, regardless of their origin (Tot). The three columns to the right are the separated results for the three countries United Kingdom (UK), Netherlands (NL) and Germany (DE). The numbers in the diagrams are the absolute numbers of participants who rated the respective procedure in each category, the numbers behind the countries (N=…) indicate the sum of participants in the particular country (or in total, leftmost column). All four columns are normalized to that sum (N), showing the relative portion of people who rated the procedure in each category.

The two lower diagrams show what the participants wanted to be in the “real situation” (left diagram) and in the “ideal situation” (right diagram).

Otherwise the presentation of these results is the same as for the preceding explained data.

In the following all questions and their respective results are shown one by one with the scheme discussed before:
Figure 9-1 Stage 1, question 1: Discussion about hearing loss and hearing aids

Figure 9-2. Stage 1, question 2. Medical history
Figure 9-3. Stage 1, question 3. Information for family of hearing impaired

Figure 9-4 Stage 1, question 4. Otoscopy
Figure 9-5. Stage 1, question 5. Tuning fork tests

Figure 9-6. Stage 1, question 6. Tympanometry
### Figure 9-7. Stage 1, Question 7. Pure tone audiometry (air and bone conduction)

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### Figure 9-8. Stage 1, Question 8. Uncomfortable loudness level measures (ULL)

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Figure 9-9 Stage1, Question 9: Most comfortable loudness level measures (MCL)

Figure 9-10 Stage1, Question 10A: Use of questionnaires to assess: Hearing difficulties in different situations prior to fitting (measure of disability)
Figure 9-11 Stage 1, Question 10B: Use of questionnaires to assess: Expectations of hearing aid fitting

Figure 9-12 Stage 1, Question 10C: Use of questionnaires to assess: Quality of life prior to fitting
Figure 9-13 Stage1, Question 10D: Use of questionnaires to assess: Speech intelligibility in different situations prior to fitting

Figure 9-14 Stage1, Question 10E: Use of questionnaires to assess: Hearing difficulties of patient/client rated separately by family member or friend
Figure 9-15 Stage 1, Question 10F: Use of questionnaires to assess: Impact on daily life of hearing loss (measure of handicap)

Figure 9-16. Stage 1, Question 11A: Speech intelligibility in quiet at fixed level: Everyday sentences using open-set test materials
Figure 9-17. Stage 1, Question 11B: Speech intelligibility in quiet at fixed level: Closed set sentences ("Matrix-sentences")

Figure 9-18. Stage 1, Question 11C: Speech intelligibility in quiet at fixed level: Single Words
Figure 9-19. Stage1, Question 11D: Speech intelligibility in quiet at fixed level: Nonsense Words

Figure 9-20. Stage 1, Question 12A: Speech intelligibility in noise at a fixed S/N ratio: Everyday sentences using open-set test materials
Figure 9-21. Stage 1, Question 12B: Speech intelligibility in noise at a fixed S/N ratio: Closed set sentences (“Matrix-sentences”)

Figure 9-22. Stage 1, Question 12C: Speech intelligibility in noise at a fixed S/N ratio: Single Words
Figure 9-23. Stage 1, Question 12D: Speech intelligibility in noise at a fixed S/N ratio: Tests with numbers

Figure 9-24. Stage 1, Question 12E: Speech intelligibility in noise at a fixed S/N ratio: Nonsense Words
Figure 9-25. Stage 1, Question 13A: Adaptive speech audiometry in quiet (Speech Recognition Threshold SRT): Everyday sentences using open-set test materials

Figure 9-26. Stage 1, Question 13B: Adaptive speech audiometry in quiet (Speech Recognition Threshold SRT): Closed set sentences (“Matrix-sentences”)
Figure 9-27. Stage 1, Question 13C: Adaptive speech audiometry in quiet (Speech Recognition Threshold SRT): Single Words

Figure 9-28. Stage 1, Question 13D: Adaptive speech audiometry in quiet (Speech Recognition Threshold SRT): Nonsense Words
Figure 9-29. Stage 1, Question 14A: Adaptive speech audiometry in noise (Speech Recognition Threshold SRT): Everyday sentences using open-set test materials.

Figure 9-30. Stage 1, Question 14B: Adaptive speech audiometry in noise (Speech Recognition Threshold SRT): Closed set sentences ("Matrix-sentences")
Figure 9-31. Stage 1, Question 14C: Adaptive speech audiometry in noise (Speech Recognition Threshold SRT): Single Words

Figure 9-32. Stage 1, Question 14D: Adaptive speech audiometry in noise (Speech Recognition Threshold SRT): Tests with numbers
Figure 9-33. Stage 1, Question 14E: Adaptive speech audiometry in noise (Speech Recognition Threshold SRT): Nonsense Words

Figure 9-34. Stage 1, Question 15: Comparison of tone audiogram to speech audiogram (question excluded from UK questionnaire)
Figure 9-35. Stage 1, Question 16: Loudness Scaling Tests (ACALOS)

Figure 9-36. Stage 1, Question 17: Sound localisation tests in the horizontal and/or vertical plane (speech, tone or noise stimulus)
Figure 9-37. Stage 1, Question 18: TEN test to find dead regions in the cochlea

Figure 9-38. Stage 1, Question 19: Tests of frequency resolution (e.g. psychoacoustic tuning curve, notched-noise masked thresholds)
Figure 9-39. Stage 1, Question 20: Tests of temporal resolution (e.g. gap detection, temporal modulation transfer function)

Figure 9-40. Stage 1, Question 21: Binaural intelligibility level difference test (BILD) - a test for binaural hearing aid fittings
Figure 9-41. Stage 1, Question 22: Tests above threshold (SISI, Fowler, Lüscher, Carhart etc.). Only asked in German questionnaire.
9.1.2 Stage 2

**Current Situation**

![Current Situation Chart]

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**Real Situation**

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Figure 9-42. Stage 2, Question 1: Choice of ear(s), choice of hearing aid(s), selection of earmould (or open fitting)

**Current Situation**

![Current Situation Chart]

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**Real Situation**

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Figure 9-43. Stage 2, Question 2: Prescriptive fitting of one model of hearing aid(s) according to manufacturer fitting rules
Figure 9-44. Stage 2, Question 3: Prescriptive fitting of one model of hearing aid(s) according to generic fitting rules

Figure 9-45. Stage 2, Question 4: Interactive optimising of the fitting for the individual using new techniques being researched currently
Figure 9-46. Stage 2, Question 5: Prescriptive fitting of alternative hearing aid(s) for comparative purposes

Figure 9-47. Stage 2, Question 6: Fine tuning of hearing aid
### Figure 9-48. Stage 2, Question 7: Real-ear measures to verify fitting

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### Figure 9-49. Stage 2, Question 8: Test of at least one hearing aid in daily-life (trial period)

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Figure 9-50. Stage 2, Question 9: Rating of hearing aid benefit at fitting

Figure 9-51. Stage 2, Question 10: Explain the functionality, handling and care of the hearing aid to the user
9.1.3 Stage 3

Figure 9-52. Stage 3, Question 1: If more hearing aids received the same subjective score, than they will be compared with a speech in noise test or loudness scaling.

Figure 9-53. Stage 3, Question 2A: Speech intelligibility in quiet at fixed level: Everyday sentences using open-set test materials.
Figure 9-54. Stage 3, Question 2B: Speech intelligibility in quiet at fixed level: Closed set sentences ("Matrix-sentences")

Figure 9-55. Stage 3, Question 2C: Speech intelligibility in quiet at fixed level: Single Words
Figure 9-56. Stage 3, Question 2D: Speech intelligibility in quiet at fixed level: Nonsense Words

Figure 9-57. Stage 3, Question 3A: Speech intelligibility in noise at a fixed S/N ratio: Everyday sentences using open-set test materials
Figure 9-58. Stage 3, Question 3B: Speech intelligibility in noise at a fixed S/N ratio: Closed set sentences ("Matrix-sentences")

Figure 9-59. Stage 3, Question 3C: Speech intelligibility in noise at a fixed S/N ratio: Single Words
Figure 9-60. Stage 3, Question 3D: Speech intelligibility in noise at a fixed S/N ratio: Tests with numbers

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Figure 9-62. Stage 3, Question 4A: Adaptive speech audiometry in quiet (Speech Recognition Threshold SRT): Everyday sentences using open-set test materials

Figure 9-63. Stage 3, Question 4B: Adaptive speech audiometry in quiet (Speech Recognition Threshold SRT): Closed set sentences ("Matrix-sentences")
Figure 9-64. Stage 3, Question 4C: Adaptive speech audiometry in quiet (Speech Recognition Threshold SRT): Single Words

Figure 9-65. Stage 3, Question 4D: Adaptive speech audiometry in quiet (Speech Recognition Threshold SRT): Nonsense Words
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Figure 9-67. Stage 3, Question 5B: Adaptive speech audiometry in noise (Speech Recognition Threshold SRT): Closed set sentences (“Matrix-sentences”)
Figure 9-68. Stage 3, Question 5C: Adaptive speech audiometry in noise (Speech Recognition Threshold SRT): Single Words

Figure 9-69. Stage 3, Question 5D: Adaptive speech audiometry in noise (Speech Recognition Threshold SRT): Tests with numbers
Figure 9-70. Stage 3, Question 5E: Adaptive speech audiometry in noise (Speech Recognition Threshold SRT): Nonsense Words

Figure 9-71. Stage 3, Question 6: Loudness scaling tests
Figure 9-72. Stage 3, Question 7: Sound localisation tests in the horizontal and/or vertical plane (speech, tone or noise stimulus)

Figure 9-73. Stage 3, Question 8A: Use of questionnaires to assess: Hearing difficulties in different situations after fitting (measure of residual disability)
Figure 9-74. Stage 3, Question 8B: Use of questionnaires to assess: Sound quality in different situations after fitting

Figure 9-75. Stage 3, Question 8C: Use of questionnaires to assess: Quality of life measure after fitting
Figure 9-76. Stage 3, Question 8D: Use of questionnaires to assess: Speech intelligibility in different situations after fitting.

Figure 9-77. Stage 3, Question 8E: Use of questionnaires to assess: Success of hearing aid fitting rated by family member or friend.
Figure 9-78. Stage 3, Question 8F: Use of questionnaires to assess: Impact on daily life of hearing loss after fitting (measure of handicap)

Figure 9-79. Stage 3, Question 8G: Use of questionnaires to assess: Use of hearing aid(s)
Figure 9-80. Stage 3, Question 8H: Use of questionnaires to assess: Satisfaction with hearing aid(s)

Figure 9-81. Stage 3, Question 8I: Use of questionnaires to assess: Benefit of hearing aid fitting
Figure 9-82. Stage 3, Question 9: Daily diary of hearing aid use
10 Annex: Online questionnaire questions used in the 3 countries

The questions are always in the same order: First the English version, followed by the German and the Dutch version.

The question numbering used below refers to the stage (1, 2 or 3), and then to the numbering of the questions within each stage. Where several related questions were grouped together, there an additional alphabetic code is added.

10.1.1 Stage 1: Assessment procedures prior to fitting

UK: Stage 1: Assessment procedures prior to fitting
DE: Stufe 1: Diagnostik, unversorgte Messungen
NL: Fase 1: Procedures die plaatsvinden vóór hoortoestelaanpassing

1_01
- **Discussion about hearing loss and hearing aids**
- **Beratung/Information** über Hörgeräte/Hörsysteme und ihren Anpassungsprozess;
- **Uitleg over slechthorendheid en hoortoestellen**

1_02
- **Medical history**
- **Anamnese**: Strukturiertes Interview über medizinische Vorgeschichte und Beschwerden (z.B. Hörsturz, Mittelohrentzündung, Ohrenschmerzen, Operationen, Tinnitus, Schwindel, ...)
- **Anamnese, een gestructureerd interview over het medisch verleden en over klachten**

1_03
- **Not used in UK: Information for family of hearing impaired**
- Informieren und **Einbeziehen der Angehörigen**
- **Informeren van de familie van de slechthorende en ze betrekken bij de hoortoestelkeuze**

1_04
- **Otoscopy**
- **Otoskopie**
- **Otoscopie**
1_05
- Tuning fork tests
- Stimmgabeltest
- Stemvorktest (Weber- of Rinne-test)

1_06
- Tympanometry
- Tympanometrie (Impedanzaudiometrie)
- Tympanometrie

1_07
- Pure tone audiometry (air and bone conduction)
- Tonaudiogramm Luftleitung/Knochenleitung (mit erforderlicher Vertäubung)
- Toonaudiogram (lucht- en/of beengeleiding)

1_08
- Uncomfortable loudness level measures (ULL)
- Unbehaglichkeitsschwelle / Unangenehmheitsschwelle (UCL)
- Uncomfortable loudness level (UCL)

1_09
- Most comfortable loudness level measures (MCL)
- Pegel angenehmer Lautheit (MCL)
- Most comfortable loudness level (MCL)

1_10: grouped questions
- Use of questionnaires to assess:
  - Fragebögen...
  - Vragenlijsten voor het onderzoeken van:
1_10A
  - Hearing difficulties in different situations prior to fitting (measure of disability)
  - um Situationen zu identifizieren, in denen Hörprobleme auftreten (ohne Hörsystem bzw. mit altem Hörsystem)";
  - Hoorproblemen zonder (of met vorig) hoortoestel (beperking)
1_10B
  - Expectations of hearing aid fitting
  - bezüglich Anforderungen und Erwartungen an das Hörsystem
  - Verwachting ten aanzien van een hoortoestel
1_10C
  - Quality of life prior to fitting
  - bzgl. allgem. Lebensqualität und Gesundheitszustand
  - Kwaliteit van leven zonder (of met vorig) hoortoestel
1_10D
- Speech intelligibility in different situations prior to fitting
  - bzgl. Sprachverständlichkeit in verschiedenen Situation
  - Spraakverstaanvaardigheid zonder (of met vorig) hoortoestel

1_10E
- Hearing difficulties of patient/client rated separately by family member or friend";
  - an die Angehörigen des Kunden/Patienten bzgl. der Hörproblemen des Kunden/Patienten
  - Beoordeling van handicap door de partner

1_10F
- Impact on daily life of hearing loss (measure of handicap)
  - über den Einfluss der Hörstörung auf das tägliche Leben ("Handicap") des Kunden/Patienten
  - Invloed van gehoorverlies op het dagelijkse leven (handicap)

1_11: grouped questions
- Speech intelligibility in quiet at fixed level
  - Sprachverständlichkeitsmessungen in Ruhe bei konstantem Pegel
  - Meting van Spraakverstaanvaardigheid (score) in stilte: bepaling van spraakscore bij één of meerdere vaste geluidniveaus:

1_11A
- Everyday sentences using open-set test materials (e.g. BKB, IHR-ASL, HINT)
  - Natürliche Sätze mit offenem Testmaterial, z.B. Göttinger Satztest
  - Natuurlijke spraak, hele zinnen (open set, zoals Plomp of VU98)

1_11B
- Closed set sentences ("Matrix-sentences"; e.g. Hagerman, OLSA)
  - Tests mit geschlossenem Testmaterial ("Matrix-Sätze"), z.B. Oldenburger Satztest (OLSA)
  - Gesloten set, hele zinnen (Matrixtest waarbij ieder woord uit de zin uit een vaste (gesloten) set van 10 alternatieven gekozen wordt)

1_11C
- Single Words (e.g. CVC words, AB words, FAAF)
  - Einzel-Wörter, z.B. WaKo Reimtest, Freiburger Wörtertest
  - Woorden, bijvoorbeeld CVC, spondeën
1_11D
- **Nonsense Words** (e.g. VCV test)
- **Sinnlose Wörter**, z.B. Logatomtest (Kieler, Aachener, Oldenburger,...) oder VCV-Wörter
- **Onzin woorden, bijvoorbeeld VCV of CV**

12_1: grouped questions
- **Speech intelligibility in noise at a fixed S/N ratio**
- **Sprachverständlichkeit gemessen im Störgeräusch bei konstantem S/N**
- **Meting van Spraakverstaanvaardigheid (score) in ruis, bepaling van spraakscore één of meerdere vaste signaal-ruisverhoudingen:**

1_12A
- **Everyday sentences using open-set test materials** (e.g. BKB, IHR-ASL, HINT)
- **Natürliche Sätze** mit offenem Testmaterial, z.B. Göttinger Satztest
- **Natuurlijke spraak, hele zinnen (open set, zoals Plomp of VU98)**

1_12B
- **Closed set sentences** ("Matrix-sentences"; e.g. Hagerman, OLSA)
- **Tests mit geschlossenem Testmaterial** ("Matrix-Sätze"), z.B. Oldenburger Satztest (OLSA)
- **Gesloten set, hele zinnen (Matrixtest waarbij ieder woord uit de zin uit een vaste (gesloten) set van 10 alternatieven gekozen wordt)**

1_12C
- **Single Words** (e.g. CVC words, AB words, FAAF)
- **Einzel-Wörter**, z.B. WaKo Reimtest, Freiburger Wörtertest
- **Woorden, bijvoorbeeld CVC, spondeëën**

1_12D
- **Tests with numbers**, (e.g. Number Triplets)
- **Test mit Zahlen**, z.B. Zahlentrippel-Test
- **Getallen, bijvoorbeeld Number Triplets**

1_12E
- **Nonsense Words** (e.g. VCV test)
- **Sinnlose Wörter**, z.B. Logatomtest (Kieler, Aachener, Oldenburger,...) oder VCV-Wörter
- **Onzin woorden, bijvoorbeeld VCV of CV**
1_13 – Grouped questions

- **Adaptive speech audiometry in quiet** (Speech Reception Threshold SRT)
- **Adaptive Messung der Schwelle der Sprachwahrnehmung (SRT) in Ruhe**
- **Adaptieve spraakaudiometrie in stilte: Adaptief bepalen van de drempel in stilte met de volgende materialen:**
  
  1_13A
  - **Everyday sentences using open-set test materials** (e.g. BKB, IHR-ASL, HINT)
  - **Natürliche Sätze** mit offenem Testmaterial, z.B. Göttinger Satztest
  - **Natuurlijke spraak, hele zinnen (open set, zoals Plomp of VU98)**

  1_13B
  - **Closed set sentences** ("Matrix-sentences"; e.g. Hagerman, OLSA)
  - **Tests mit geschlossenem Testmaterial** ("Matrix-Sätze"), z.B. Oldenburger Satztest (OLSA)
  - **Gesloten set, hele zinnen (Matrixtest waarbij ieder woord uit de zin uit een vaste (gesloten) set van 10 alternatieven gekozen wordt)**

  1_13C
  - **Single Words** (e.g. CVC words, AB words, FAAF)
  - **Einzel-Wörter**, z.B. WaKo Reimtest, Freiburger Wörtertest
  - **Woorden, bijvoorbeeld CVC, spondeën**

  1_13D
  - **Nonsense Words** (e.g. VCV test)
  - **Sinnlose Wörter**, z.B. Logatomtest (Kieler, Aachener, Oldenburger,...) of VCV-Wörter
  - **Onzin woorden, bijvoorbeeld VCV of CV**

14_1: grouped questions

- **Adaptive speech audiometry in noise** (Speech Reception Threshold SRT)
- **Adaptive Messung der Schwelle der Sprachwahrnehmung (SRT) im Störgeräusch**
- **Adaptieve spraakaudiometrie in ruis: Adaptief bepalen van de kritische signaal-ruisverhouding (Speech Reception Threshold test) met de volgende materialen:**

  1_14A
  - **Everyday sentences using open-set test materials** (e.g. BKB, IHR-ASL, HINT)
  - **Natürliche Sätze** mit offenem Testmaterial, z.B. Göttinger Satztest
  - **Natuurlijke spraak, hele zinnen (open set, zoals Plomp of VU98)**
**1_14B**
- **Closed set sentences** ("Matrix-sentences"; e.g. Hagerman, OLSA)
- **Tests mit geschlossenem Testmaterial** ("Matrix-Sätze"), z.B. Oldenburger Satztest (OLSA)
- **Gesloten set, hele zinnen (Matrixtest waarbij ieder woord uit de zin uit een vaste (gesloten) set van 10 alternatieven gekozen wordt)**

**1_14C**
- **Single Words** (e.g. CVC words, AB words, FAAF)
- **Einzel-Wörter**, z.B. WaKo Reimtest, Freiburger Wörtertest
- **Woorden, bijvoorbeeld CVC, spondeën**

**1_14D**
- **Tests with numbers**, (e.g. Number Triplets)
- **Test mit Zahlen**, z.B. Zahlentrippel-Test
- **Getallen, bijvoorbeeld Number Triplets**

**1_14E**
- **Nonsense Words** (e.g. VCV test)
- **Sinnlose Wörter**, z.B. Logatomtest (Kieler, Aachener, Oldenburger,...) oder VCV-Wörter
- **Onzin woorden, bijvoorbeeld VCV of CV**

**1_15**
- **Not used in UK**: Comparison of tone audiogram to speech audiogram
- **Vergleich Tonaudiogramm - Sprachaudiogramm**
- **Vergelijking van het toonaudiogram met het spraakaudiogram**

**1_16**
- **Loudness Scaling Tests**
- **Adaptive Lautheitsskalierung (ACALOS)**
- **Luidheidsschaling (bijvoorbeeld ACALOS)**

**1_17**
- **Sound localisation tests in the horizontal and/or vertical plane** (speech, tone or noise stimulus)
- **Lokalisation**: Sprach-, Ton- oder Rauschsignale aus verschiedenen Richtungen mittels mehrerer Lautsprecher
- **Geluidslocalisatietest in het horizontale en/of verticale vlak**

**1_18**
- **TEN test to find dead regions in the cochlea**
- **Feststellen von „toten Bereichen“ auf der Cochlea**, z.B. mit 'Threshold Equalizing Noise' (TEN-Test) oder 'psychoakustische Tuningkurven'
• Test om dode zones in de cochlea vast te stellen, bijvoorbeeld 'Threshold equalizing noise (TEN) test' of 'psychoakoestische tuning curves'

1_19
• Tests of frequency resolution (e.g. psychoacoustic tuning curve, notched-noise masked thresholds)
• Beurteilung des Frequenzauflösungsvermögens z.B. mittels 'Notched Noise Test' (Detektionsschwelle für Töne als Funktion der Lückenbreite des maskierenden Rauschens) oder 'psychoakustische Tuningkurven'
• Meting van frequentieresolutie, bijvoorbeeld 'psychoakoestische tuning curves' of 'notched-noise test'

1_20
• Tests of temporal resolution (e.g. gap detection, temporal modulation transfer function)
• Beurteilung des zeitlichen Auflösungsvermögens z.B. mit 'Gap Detection' oder 'Temporal Modulation Transfer Function' (Detektion von Amplitudenmodulationen)
• Meting van temporele resolutie, bijvoorbeeld 'gap detection' of 'Temporal modulation transfer function' (detectie van amplitude modulatie)

1_21
• Binaural intelligibility level difference test (BILD) - a test for binaural hearing aid fittings
• Feststellen des „binauralen Gewinns“ bei der Anpassung von 2 Hörgeräten (binaural) gegenüber nur einem Hörgerät (monaural), z.B. mit BILD-Test ('Binaural Intelligibility Level Difference')
• Vaststellen van verschil in spraakverstaan tussen een monaurale en een binaurale aanpassing, bijvoorbeeld Binaural intelligibility level difference (BILD) test

1_22
• Not used in UK:
• Überschwellige Tests: SISI, Fowler, Lüscher, Carhart, ...
• Not used in NL:
10.1.2  STAGE 2: Procedures related to fitting a hearing aid

UK: Stage 2: Procedures related to fitting a hearing aid
DE: Stufe 2: Hörgeräte-Anpassung
NL: Fase 2: Procedures die plaatsvinden tijdens hoortoestelaanpassing

2_01
- Choice of ear(s), choice of hearing aid(s), selection of earmould (or open fitting)
- Auswahl welches Ohr versorgt wird (oder beidohrige Versorgung), Auswahl des Hörsystemtyps, Auswahl der Otoplastik (oder offene Versorgung)
- Keuze van het aan te passen oor, van het type hoortoestel, specificatie van het type oorstukje, en nemen van oorafdruk

2_02
- Prescriptive fitting of one model of hearing aid(s) according to manufacturer fitting rules
- Anpassung eines Hörsystems nach Herstellervorschrift
- Aanpassen van één type hoortoestel volgens de aanpasregels van de fabrikant

2_03
- Prescriptive fitting of one model of hearing aid(s) according to generic fitting rules
- Anpassung eines Hörsystems nach allgemeinen Regeln wie NAL-NL1, DSL [i/o], Fig6 ...
- Aanpassen van één type hoortoestel volgens algemene aanpasregels, zoals bijvoorbeeld NAL-NL1, Fig6, DSL [i/o], etc.

2_04
- Interactive optimising of the fitting for the individual using new techniques being researched currently
- Interaktive Optimierung der individuellen Anpassung, z.B. anhand von systematischen Qualitätsvergleichen
- Optimaliseren van de hoortoestelaanpassing volgens een op het individu gerichte (interactieve) methode, bijvoorbeeld aan de hand van systematische kwaliteitsvergelijkingen

2_05
- Prescriptive fitting of alternative hearing aid(s) for comparative purposes
- Anpassung weiterer Hörsysteme, sodass der Kunde/Patient vergleichen kann
- Aanpassen van een (of meerdere) extra hoortoestel(len) zodat de hoortoestellen vergeleken kunnen worden
2_06
- **Fine tuning of hearing aid**
- **Feinanpassung** von mindestens einem Hörsystem (mehrere Sitzungen)
- **Fine tuning van de aanpassing**

2_07
- **Real-ear measures to verify fitting**
- **In-Situ Messung**
- **Real-ear metingen**

2_08
- **Not used in UK**: Test of at least one hearing aid in daily-life (trial period)
- **Test von mindestens einem Hörsystem im Alltag** des Kunden/Patienten (zu Hause)
- **Testen van minimaal één hoortoestel in de dagelijkse praktijk** (proefperiode)

2_09
- **Not used in UK**: Rating of hearing aid benefit at fitting
- **Subjektive Bewertung des Hörsystems (‘Benefit’)** durch den Kunden/Patienten
- **Not used in NL**: Beoordeling van het hoortoestel

2_10
- **Explain the functionality, handling and care of the hearing aid to the user**
- **Erläuterung der Funktionen, Bedienung und Wartung des Hörsystems**
- **Uitleg over het gebruik van het hoorstoestel**
10.1.3 STAGE 3: Evaluation and benefit measurements

UK: Stage 3: Evaluation and benefit measurements (Aided measures)
DE: Stufe 3: Abschlußmessungen (versorgte Messungen)
NL: Fase 3: Procedures die plaatsvinden na hoortoestelaanpassing

3_01
• **Not used in UK:** If more hearing aids received the same subjective score, then they will be compared with a speech in noise test or loudness scaling
• **Falls mehrere Hörgeräte subjektiv gleich bewertet werden,** wird ein vergleichender Sprachtest oder eine Lautheitsskalierung durchgeführt
• **Als meerdere hoortoestellen dezelfde subjectieve beoordeling kregen, dan worden ze vergeleken aan de hand van bijvoorbeeld een spraak-in-ruis test, of Luidheidsschaling**

3_02: grouped questions
• **Speech intelligibility in quiet at a fixed level**
• **Sprachverständlichkeitsmessungen in Ruhe bei konstantem Pegel**
• **Meting van Spraakverstaanvaardigheid (score) in stilte: bepaling van spraakscore bij één of meerdere vaste geluidniveaus:**

3_02A
• **Everyday sentences using open-set test materials** (e.g. BKB, IHR-ASL, HINT)
• **Natürliche Sätze** mit offenem Testmaterial, z.B. Göttinger Satztest
• **Natuurlijke spraak, hele zinnen (open set, zoals Plomp of VU98)**

3_02B
• **Closed set sentences** ("Matrix-sentences" e.g. Hagerman, OLSA)
• **Tests mit geschlossenem Testmaterial** ("Matrix-Sätze"), z.B. Oldenburger Satztest (OLSA)
• **Gesloten set, hele zinnen (Matrixtest waarbij ieder woord uit de zin uit een vaste (gesloten) set van 10 alternatieven gekozen wordt)**

3_02C
• **Single Words** (e.g. CVC words, AB words, FAAF)
• **Einzel-Wörter,** z.B. WaKo Reimtest, Freiburger Wörtertest
• **Woorden, bijvoorbeeld CVC, spondeën**
3_02D

- **Nonsense Words** (e.g. VCV test)
- **Sinnlose Wörter**, z.B. Logatomtest (Kieler, Aachener, Oldenburger,...) oder VCV-Wörter
- **Onzin woorden, bijvoorbeeld VCV of CV**

3_03: grouped questions

- **Speech intelligibility in noise at a fixed S/N ratio**
- **Sprachverständlichkeitssmessungen im Störgeräusch bei konstantem S/N**
- **Meting van Spraakverstaanvaardigheid (score) in ruis, bepaling van spraakscore één of meerdere vaste signaal-ruisverhoudingen:**

3_03A

- **Everyday sentences using open-set materials** (e.g. BKB, IHR-ASL, HINT)
- **Natürliche Sätze** mit offenen Testmaterial, z.B. Göttinger Satztest
- **Natuurlijke spraak, hele zinnen (open set, zoals Plomp of VU98)**

3_03B

- **Closed set sentences** ("Matrix-sentences" e.g. Hagerman, OLSA)
- **Tests mit geschlossenem Testmaterial** ("Matrix-Sätze"), z.B. Oldenburger Satztest (OLSA)
- **Gesloten set, hele zinnen (Matrixtest waarbij ieder woord uit de zin uit een vaste (gesloten) set van 10 alternatieven gekozen wordt)**

3_03C

- **Single Words** (e.g. CVC words, AB words, FAAF)
- **Einzel-Wörter**, z.B. WaKo Reimtest, Freiburger Wörtertest
- **Woorden, bijvoorbeeld CVC, spondeeën**

3_03D

- **Tests with numbers**, (e.g. Number Triplets)
- **Test mit Zahlen**, z.B. Zahlentrippel-Test
- **Getallen, bijvoorbeeld Number Triplets**

3_03E

- **Nonsense Words** (e.g. VCV test)
- **Sinnlose Wörter**, z.B. Logatomtest (Kieler, Aachener, Oldenburger,...) oder VCV-Wörter
- **Onzin woorden, bijvoorbeeld VCV of CV**
3_04: grouped questions

- **Adaptive speech audiometry in quiet** (Speech Reception Threshold SRT)
- **Adaptive Messung der Schwelle der Sprachwahrnehmung (SRT) in Ruhe**
- Adaptieve spraakaudiometrie in stilte: Adaptief bepalen van de drempel in stilte met de volgende materialen:
  3_04A
  - **Everyday sentences using open-set test materials** (e.g. BKB, IHR-ASL, HINT)
  - **Natürliche Sätze** mit offenem Testmaterial, z.B. Göttinger Satztest
  - **Natuurlijke spraak, hele zinnen (open set, zoals Plomp of VU98)**

3_04B

- **Closed set sentences** ("Matrix-sentences" e.g. Hagerman, OLSA)
- **Tests mit geschlossenem Testmaterial** ("Matrix-Sätze"), z.B. Oldenburger Satztest (OLSA)
- **Gesloten set, hele zinnen (Matrixtest waarbij ieder woord uit de zin uit een vaste (gesloten) set van 10 alternatieven gekozen wordt)**

3_04C

- **Single Words** (e.g. CVC words, AB words, FAAF)
- **Einzel-Wörter**, z.B. WaKo Reimtest, Freiburger Wörtertest
- **Woorden, bijvoorbeeld CVC, spondeëén**

3_04D

- **Nonsense Words** (e.g. VCV test)
- **Sinnlose Wörter**, z.B. Logatomtest (Kieler, Aachener, Oldenburger,...) of VCV-Wörter
- **Onzin woorden, bijvoorbeeld VCV of CV**

3_05: grouped questions

**Adaptive speech audiometry in noise** (Speech Reception Threshold SRT)

- **Adaptive Messung der Schwelle der Sprachwahrnehmung (SRT) im Störgeräusch**
- Adaptieve spraakaudiometrie in ruis: Adaptief bepalen van de kritische signaal-ruisverhouding (Speech Reception Threshold test) met de volgende materialen:

3_05A

- **Everyday sentences using open-set materials** (e.g. BKB, IHR-ASL, HINT)
- **Natürliche Sätze** mit offenem Testmaterial, z.B. Göttinger Satztest
- **Natuurlijke spraak, hele zinnen (open set, zoals Plomp of VU98)**
3_05B
- **Closed set sentences** ("Matrix-sentences" e.g. Hagerman, OLSA)
- **Tests mit geschlossenem Testmaterial** ("Matrix-Sätze"), z.B. Oldenburger Satztest (OLSA)
- **Gesloten set, hele zinnen (Matrixtest waarbij ieder woord uit de zin uit een vaste (gesloten) set van 10 alternatieven gekozen wordt)**

3_05C
- **Single Words** (e.g. CVC words, AB words, FAAF)
- **Einzeln-Wörter**, z.B. WaKo Reimtest, Freiburger Wörtertest
- **Woorden, bijvoorbeeld CVC, spondeen**

3_05D
- **Tests with numbers**, (e.g. Number Triplets)
- **Test mit Zahlen**, z.B. Zahlentrippel-Test
- **Getallen, bijvoorbeeld Number Triplets**

3_05E
- **Nonsense Words** (e.g. VCV test)
- **Sinnlose Wörter**, z.B. Logatomtest (Kieler, Aachener, Oldenburger,...) oder VCV-Wörter
- **Onzin woorden, bijvoorbeeld VCV of CV**

3_06
- **Loudness scaling tests**
- **Adaptive Lautheitsskalierung** mit Hörsystem (Freifeld, ACALOS, mit Schmalband-, Breitband- oder Sprachrauschen)
- **Luidheidsschaling met hoortoestel (vrije veld, ACALOS, met smalband, breedband, of spraakruis)**

3_07
- **Sound localisation tests in the horizontal and/or vertical plane** (speech, tone or noise stimulus)
- **Lokalisation**: Sprach-, Ton- oder Rauschsignale aus verschiedenen Richtungen mittels mehrerer Lautsprecher
- **Geluidslocalisatietest in het horizontale en/of verticale vlak** (spraak, toon of ruis stimuli)

3_08: grouped questions
- **Use of questionnaires to assess:**
  - Fragebögen...
  - Vragenlijsten voor het onderzoeken van:

3_08A
- **Hearing difficulties in different situations after fitting** (measure of residual disability)
- **um Situationen zu identifizieren, in denen Hörprobleme auftreten** (mit Hörsystem)
- **Hoorproblemen met hoortoestel (resterende beperking)**
3_08B
- **Sound quality in different situations after fitting**
- bzgl. Geräuschqualität des Hörsystems
- Geluidskwaliteit met hoortoestel

3_08C
- **Quality of life measure after fitting**
- bzgl. allgem. Lebensqualität mit Hörsystem
- Kwaliteit van leven met hoortoestel

3_08D
- **Speech intelligibility in different situations after fitting**
- bzgl. Sprachverständlichkeit in verschiedenen Situation mit Hörsystem
- Spraakverstaanvaardigheid met hoortoestel

3_08E
- **Success of hearing aid fitting rated by family member or friend**
- über den Nutzen des Hörsystems, auszufüllen von den Angehörigen des Kunden/Patienten
- Beoordeling van handicap door de partner

3_08F
- **Impact on daily life of hearing loss after fitting** (measure of handicap)
- über den Einfluss der Hörstörung auf das tägliche Leben ("Handicap") des Kunden/Patienten mit Hörsystem
- Invloed van gehoorverlies of het dagelijkse leven (handicap met hoortoestel)

3_08G
- **Use of hearing aid(s)**
- zur Benutzung des Hörsystems
- Hoortoestelgebruik

3_08H
- **Satisfaction with hearing aid(s)**
- über die Zufriedenheit mit dem Hörsystem
- Tevredenheid/voldoening met hoortoestel

3_08I
- **Benefit of hearing aid fitting**
- zum Gewinn ('Benefit') durch das Hörsystem
- Baat van het hoortoestel

3_09
- **Daily diary of hearing aid use**
- Der Kunde/Patient führt ein "Hörtagebuch" bzgl. der Erfahrungen und Gebrauch des Hörsystems
- Dagelijks laten bijhouden van hoortoestelgebruik (dagboek)
11 Examples of the Online-Questionnaire pages

Figure 11-1: First page of the online questionnaire
Dear Audiologist or Hearing Aid Dispenser

RNID are carrying out a survey as part of our involvement with the HearCom project (www.hearcom.info), which aims to reduce the barriers in communication that deaf and hard of hearing people face in society.

The survey is investigating adult rehabilitation procedures across Europe to see what types of tests are being done and what professionals think about them. For this survey, we are not investigating issues regarding tinnitus or balance problems. Hopefully, one of the outcomes of the Hearcom project will be to increase the availability of on-line tools for hearing assessment and rehabilitation. Please help us by completing the survey.

We have divided the rehabilitation patient pathway into 3 stages,

1. Procedures prior to fitting
2. Procedures related to fitting
3. Evaluation and benefit measurements

For each stage we would like to know which procedures (tests and questionnaire dimensions) you currently use and how you might like to change them given two different conditions - with current time constraints within appointments and in an ideal world without any time constraints. Some procedures are repeated in more than one stage within the pathway, so please select where you would like to use them, even if this means selecting them twice, e.g. you might want to use speech tests before the fitting in Stage 1 and also as an evaluation measure in Stage 3.

We have deliberately not included great detail on counselling issues as we feel these are extremely important and are carried out by all professionals. Please therefore assume that these are part of the patient pathway shown.

The questionnaire will take about 15-20 minutes to complete. Thank you for your help.

All results are anonymous.

If you have any queries about the project, please contact Elizabeth Davey at Elizabeth.Davey@rnid.org.uk.

This page is for people from the UK only!
If you are not working in the UK, please go to the MAIN PAGE and choose the appropriate country!

Thank you very much!

Firstly, are you:
- An audiologist
- A hearing aid dispenser
- Both
- Other [please enter]

In which area do you work?
- NHS
- Private sector service
- Both
- Other [please enter]

In which country do you work?
[Please choose]

[Start the survey]

Figure 11-2: First country-specific page (here the English one) of the online questionnaire
Stage 1 (of 3): Assessment procedures prior to fitting

Below is a list of procedures. Please indicate how often you currently use them - You have the choice between Always, Often, Sometimes or Never.

Because the following items are being compared across Europe, you may not be familiar with some of the procedures. If so, please select 'Procedure is unknown'. e.g. in some European countries, 3 different models of hearing aid are fitted and compared. We have included this in our list so that you can see what is done elsewhere and be able to select them if you would like to.

If you are using any procedures that are not listed here please insert their names in the boxes at the bottom of the list. Please note that we are not investigating tinnitus or balance problems with this survey. Please also remember to select an answer for each procedure before proceeding onto the next part of the questionnaire.

<table>
<thead>
<tr>
<th>List of procedures:</th>
</tr>
</thead>
<tbody>
<tr>
<td>01) Discussion about hearing loss and hearing aids</td>
</tr>
<tr>
<td>How often do you use the procedure: Always, Often, Sometimes, Never, Procedure is unknown</td>
</tr>
</tbody>
</table>

Figure 11-3: Instruction and rating section for the first stage in the English version (top-part – see next figure for bottom-part)
### Adaptive speech audiometry in quiet (Speech Reception Threshold SRT)

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Frequency Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Everyday sentences using open-set test materials (e.g. BKB, HR-ASL, HINT)</td>
<td>Always, Often, Sometimes, Never, Procedure is unknown</td>
</tr>
<tr>
<td>2) Closed set sentences (Matrix-sentences* e.g. Hayman, OLBA)</td>
<td>Always, Often, Sometimes, Never, Procedure is unknown</td>
</tr>
<tr>
<td>3) Single Words (e.g. CVC words, AB words, FAF)</td>
<td>Always, Often, Sometimes, Never, Procedure is unknown</td>
</tr>
<tr>
<td>4) Nonsense Words (e.g. VCV test)</td>
<td>Always, Often, Sometimes, Never, Procedure is unknown</td>
</tr>
</tbody>
</table>

### Adaptive speech audiometry in noise (Speech Reception Threshold SRT)

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Frequency Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Everyday sentences using open-set test materials (e.g. BKB, HR-ASL, HINT)</td>
<td>Always, Often, Sometimes, Never, Procedure is unknown</td>
</tr>
<tr>
<td>2) Closed set sentences (Matrix-sentences* e.g. Hayman, OLBA)</td>
<td>Always, Often, Sometimes, Never, Procedure is unknown</td>
</tr>
<tr>
<td>3) Single Words (e.g. CVC words, AB words, FAF)</td>
<td>Always, Often, Sometimes, Never, Procedure is unknown</td>
</tr>
<tr>
<td>4) Tests with numbers, (e.g. Number Triplets)</td>
<td>Always, Often, Sometimes, Never, Procedure is unknown</td>
</tr>
<tr>
<td>5) Nonsense Words (e.g. VCV test)</td>
<td>Always, Often, Sometimes, Never, Procedure is unknown</td>
</tr>
</tbody>
</table>

16) Loudness Scaling Tests
How often do you use the procedure: Always, Often, Sometimes, Never, Procedure is unknown

17) Sound localization tests in the horizontal and/or vertical plane (speech, tone or noise stimulus)
How often do you use the procedure: Always, Often, Sometimes, Never, Procedure is unknown

### 8) TEOAE test to find dead regions in the cochlea
How often do you use the procedure: Always, Often, Sometimes, Never, Procedure is unknown

### 9) Tests of frequency resolution (e.g. psychoacoustic tuning curve, notched-noise masked thresholds)
How often do you use the procedure: Always, Often, Sometimes, Never, Procedure is unknown

### 10) Tests of temporal resolution (e.g. gap detection, temporal modulation transfer function)
How often do you use the procedure: Always, Often, Sometimes, Never, Procedure is unknown

### 21) Binaural inaudibility level difference test (BILD) - a test for binaural hearing aid fittings
How often do you use the procedure: Always, Often, Sometimes, Never, Procedure is unknown

---

**Figure 11-4:** Instruction and rating section for the first stage in the English version (bottom-part – see preceding figure for top-part)
Stage 1 (of 3): Assessment procedures prior to fitting

We would now like to know what procedures you would like to include in the current patient pathway if you could change it, considering two different conditions.
1) given current time constraints within appointments.
2) in an ideal world without these constraints

Please look at the table below which lists the procedures you are currently using. At first decide for both conditions separately, if you would like to keep the procedures as they are, keep them but improve* them or drop (remove) them.

In the table at the bottom you will see another list of procedures that you may like to include in your changed patient pathway.

* Improve refers to improvements in the tool or process rather than in frequency of use.

List of procedures:

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Stay as Is</th>
<th>Stay but improve</th>
<th>Remove</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion about hearing loss and hearing aids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Given current time constraints</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under ideal conditions</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 11-5: Instruction and rating section for the first stage, “real” and “ideal” situation in the English version (top-part – see next figure for bottom-part)
### Instructions and Rating Section for the First Stage, “Real” and “Ideal” Situation in the English Version

<table>
<thead>
<tr>
<th>Procedure Description</th>
<th>Stay as It Is</th>
<th>Stay in But Improve</th>
<th>Remove</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound localization tests in the horizontal and/or vertical plane</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(speech, tone or noise stimulus)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Given current time constraints:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under ideal conditions:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TEN test to find dead regions in the cochlea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Given current time constraints:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under ideal conditions:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tests of frequency resolution (e.g. psychoacoustic tuning curve, masked thresholds)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Given current time constraints:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under ideal conditions:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Binaural intelligibility level difference test (BILD) - a test for</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>binaural hearing aids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Given current time constraints:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under ideal conditions:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Please now look at the list below and add any other procedures that you want to include for either condition.

**List of procedures:**

- **Discussion about hearing loss and hearing aids**
  - Add
  - Given current time constraints: ✓
  - Under ideal conditions: ✓

- **Medical history**
  - Add
  - Given current time constraints: ✓
  - Under ideal conditions: ✓

- **Tests of temporal resolution** (e.g. gap detection, temporal modulation transfer function)
  - Add
  - Given current time constraints: ✓
  - Under ideal conditions: ✓

You can fill in suggestions or comments here or please list the names of any specific tests or questionnaires that are mentioned in the categories above...

**ATTENTION:** Please make sure that you are happy with your selections before continuing and that you have selected an answer for each procedure...

---

Figure 11-6: Instruction and rating section for the first stage, “real” and “ideal” situation in the English version (bottom-part – see preceding figure for top-part)
Final Questions:

Please fill in the last 4 questions:

1. Would you be interested in using tests or questionnaires that are standardised across Europe, to enable large data sets to be obtained for comparative purposes? Please give your reasons in the box below.
   - YES □ NO □

2. Would you be interested in allowing your patients/clients to assess benefit from fitting in the comfort of their own home by using properly designed and controlled tests or questionnaires that can be run on the internet? Please give your reasons in the box below.
   - YES □ NO □

3. Do you think it is possible to develop a procedure which would allow your patients/clients to adjust the settings of their hearing aid(s) themselves using safe and appropriately calibrated tools on their own (maybe over the internet) in the future? Please give your reasons in the box below.
   - YES □ NO □

4. If such a procedure did exist, would you use it? Please give your reasons in the box below.
   - YES □ NO □

Please insert any comments regarding your answers above in the box below.

You can fill in suggestions or comments here ...

ATTENTION: Please make sure that you are happy with your selections before continuing and that you have selected an answer for each procedure ...

Send

Figure 11-7: Final questions in the English version
12 Free text comments to the online questionnaire

All comments from Dutch and German participants have been translated into English

12.1 Additional procedures used

Stage 1

UK:
- Glasgow Hearing Aid Benefit Profile (GHABP) (7 participants)

NL:
- Speech audiometry with hearing aids
- In situ measurement (the measurement of sound pressure level in the ear canal of a hearing aid, with the use of a hearing aid)
- Speech intelligibility over the table (‘live speech without lip reading’)
- Amplifit comparison, with videoclips that are relevant for daily life
- Sound localisation test (9 speakers) with binaural fitting
- Only for young children and mentally challenged individuals. Both with and without hearing aid
- Insertion gain
- Insertion gain measurement with the fitted hearing aids

DE:
- Tests with sounds of everyday life
- Investigation of benefit for speech intelligibility monaural vs. binaural using Freiburger speech test with broadband-noise
- In situ
- Natural sounds, subjective rating of sounds
- Different examples of sounds at fitting or checkups
- Loudness-Scaling with hearing aids in free-field
- Toleranztest: “Test of tolerance” if there are tendencies for repulsion of the hearing aid (for children?)
- Feldmann-Test: dichotic discrimination score, a Dichotic speech test with words, sentences, numbers. (often used for children?)
• GHABP modified
• Work with natural sounds
• Aurical Vis. Speech. (Aurical refers to the proprietary procedure “Visible Speech Mapping from GN Otometrics)

Stage 2

UK:

• Soundfield testing
• Measure REUR, REOR and RECD and incorporate into fitting software without using REM
• Use of demonstration hearing aid
• Live speech testing (BKB)
• Fine tune hearing aid based on patient experiences

NL:

• Speech intelligibility with CVC, with and without hearing aid(s)
• Speech intelligibility with hearing aids, with spondees
• Free field small band noise thresholds with hearing aids

DE:

• Scaling or taking into consideration the individual fitting
• Loudness-Scaling
• Examples of typical situations (play back exemplary sounds for optimisation)

Stage 3

UK:

• No added procedures mentioned

NL:

• Comparison through Amplifit

DE:

• Problems/benefit etc are analyzed in face-to-face interview
• Communication training: training how to communicate and to use better “strategies” for that
12.2 General comments

Stage 1

UK:

- Existing questionnaires are often badly presented/worded and too long. I would not expect to perform all procedures on all patients, but would select appropriate procedures based on patient history and expectations of the aid, together with patient ability, given that a lot of elderly patients are not able to reliably complete questionnaires and tests and are not necessarily accompanied by family or carers who would be able to give information.

NL:

- Patients are first diagnosed by an ENT physician. This means otoscopy, Weber, Rinne

- In the audiological centers, the medical anamnesis and the tuning fork tests are conducted by ENT physician and not by the audiologist. The questions on speech material are confusing. For scoring we always use words or nonsense words. For threshold measurements (adaptive methods) we use sentence lists, matrix of number triplet.

- I would like more development in diagnostic measurement procedures

- It is completely unclear if the above-mentioned tests are concerned with the situation with or without hearing aids. If it is for the situation with hearing aid, then I do not understand the relation between tone audiometry and speech audiometry. I do not think somebody would conduct both with hearing aids. On the other hand does it seem that the next pages concerns speech audiometry with hearing aids. What's the deal?

- Auditory processing is not included

- I do use the Weber test and think it is useful. I conduct this test by using the bone conductor in CAMEA. However in the Questions only the tuning fork test is mentioned. For this reason I have not marked the Weber test as being used by me.

DE:

- What profit do the tests 18-20 have if they don't have any influences on the fitting of the hearing aids? With this we only can show that the hard of hearing cannot understand better, because his brain won't function free from error. For the fitting this has absolutely no effect.

Stage 2

UK:

REMs are always attempted, but occasionally patients do not tolerate the REM tube making completion impossible.

NL:
• Most audiologists chose the ear and specify the ear piece, but do not take the ear impression themselves.

• In the current NOAH 3 set (national platform for hearing aid fitting), it is not possible to choose the in-situ module and the fitting module at the same time. It is also not possible to simultaneously use free field speech measurements and the fitting module. This makes use of these measurements tiresome. This suggests that the development of NOAH is more based on IT skills that on the daily practice of audiology.

DE:

• No comments

Stage 3

NL:

• Every item from the questionnaires is treated, but not in the form of a questionnaire (questions are posed by heart)

UK:

• As before I would not expect to perform all procedures on all patients. I would aim to repeat the procedures carried out prior to fitting to enable comparisons and evaluate benefit.

DE:

• I query all the things mentioned in the given questionnaires in a personal interview

12.3 Comments on the final questions

The following are all of the additional remarks for question 1:

• (UK, NHS) Standardisation of assessments of whatever form obtained from a larger patient sample drawn from more different backgrounds should produce more reliable information.

• (UK, NHS) Standardisation would benefit patients in the long term.

• (DE, HAD) If a test is standardized it does not mean that it is suitable for daily work.

• (DE, HAD) At present already too much paper work.

• (DE, HAD) Too much bureaucracy

• (DE, HAD) Uniform questionnaires are welcome, but they give rise to more and more paper work.

• (DE, HAD) No, because often regional and user-specific differences
• (DE, HAD) I don't want to use standardized questionnaires because we have our own questionnaires which we think are reasonable and we have put a lot of time and effort into them.

The following are all the remarks for QN2

Participants who support the idea to develop internet-based tests:

• (UK, NHS) Patients would not feel pressured to complete questionnaires in a given time and could complete them over more than one session. They would be completing them in their normal environment rather than a clinical situation enabling them to assess situations more reliably if there was any doubt of outcomes etc. It would enable audiologists to use their time more effectively. Completed questionnaires could be submitted via email or internet connection and feedback returned to the patient by the same route.

• (UK, NHS) Some patients may benefit from internet access to questionnaires at home.

• (UK, NHS) I think questionnaires should be carried out in the home as outcome measures due to time constraints in clinic.

• (NL, Audiologist) For some patients this is useful indeed. If I feel that the adjustment of the fitting might be the final one, I often plan a consult by telephone to check if the last fitting adjustment was good. If I think the adjustment might be the final one, I immediately perform tests. If it would be possible to do this remotely via the internet, then this would be convenient. This would give the patient some time to get used to the new settings and during the last telephone/internet consult I could even conduct some more tests.

Participants who oppose the idea to develop internet-based tests:

• (UK, NHS) Not a good use of NHS time except for patients unable to get to clinic.

• (NL, HAD) I think that a good personal conversation is more effective than a procedure. Within a procedure it is not possible to specifically target the patient and to focus on patient specific signals (verbal and nonverbal signals). Also the comparison of the self-image of the patient to the image of the partner or the environment is limited within a procedure.

• (DE, HAD) Hearing aid fitting is very intensive in terms of counselling. Questions can solely be resolved in a one-on-one interview.

• (DE, HAD) I take root for the personal contact to the hard of hearing, therefore by no means via email!

• (DE, HAD) Face-to-face contact to the customer is important. Many questions of this questionnaire are clearly answered for you, but must be much more precisely differentiated by us. We often choose the answer we find to be "the lesser of the two evils". In that way the internet-user will do.

• (DE, HAD) Internet can't be used by the major part! I would like to get to know the procedures myself first.

• (DE, HAD) If I facilitate my customers to evaluate their hearing aids over the internet I give a part of my job to the internet. As a consequence I make myself somewhat obsolete - which can't be my interest
Remarks for questions 3 and 4 (combined)

Positive:

- (UK, NHS) The next cohort of hearing aid users are in their 40s and 50s now. They will be more comfortable adjusting hearing aids themselves,

- (UK, NHS) There seems to be no limit to what is possible via the internet or similar, so this should be no exception. Advantages would be that the patient could adjust their hearing aids according to their need in their home environment, i.e. the "real world", rather than a contrived clinical situation

- (UK, NHS) I have reservations about patients adjusting aids themselves, however, it could be selectively used, and for certain patients it could be beneficial. There are some patients who would really abuse it!

- (UK, private) As hearing aid technology advances there should be less need for patients to do further adjustments, other than volume controls or program changes. If the hearing aid/s are fitted well by the hearing aid audiologist then a patient should not want to do any further changes. However there is always the exception to the rule, perhaps if someone lived in a remote place then such a system to allow a person to do limited changes would be useful.

- (UK, NHS) Some patients would benefit from this but some would fiddle altering settings unnecessarily.

- (UK, NHS) I'm sure it would be possible, maybe not appropriate for a lot of patients. In selected cases which have been appropriately advised and only if they could make limited changes

- (UK, private) The system would have to be very simplified as the current knowledge of computing in the retired age group is still in the most part inadequate. However in the future as the younger population age this will be a much more likely benefit to the hearing impaired who will have better computing skills

- (NL, audiologist) Safety and reliability of the procedure must be guaranteed!

- (NL, audiologist) I think that patients should have a large say in the hearing aid fitting and should have a large input as well. However, I also think that measurements such as insertion gain are absolutely needed and for this the patients should visit us. After this it might be possible to do the fine tuning remotely.

- (DE, HAD) For some few hearing aid users certainly useful. For most hearing aid users only disadvantageous, because a lot of settings can be shifted (misapplied). We see big problems with the liability in terms of “medical device law” (German law for medical devices). Furthermore this may be the foundation for no serious, untrained hearing “aid-adjusters”.

- (DE, HAD) If the internet generation with hardness of hearing comes to us we will have no other choice left – now the customers want to feel Closeness!

Negative:

- (UK, NHS) For some patients - let them programme the aid(s)
• (UK, NHS) I don’t think the majority of our elderly patients could handle adjustments themselves.

• (UK, NHS) I do not think hearing aid users should be able to adjust their hearing aids at home!

• (UK, NHS) The procedure would have to be very user friendly and not all hearing aid users would be able to use the web although this would grow in time.

• (UK, private) The fitting and, more importantly the follow up appointments can disclose problems with the instruments that are not always apparent to the wearer. Whilst it may be possible for those with a minor loss to self fit a basic instrument, as the wearer has increased loss, coupled with increasing age, this is not an easy procedure, even with latest fitting software, and to get optimum satisfaction is still a difficult thing to accomplish and takes skill.

• (UK, NHS) Whilst self fitting using computer technology sounds like a good idea - I believe that it would generate innumerab le problems for many service users - I also think that a personal approach is preferable, how do computers encourage clients to get the most from their aids etc.

• (UK, NHS) Although very time - constrained on the NHS - I would be reluctant to allow pts to have too much control over altering aids away from prescribed/REM targets - I would rather have more time and availability of more tests/ questionnaires to allow investigation of problems and controlled change to hearing aids

• (UK, NHS) I think it may be possible for patients to adjust their own aids but think this would not be a good idea as it would not allow close monitoring and the patient may not necessarily choose the optimal settings.

• (UK, NHS) Majority of our patients would not be able to successfully alter their HA settings. Many are very elderly. Maximum intelligibility doesn't equal maximum comfort. Patient may not be able to optimise their settings.

• (NL, HAD) A hearing aid is more than a programmable computer. The earmould is very important, and so is counselling. Contact with the hearing impaired is therefore always required.

• (NL, audiologist) I do not expect that this is feasible for all patients. Sometimes you’ll just want to see the patient: to check if the earpiece is in order, to check how the patient interacts with the hearing aid etc.

• (NL, HAD) It looks like a sort of self medication in which professional and reliable consultation is lacking and in which symptoms will be overlooked or not treated

• (DE, HAD) The setup of a hearing aid can solely be conducted by an expert with the necessary background knowledge

• (DE, HAD) I hope that there NEVER will be the possibility that hard of hearing persons can adjust and program their hearing aids, because otherwise in one swoop thousands of hearing aid dispensers are spare. The manufacturers who are developing such things should be boycotted!

• (DE, HAD) Why not hearing aids “out of the automate”? I don’t want to be the one who set up those automates”
• (DE, HAD) Programming and selection of hearing systems should remain with experts, there are too many sources of error, which can’t be controlled by a layman.

• (DE, HAD) As a hearing aid dispenser I have no interest in an internet-programming. Existing systems (auric) are of doubtful quality. Our customers are in the average 68 years old and in many cases not able use the internet. What if the customer isn’t satisfied with the self-performed changes in setup of his hearing aid? How can risks be foreclosed? Who is responsible for errors?

• (DE, HAD) There will be no European-uniform benchmarking of the success of fitting because of the differences in the level of vocational education throughout Europe.

• (DE, HAD) For this question I react with a shake of my head: why did I enjoy 3 years of vocational education if our customers can eventually adjust their hearing aids in the future themselves? I think this is absolute absurd because my profession will be queried. Will I be out-of-work and stranded sometime? Never ever I endorse such a procedure. Our complete professional responsibility would be queried. Is that your intention?

• (DE, HAD) The customer is commonly "old" and not used to using computers and the internet, therefore these customers would not have the opportunity to use reasonable adjusted hearing aids....? Furthermore the question arises: For what the vocational education of a hearing aid dispenser would be still needed??

• (DE, HAD) Change: yes – but reasonable? No control of the level at the ear and when damage occurs eventually the customer is liable.

• (DE, HAD) I don’t think the setup the customer does himself is reasonable because he doesn’t have the methodical responsibility and audiological skill. Hearing aids which are solely adjusted to the requests of the customer are mostly too quiet and do not give limited speech intelligibility, Furthermore the internet won’t be used / won’t be used safely by the older persons.

• (DE, HAD) The improvement of the performance of fitting over the internet by the customer himself is not desirable.

• (DE, HAD) It would certainly be possible to give the customers the opportunity to adjust their hearing aids over the internet. However, in my opinion I think that should be avoided because one will make oneself obsolete. As a consequence there is a big risk that fewer hearing aid dispensers will be needed and therefore I may get out-of-work!

• (DE, HAD) I don’t think that is desirable!

• (DE, HAD) Hearing aid setup / programming over the internet endanger the profession of hearing aid dispensers and are not tolerable in terms of “medical device law” (German law for medical devices).

• (DE, HAD) The organ of hearing is a sense organ, complicated and complex – Besides psychoacoustic and electro acoustic parameters cannot be captured mathematically. - The customer has to compare sound, speech, the intelligibility, the handling primarily.
13 Annex: Focus Group Discussions

It was the aim of the focus group discussions to find out the optimal procedure for the rehabilitation with hearing aids. Therefore in a first step the project partners developed the “Scientific Opinion” (SO). The initial SO as used in the focus group studies is shown in 13.6. In the second step the SO was checked in cooperation with hearing aid dispensers (HAD) for completeness and practicability. In a third step it was investigated whether the willingness to cooperate of hearing aid users (HAU) and unaided hearing impaired persons (NHAU) is sufficient to realise the optimal procedure (the SO) in everyday life. This investigation was carried out in Oldenburg for Germany. This was regarded as a pilot study that would inform the main work of task 2.

13.1 Concept and realisation of the study:

Since with this study an evaluation of a given expert opinion (the SO) was intended, a group discussion in the form of a focus group was considered suitable. Group discussions allow a cost-efficient and rapid result generation. With a focus group an overview of the range of variation and configuration of opinions and attitudes towards special topics can be achieved. The personal effort and expenditure of time is comparatively low for this method. Focus groups are an “open” form of interviewing: The participants can announce their arguments and views in their own words, not influenced and biased in any way. The biggest benefit is to get the information from the participants with their own rank of importance and point of view. This would be impossible for example with questionnaires or “closed” interviews where the participants only can put their answers in the structure given by the questionnaire / interviewer.

To achieve comparable results of the three target audiences:
- hearing aid dispensers (HAD)
- hearing aid users (HAU) and
- unaided hearing impaired persons (NHAU)

A guideline was developed that was analogous in most parts for the three groups. For the hearing aid dispensers we wanted at first to obtain their uncommitted opinion about the relevant procedures and measurements of the individual steps of hearing aid fitting.

However, the presentation of the Scientific Opinion (SO) with subsequent evaluation of the relevancy of the individual elements is comparable in all three groups. Due to the available expert knowledge in the group of the hearing aid dispensers (HAD) the emphasis was in the description of the details of the measurements. On the other hand in the groups of hearing aid users (HAU) and unaided hearing impaired persons (NHAU), the request to explain the procedures understandably and traceably was pursued. This was done for the more difficult measurements by the demonstration of film clips which represent the respective procedures.
In the following chapters the results of the three groups are presented.

13.2 Results of the focus group with hearing aid dispensers (HAD)

The focus group lasted 4.5 hours and was carried out in Oldenburg at DE-HZO (Hörzentrum Oldenburg). Eight experienced hearing aid dispensers from Germany participated. They were addressed as former participants of a seminar by the centre of excellence “HörTech”. They lived mainly in an area of approx. 100 km around Oldenburg, two participants had to travel longer distances (400 km respectively 340 km).

The participants were between 35 and 60 years old and worked currently as master level hearing aid dispensers or as paediatric audiologists.

Prior to the focus group discussions the hearing aid dispensers (HAD) had to fill out a questionnaire at home. The questionnaire surveys the currently used methods and the typical course of hearing aid fitting in everyday practise. The questions and results are shown in section 13.7.

At the beginning of the focus group discussion the participants had to deal with the components of the different steps of hearing aid fitting in two groups: group 1: unaided measurement / hearing aid fitting; group 2: aided measurements / follow-up. This was intended as a starting point and to verify the Scientific Opinion (SO). Each group presented the result of this 60 minutes teamwork to the other group and discussed.

For the illustration, development and verification of the Scientific Opinion (SO) by the hearing aid dispenser, the method focus group illustration map (FGIM) is used. This procedure is a combination of the moderated focus group discussion and the application of knowledge-mapping: A Focus Group Illustration Map can be interpreted as follows. In the centre of each map is the main question, here the 4 steps in hearing aid fitting: 1.) unaided measurements, 2.) hearing aid fitting, 3.) aided measurements 4.) follow-up. Around the centre the core elements (pink fields) for the respective step are arranged. Further descriptions and discrepancies in the group are connected to the core elements. See Pelz and Schmitt (2004) and Pelz (2002).

13.2.1 Unaided Measurements

As essential components of an unaided measurement the categories "counselling", "otoscopy", "audiometry" and "loudness scaling" are found.

The counselling at the beginning fulfils two important functions: On the one hand to find out the objectives and special problems of the hearing impaired person, on the other hand to point out the limits and the possibilities of hearing aids. The counselling can be shortened only by reducing the number of questions / topics, concentrating on those
questions / topics which are absolutely relevant for the following measurements.

The **otoscopy** is regarded as an elementary assumption for the realisation of any kind of measurements or hearing aid fitting.

The **audiometry** contains the components of pure-tone audiometry, (air- and bone conduction) with measurement of the uncomfortable loudness level and speech audiometry. The participating hearing aid dispensers agree that the Freiburger speech test is in fact not necessary – it is only useful for reasons of control. Modern and contemporary test materials using up-to-date technology would be desirable in order to be able to compare the results throughout the entire steps of fitting. For this purpose the Freiburger speech test is not suitable.

The **loudness scaling** is not a basic component of the unaided measurement for all participants since it is not reasonable and/or possible in all cases.

The points mentioned above are the most important results taken from figure 1, which is the Focus Group Illustration Map for the unaided measurements.

### 13.2.2 Hearing aid fitting

The participants normally use the generic **first-fit-algorithms** of the hearing aid companies because it is a good approach for fitting. However, some settings have to be altered right from the start. Fundamental is the subsequent **subjective evaluation** of the hearing aid by the user. This can be done by structured inquiry.

The use of **audio-examples** is an inherent part of hearing aid fitting. For a better comparability between the hearing aids manufacturer-independent audio-materials, preferably with visual anchoring (audio-visual-materials), would be desirable.

Generally the participants state that the use of the **same test material** as well as a **standardized fitting algorithm** would simplify the comparability of different hearing aids. Some participants use real ear measurements (in-situ measurements) as a test of what in fact happens inside the hearing devices. Primarily they are used in problem cases.

See figure 2 for the Focus Group Illustration Map for the hearing aid fitting.

### 13.2.3 Aided measurements

During the discussions about the aided measurements it arose that it is very important to test and compare all hearing aids under **similar test conditions**. For this purpose s of the measurements, the test material as
well as the technical equipment and size of the fitting-room need to be similar.

Generally the fitting routine runs in the “tournament-method” (tournament strategy). The fitting is interactive in order to be able to go into the needs of the hearing impaired person. The interactive fitting is more relevant than the objective fitting since the hearing aid user must be willing to use the hearing aid - that is not always the case for the objectively-prescribed optimum.

An important factor is the consistent and standardised documentation. In this way it could be achieved that specific measurements have to be done by every hearing aid dispenser. These measurements are a kind of baseline and have to be carried out in an identical way. Furthermore there should be a list with measurements to be made in cases where the customer has not achieved his personal optimum yet. Through that the working methods of different hearing aid dispensers become more reproducible, understandable and uniform.

As completion of the aided measurements the hearing aid dispensers want a final evaluation, i.e. a comparison between the initial requirement analysis and the achieved benefit of the hearing aid.

13.2.4 Follow-up

The follow-up includes regular inspection appointments subsequent to the fitting procedure. The lag between the appointments is dependent on the progress of the gradual adjustment and the conditioning. It can be between 14 days and a maximum of 3 months. In some cases a verification of the audiometric characteristics and measurements is necessary, for example if problems arose in special situations. The acceptance of the hearing aid should be recorded, e.g. by questionnaires as COSI. Further components of the follow-up are information about hearing strategies, further trainings (e.g. communication training), introduction to handling and service of the devices and accessories. The integration of the family (the significant others) plays an important role. For example modifications and improvements of the habits linked to the use of or the acceptance of the hearing aid can be achieved.
Unaided Measurements

- Tinnitus?
- State of health?
- Limited number of important questions:
  - Fluctuating hearing loss?

Counselling

- Consideration of the customers preferences
- The limits of the possibilities have to be pointed out

Otoscopie

- In general very important to notice individual problems
- Checkup whether everything is fine inside the ear

Pure-tone audiometry

- Requirement for every measurement
- Maybe the frequencies 125/250 Hz and 8 kHz can be omitted
  - However, this is not a relevant difference - neither temporal nor qualitative

Bone conduction measurements of at least 4 data points necessary

- If other transducers were available, the additional information would be usable
- No possible for optimisation

Pure-tone audiometry

- Loudness discomfort level
- Measurement of loudness discomfort level

Speech audiometry

- Speech tests desirable
- Has to be applied in different phases of fitting: with and without hearing aids
- Comparability possible only in this way

Loudness scaling

- Only for reasons of control
- No utilizable information

Freiburger not necessary

- Checking of understanding/ intelligibility is only possible with a speech test

Other speech-tests desirable

- Appropriate, standardized test materials for up-to-date technology desirable

Figure 1:
Focus Group Illustration Map for the unaided measurements.
In situ-measurements

Manufacturer first-fit

First impression

Questionnaire

For example COSI, which is accepted by private health insurances

Questionnaire accepted by health insurances

Audio-Examples

Independent from hearing aid manufacturer(s)

Evaluating various hearing aids by means of same sound examples

Subjective evaluations to do by the hearing impaired

For example COSI, which is accepted by private health insurances

Good approach

However, some settings have to be altered right from the start

For testing what actually happens within the hearing aids

Identical test materials

Allows comparability of the hearing aids

Preparatory work for other hearing aids can not be used

Standardised fitting-formular

Standardised test materials required for comparability of the hearing aids

Hearing Aid Fitting

Figure 2:
Focus Group Illustration Map for the hearing aid fitting.
Figure 3:
Focus Group Illustration Map for the aided measurements.

- There has to be a prescribed repertory of methods - some of them have to be carried out, the others are optional.
- Until the optimum for the customer is achieved, there has to be a consistent in order that it is reproducible what everybody has done.
- Documentation consistent in order that it is reproducible what everybody has done.
- Interactive fitting requires that the customer has to be willing to use the hearing aid - that's not obligatory for the interactive fitting.
- Objective fitting requires that the customer has to be willing to use the hearing aid - that's not obligatory for the objective fitting.
- The customer has to use the hearing aid - that's not obligatory for the interactive fitting.
- Each hearing aid should be tested in similar conditions.
- There's no optimised standardised test material.
- Speech intelligibility in noise is the most important aim of most hearing impaired persons.
- Standardised measurements in noise are necessary for example character of the room.
- Test materials include standardised soundfiles.
- Scaling is important for example character of the room.
- Standards for room size necessary for example character of the room.
- Technical equipment of the room includes magnetic loop induction system, audiometer, PC, spatial hearing equipment.
- Software which can be used by anyone is necessary.
- There has to be a prescribed repertory of methods - some of them have to be carried out, the others are optional.
- Until the optimum for the customer is achieved, there has to be a consistent in order that it is reproducible what everybody has done.
- Documentation consistent in order that it is reproducible what everybody has done.
- Interactive fitting requires that the customer has to be willing to use the hearing aid - that's not obligatory for the interactive fitting.
- Objective fitting requires that the customer has to be willing to use the hearing aid - that's not obligatory for the objective fitting.
- The customer has to use the hearing aid - that's not obligatory for the interactive fitting.
- Each hearing aid should be tested in similar conditions.
- There's no optimised standardised test material.
- Speech intelligibility in noise is the most important aim of most hearing impaired persons.
- Standardised measurements in noise are necessary for example character of the room.
- Test materials include standardised soundfiles.
- Scaling is important for example character of the room.
- Standards for room size necessary for example character of the room.
- Technical equipment of the room includes magnetic loop induction system, audiometer, PC, spatial hearing equipment.
- Software which can be used by anyone is necessary.

Figure 3:
Focus Group Illustration Map for the aided measurements.
Follow-up

- up to 3 month for persons everything is fine
- from 14 days for people with problems
- conditioning still necessary
- dependent on the needs of the hard of hearing
- objective checking if even more can be accomplished
- "usability first, the intelligibility comes on its own"
- customer has reached his subjective comfortable optimum
- if all elements should be accomplished, an additional assistant would be necessary
- Is it fair to offer the same procedures/performances for hearing aids with and without extra payment?
- sale of basis packages - expensive hearing system --> better aftercare (follow-up)
- change for the worse of the hearing?
- cause study
- subjective sensation?
- Settings of hearing aid?

Follow-up

- certificate for customer and hearing aid dispenser which documents what has been done
- basis for argumentation if the hard of hearing alternates his/her opinion
- formal fitting documentation
- inquiry of the relevants about usage and acceptance of the hearing aid
- integration of relevants
- accessories
- formal fitting documentation
- regular checkups
- gradual adjustment
- verification of characteristic audimetric data
- measurements in noise
- hearing strategies
- handling of the device
- other trainings
- integration of relevants
- fundamentals on usage, attitude and acceptance of the hearing aid
- simulation of how hard of hearing persons hear with and without hearing aids
- what can be done additionally to the hearing system?
- which further options are possible?
- solutions for problematic situations
- USability first, the intelligibility comes on its own
- necessary because the experiences of hearing impaired people that intelligibility is not optimal in noisy situations
- possibly something has changed in the course of the fitting procedure?
- COSS
- testing for acceptability of the hearing aid
- which further options are possible?
13.2.5 Comparison of the Scientific Opinion (SO) to the opinion of the hearing aid dispensers (HAD)

If the Scientific Opinion is compared to the opinion of the hearing aid dispensers it becomes clear that there are many overlaps. The HAD mentioned almost all elements of the Scientific Opinion, although they did not fully describe them.

On the other hand only a few elements which are relevant for the HAD where added to the SO. For example “integration of the family/significant others” and “speech-audiometry in quiet with ‘other’ (than Freiburger) speech material” was appended to the initial SO for the first step “unaided measurements”.

For the second step “hearing aid fitting” the HAD substantiated that it is important to fit 2-3 hearing aids per category. It is important to fit hearing aids of at least 2 categories. The HAD highlighted this fact, because the tournament-strategy for fitting is only applicable for hearing devices within the same category. The choice of the categories is the result of the previous counselling. First of all it is dependent on how much money the hearing impaired can afford to spend and is willing to pay for the hearing aids. In the opinion of one participant it is important to inform the customer about the accessories of the hearing aids during the step of fitting.

For the third step “aided measurements” an alternative to the Freiburger Speech-Test was once more requested, as for unaided measurements (speech-tests in quiet, other speech material).

During the “follow-up” the HAD completed the initial SO by the elements “integration of the family/significant others”, “surveying the benefit of the hearing aid, e.g. with COSI”, “frequent appointments for check-ups, at least 2 per year”.

To conclude, the vision of the HAD for an ideal medical care with hearing aids is close to the initial SO. Most complaints were about speech-audiometry. The HAD want the Freiburger Speech-Test to be replaced by a more contemporary, state of the art and standardised test.

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1 In the German system, hearing aids are categorized according to cost to the client. A base category of hearing aids are fully funded by the health insurance, while aids in higher categories require some payment by the client.
13.3 Results of the focus groups of the hearing impaired with and without hearing aids, compared to the HAD

The aim was to evaluate the relevancy of the individual elements of the Scientific Opinion (SO) which was supplemented with the additional elements of the HAD. The evaluation was done by the HAD themselves and by the hearing impaired persons, both aided and unaided with hearing aids.

All elements of the SO were explained to the hearing impaired by a hearing aid dispenser. He was present in addition to the moderator throughout the whole discussion of the focus group to advise the participants concerning relevant questions about hearing aids and hearing aid fitting. The hearing aid dispenser demonstrated all methods and procedures listed in the SO to the participants, in many cases he used film clips which showed and illustrated the respective procedures.

For reasons of simplicity some of the methods mentioned in the SO were split up in smaller parts for the focus group discussions with the hearing impaired persons. For example the element “speech-tests in quiet” was split in four parts: discomfort level for numbers, words at 65dB SPL, numbers, and optimal loudness for maximum speech intelligibility. Note that the group of the HAD rated this element as a whole, not discriminating between the sub-parts.

13.3.1 Hearing impaired with hearing aids – “hearing aid users (HAU)”

The six participants of this group had been using hearing aids for an average of 20 years (max. 40 years, min. 4 years). At the beginning of the group discussion the participants filled out the International Outcome Inventory for Hearing Aids IOI-HA in the German version in order to guarantee that the degree of the contentment with the hearing aid in this group is uniform. The evaluation of the questionnaires shows however, that there is a similar level of satisfaction throughout the participants of the focus group. (see Appendix C – translated back in English). Thus there is no need to exclude any of the persons in the following analysis for reasons of homogeneity.

All evaluations and filling in of the questionnaires were anonymous and controlled by the assignment of numbers to the participants. Thereby it was possible to track and group together the evaluations of each participant.

If one of the participants differed in his evaluation from the mean of the group significantly, the possibility existed therefore to exclude him from the entire evaluation in order to prevent a biased result.
Thereafter the group had to estimate the duration of the elements of the SO. In this case the elements were combined to four (five) steps as mapped below. Because all participants had knowledge about hearing aid fitting, the estimation (cf. table below) was realistic even though the rating was based on individual experiences of the participants. After that all elements of the SO were presented by the HAD and discussed afterwards. Subsequently the evaluation of the duration for the four (five) steps of the SO was repeated to see how the ratings changed. (cf. table below)

It is not astonishing that the 1st appraisal is already realistic and that there are no large differences as a whole from the appraisal after the SO was presented. The aided and unaided measurements were estimated much shorter in the 1st appraisal. This is a hint that the measurements the participants are used to are shorter than they should be. This means that many HADs do not carry out some of the elements of the SO, cf. the list below.

<table>
<thead>
<tr>
<th></th>
<th>1. Appraisal</th>
<th>2. Appraisal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counselling and unaided measurements</td>
<td>1 h.</td>
<td>clearly longer: 2-3 h.</td>
</tr>
<tr>
<td>Work to be done by the HAD in between 2 appointments</td>
<td>predominant 30 min.</td>
<td>no modification</td>
</tr>
<tr>
<td>Hearing aid fitting</td>
<td>A minimum of 5-6 weeks up to 1/2 year. Approx. 1 h per appointment.</td>
<td>no modification</td>
</tr>
<tr>
<td>Counselling and aided measurements</td>
<td>1/2 - 1 h.</td>
<td>clearly longer: 2 h.</td>
</tr>
<tr>
<td>Follow-up</td>
<td>every 3 - 4 months approx. 1/2 h. per appointment</td>
<td>no modification</td>
</tr>
</tbody>
</table>

During the presentation of the elements of the Scientific Opinion it became obvious, that some measurements are usually not performed at all or performed only rarely. These include:

- **Unaided measurements:** Questionnaires, (horizontal) Localization, Loudness-scaling
- **Hearing aid fitting:** In-situ-measurement (real ear measures.)
Aided measurements:
- In-situ-measurement (real ear measures.)
- (horizontal) Localization
- Loudness-scaling
- Questionnaires

Follow-up
- Questionnaires

13.3.2 Hearing impaired without hearing aids – “no hearing aid users (NHAU)”

This focus group consisted of 8 participants who had had hearing impairments for up to 15 years. For different reasons none of them has used hearing aids regularly.

Nevertheless specific knowledge about hearing aids and hearing aid fitting as well as the elements of the SO was available in the group: One participant was under medical treatment by a hearing aid dispenser, and was at the time testing his hearing aids in everyday-life. Two other participants had gained experiences with hearing aids some years ago during a stay at a health resort.

The previous refusal concerning hearing aids was attributed to the too little psychological strain: “So far I come to grips with it”; “if it gets necessary, I will obtain one”. Some participants indicate that they would still like to wait since technically important improvements are happening now. Other participants had had bad experiences in a test phase or know persons who are dissatisfied with their hearing aids.

At the beginning of the group discussion the participants were asked to estimate the duration of the different steps of hearing aid fitting. For this purpose the participants were explained the most important facts and steps of hearing aid fitting with only a few words.

After the SO was explained in detail by the HAD, the evaluation was repeated, cf. table below for the results. During the discussions it became clear that the participants generally would readily invest “all time of the world” if it leads to an improved result.
<table>
<thead>
<tr>
<th></th>
<th>1. Appraisal</th>
<th>2. Appraisal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Counselling and unaided</td>
<td>1 – 1.5 h.</td>
<td>2 h.</td>
</tr>
<tr>
<td>measurements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work to be done by the HAD in</td>
<td>very different within the group:</td>
<td>Still no precise imagination</td>
</tr>
<tr>
<td>between 2 appointments</td>
<td>less than 30 min. up to 1 h.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hearing aid fitting</td>
<td>about 30 min. - 1 h per hearing</td>
<td>At least 1 h. per appointment,</td>
</tr>
<tr>
<td></td>
<td>aid. Test phase: 1 week - 1/2</td>
<td>several appointments at 2 h.</td>
</tr>
<tr>
<td></td>
<td>year</td>
<td></td>
</tr>
<tr>
<td>Counselling and aided</td>
<td>majority of the group:</td>
<td></td>
</tr>
<tr>
<td>measurements</td>
<td>30 min. 3 participants: 1 h.</td>
<td>1 h.</td>
</tr>
<tr>
<td>Follow-up</td>
<td>3 months - 1 year approx. 1 h.</td>
<td>approx. 30 min. per appointment</td>
</tr>
<tr>
<td></td>
<td>per appointment</td>
<td></td>
</tr>
</tbody>
</table>

The table shows that the duration is estimated slightly greater after the demonstration of the SO.
13.4 Results for comparison

Below the results of the evaluations of the Scientific Opinion of the three focus groups are compared. The three groups had the task to rank the importance of the individual elements within the four steps of fitting. Therefore they had to use the method of “dot distribution / ranking” (cf. guidelines for the design, realisation and analysis of focus groups). The number of dots per participant were the number of elements (per respective step) times 1.5 as proposed in the guidelines.

All figures show the relative quota of entries (dots) referenced to the total number of entries (dots). There are 3 figures for each step: each is ordered by increasing importance for the corresponding group for a better overview.

13.4.1 Unaided Measurements

At first the great differences between the three focus groups are noticeable. In detail the following facts are remarkable:

- Particularly the rank 2 and 3 of the HAD (“structured interview”, “gathering individual problems / objectives” and “integrating the family”) are only of minor importance, especially for the NHAU. → Probably the NHAU think that the physical / technical measurements are more important than counselling. This also appears in the next point:
- For the group of the NHAU adaptive loudness scaling is of greatest relevance. Also speech tests in permanent noise and horizontal localization play a big role (rank 2 and 3). → This might be due to the fact that in this group some participants were having considerable problems with spatial hearing and hoping for better diagnosis through this procedure.
- The HAU attribute a high importance to pure-tone audiometry. This is somewhat surprising. → Presumably they consider this procedure as a basic entrance into hearing aid fitting.
- Very important is the fact that the HAU and the NHAU assess the methods for checking the intelligibility of speech in noise or in quiet much higher than the HAD do. → This reveals that the ability to communicate is by far the most important issue for the hearing impaired participants.
- To point out the course of the fitting-procedure, only for the hearing impaired persons the elements “selection of hearing aids” and “hearing in special situations” was added to the SO (box with orange background in following 3 figures).

For reasons of simplicity the “speech-tests in quiet” was split into four parts: discomfort level for numbers, words at 65dB SPL, numbers, and optimal loudness for max. speech intelligibility for the groups with the hearing impaired persons (cf. boxes with yellow background). Note that the HAD rated these elements as a whole – therefore the total ranking is
shown for all of the 4 elements (although it was in fact rated as one element by the HAD, cf. boxes with yellow background...)

- The HAD had the additional element “speech in quiet with other (than Freiburger) speech materials” (box with green background) → this was rated most important by the HAD, showing that there is a considerable level of dissatisfaction with the Freiburger speech test.
Unaided Measurements (ordered by "HAD")

- Questionnaire: hearing impairment in special situations
- Selection of appropriate hearing aids
- Tympanometry
- Tuning fork testing
- Speech tests in quiet: opt. loudness for max. speech intelligibility
- Speech tests in quiet: discomfort-level for numbers
- Speech tests in quiet: words at 65 dB SPL
- Speech tests in quiet: Numbers
- Horizontal localisation
- Comparison: Pure-tone audiometry - speech audiometry
- Speech tests in noise (noise synchronously with speech)
- Speech tests in permanent noise at 65 and 75 dB SPL
- Otoscopy
- Questioning: hearing impairment, expectations concerning the HA
- Counselling: hearing aid-fitting: course, limits, possibilities…
- Pure-tone audiometry
- Left/Right/Binaural: Loudness-Scaling
- Informing the family
- Questionnaire/Conversation: gathering individual problems/objectives
- Structured Interview about medical case history
- Speech in quiet with other (than "Freiburger") speech-materials

Quota [%]
Unaided Measurements (ordered by "no HA-Users")

- Speech in quiet with other (than "Freiburger") speech-materials
- Tympanometry
- Tuning fork testing
- Informing the family

Questionnaire: hearing impairment in special situations
- Comparison: Pure-tone audiometry - speech audiometry
- Otoscopy
- Structured Interview about medical case history

Speech tests in quiet: cpt. loudness for max. speech intelligibility
- Speech tests in quiet: discomfort-level for numbers
- Questioning: hearing impairment, expectations concerning the HA
- Counselling: hearing aid-fitting: course, limits, possibilities…
- Questionnaire/Conversation: gathering individual problems/objectives
- Speech tests in noise (noise synchronously with speech)

Selection of appropriate hearing aids
- Speech tests in quiet: words at 65 dB SPL
- Pure-tone audiometry

Speech tests in quiet: Numbers
- Horizontal localisation
- Speech tests in permanent noise at 65 and 75 dB SPL
- Left/Right/Binaural: Loudness-Scaling
Unaided Measurements (ordered by "HA-Users")

- Speech in quiet with other (than "Freiburger") speech-materials
- Tuning fork testing
- Tymanometry
- Horizontal localisation
- Otoscopy
- Informing the family
- Questionnaire/Conversation: gathering individual problems/objectives
- Speech tests in noise (noise synchronously with speech)
- Questionnaire: hearing impairment in special situations
- Comparison: Pure-tone audiometry - speech audiometry
- Selection of appropriate hearing aids
- Speech tests in quiet: words at 65 dB SPL
- Left/Right/Binaural: Loudness-Scaling
- Counselling: hearing aid-fitting: course, limits, possibilities…
- Speech tests in permanent noise at 65 and 75 dB SPL
- Structured Interview about medical case history
- Speech tests in quiet: discomfort-level for numbers
- Questioning: hearing impairment, expectations concerning the HA
- Speech tests in quiet: opt. loudness for max. speech intelligibility
- Pure-tone audiometry
- Speech tests in quiet: Numbers

Quota [%]
13.4.2 Fitting-procedure of the hearing aid

In this step of the fitting-procedure the different objectives of the three groups are getting particularly obvious:

- The HAD classifies those procedures as especially relevant, which give him best information for the fitting procedure itself: “first rating of the hearing aids like speech intelligibility and sound quality” and “defining objectives with questionnaires and consultation”.
- The experienced HAU estimates the test of the hearing aids in everyday life as most important.
- The inexperienced NHUA puts the focus onto the search for the best hearing aid and estimates the possibility to test at least three hearing aids especially high (so do the HAU). The HAD evaluates this element with a rank of 8 – this is because this element is very time consuming for him.
- For the HAU the “rating of tested hearing aids with questionnaires” is important (rank 2.5), too. On the other hand, no participant of this group had ever used questionnaires of this kind in his personal medical care with hearing aids. Nevertheless they are perceived as an important element of information.
- The above element is of small importance for the two other groups (HAD, NHUA). However, the general rating of the hearing-system is somewhat of medium importance for the HAD.
Fitting (ordered by "HAD")

- Rating the tested hearing aids with questionnaires (Hörtech inventories, COSI) - rate of improvement by hearing aid
- Explanation of handling, care and service of hearing aids
- Documentation of all hearing aids with real-ear-measurements
- At least 3 hearing aids (one without additional payment) with different technical properties will be (first-) fitted
- At least 2 hearing aid will be fitted in several sessions for the customers requirements and preferences
- Testing of hearing aids in everyday life at home (at least 2 weeks)
- Rating of hearing aid
- Gradual adjustment (gradual build-up of amplification)
- Taking ear-impressions
- Defining objectives with questionnaires and consultation
- First rating of the hearing aids: sound, speech intelligibility
At least 3 hearing aids (one without additional payment) with different technical properties will be (first-) fitted

- Taking ear-impressions
- Testing of hearing aids in everyday life at home (at least 2 weeks)
- At least 2 hearing aid will be fitted in several sessions for the customers requirements and preferences
- First rating of the hearing aids: sound, speech intelligibility
- Gradual adjustment (gradual build-up of amplification)
- Documentation of all hearing aids with real-ear-measurements
- Rating the tested hearing aids with questionnaires (Hörtech inventories, COSI) -> rate of improvement by hearing aid
- If necessary: another real-ear measurement for selected hearing aid
- Defining objectives with questionnaires and consultation
- Explanation of handling, care and service of hearing aids
- Rating of hearing aid
Fitting (ordered by "HA-Users")

- Rating of hearing aid
- If necessary: another real-ear measurement for selected hearing aid
- Explanation of handling, care and service of hearing aids
- Taking ear-impressions
- Defining objectives with questionnaires and consultation
- Documentation of all hearing aids with real-ear-measurements
- At least 2 hearing aid will be fitted in several sessions for the customers requirements and preferences
- First rating of the hearing aids: sound, speech intelligibility
- Gradual adjustment (gradual build-up of amplification)
- Rating the tested hearing aids with questionnaires (Hörtech inventories, COSI) -> rate of improvement by hearing aid
- At least 3 hearing aids (one without additional payment) with different technical properties will be (first-) fitted
- Testing of hearing aids in everyday life at home (at least 2 weeks)
13.4.3 Aided measurements

Within this step of fitting the rating of importance is widely similar, except for two elements:

- Concerning the most important element the HAU and the HAD agree that the selection “subjective selection of preferred hearing aid” is most relevant.
- The NHAU classify “speech audiometry in noise” as most important in this step.
- The 2nd rank of the HAD “finally rating the tested hearing aids with questionnaires” achieves only rank 7 respectively 8 for HAU / NHAU. This might be due to the fact that for the HAU/NHAU finding the right hearing aid seems more important than verifying if it is actually the right one.
- The discrepancy between the HAU / NHAU and the HAD concerning the “speech tests in quiet / noise” (HAU+NHAU: rank 3, HAD: rank 10) might result from the fact, that the HAD had the additional element “speech audiometry in quiet – different speech material” (cf. box with green background in the next 3 figures) which they ranked place 3. The HAU / NHAU did not have this element – nevertheless “speech test in quiet” are in general ranked place 3 for all groups.
Aided Measurements (ordered by "HAD")

- Speech tests in quiet
- Binaural speech test in quiet with different levels
- Real-ear measurements (at different levels, with different features of hearing aid switched on/off)
- Horizontal localisation
- Documentation of settings of the selected hearing aid
- Left/Right/Binaural: Loudness-Scaling
- Speech tests in permanent noise at 65 and 75 dB SPL
- Speech audometry in quiet - different speech-material (other tests than "Freiburger")
- Rating the tested hearing aids with questionnaires (Hörtech inventories, COSI) -> rate of improvement by hearing aid
- Subjective selection of preferred hearing aid (If no preference: comparing speech intelligibility or sensation of loudness)
Aided Measurements (ordered by "No HA-Users")

- Speech tests in quiet
- Binaural speech test in quiet with different levels
- Rating the tested hearing aids with questionnaires (Hörtech inventories, COSI) - -> rate of improvement by hearing aid
- Documentation of settings of the selected hearing aid
- Real-ear measurements (at different levels, with different features of hearing aid switched on/off)
- Horizontal localisation
- Subjective selection of preferred hearing aid (If no preference: comparing speech intelligibility or sensation of loudness)
- Speech tests in quiet
- Left/Right/Binaural: Loudness-Scaling
- Speech tests in permanent noise at 65 and 75 dB SPL

Quota [%]

- HAD
- No HA-Users
- HA-Users
Aided Measurements (ordered by "HA-Users")

- Speech audometry in quiet - different speech-material (others tests than "Freiburger")
- Binaural speech test in quiet with different levels
- Horizontal localisation
- Rating the tested hearing aids with questionnaires (Hörtech inventories, COSI) - -> rate of improvement by hearing aid
- Real-ear measurements (at different levels, with different features of hearing aid switched on/off)
- Speech tests in permanent noise at 65 and 75 dB SPL
- Documentation of settings of the selected hearing aid
- Speech tests in quiet
- Left/Right/Binaural: Loudness-Scaling
- Subjective selection of preferred hearing aid (If no preference: comparing speech intelligibility or sensation of loudness)

Quota [%]
13.4.4 Follow-up

Concerning the most important element of the follow-up all groups agree:

- “Follow-up over five years: 3-4 appointments for check-ups and service, 2 for check-up of handling, 2 for check-up of skin irritation was rated most important for all groups.
- For the HAU the element “monitoring of user-contentment” is just as important as the before mentioned element, but this is rather insignificant for the two other groups.
- The HAU do not need any further arrangements (“audiologic therapy, psychosocial advice,...”) due to their long-standing experience with hearing aids – the NHAU and the HAD rate this element as quite important.
- The sense and purpose of the complete formal fitting documentation is not obvious for the HAU and NHAU: they rate this element clearly inferior than it was rated by the HAD.
- The importance of the regular appointments for check-ups cannot be estimated by the NHAU – therefore it has a less superior role than it has for the HAU and HAD.
Follow-Up (ordered by "HAD")

- After half a year: Monitoring of user-contentment with hearing aid (COSI, IOI-HA)
- Support for intrinsic motivation
  - Appointments for further checkups
  - Information about accessories
  - Handing over the fitting-documents ("hearing-pass")
  - Counselling about further possibilities: training of hearing and communication
  - Complete formal fitting documentation
  - Open repair-service (without appointment)
  - Determining needs for further actions: audiologic therapy, psychosocial advice...
  - Comparing achieved with expected objectives
  - Guidance for handling and care of the hearing aid
- Follow-up for 5 years: 2-4 checkups of hearing aids and earmolds; service, cleaning, handling, skin-kindness, …

Quota [%]

HAD
No HA-Users
HA-Users
Follow-Up (ordered by "No HA-Users")

- Integration of the family
- Support for intrinsic motivation
- Appointments for further checkups
- Complete formal fitting documentation
- After half a year: Monitoring of user-contentment with hearing aid (COSI, IOI-HA)
- Information about accessories
- Counselling about further possibilities: training of hearing and communication
- Guidance for handling and care of the hearing aid
- Handing over the fitting-documents ("hearing-pass")
- Open repair-service (without appointment)
- Determining needs for further actions: audioligic therapy, psychosocial advice...
  - Comparing achieved with expected objectives
- Follow-up for 5 years: 2-4 checkups of hearing aids and earmolds; service, cleaning, handling, skin-kindness,...
Follow-Up (ordered by "HA-Users")

- Follow-up for 5 years: 2-4 checkups of hearing aids and earmolds; service, cleaning, handling, skin-kindness,…
- After half a year: Monitoring of user-contentment with hearing aid (COSI, IOI-HA)
- Guidance for handling and care of the hearing aid
- Open repair-service (without appointment)
- Information about accessories
- Appointments for further checkups
- Handing over the fitting-documents ("hearing-pass")
- Determining needs for further actions: audioligic therapy, psychosocial advice...
  Comparing achieved with expected objectives
- Complete formal fitting documentation
- Counselling about further possibilities: training of hearing and communication
- Support for intrinsic motivation
- Integration of the family:

Quota [%]

HAD
No HA-Users
HA-Users
13.5 Discussion and outlook

First of all, the used method of focus group discussions worked well for our purpose, the guidelines used are adequate to fulfil the objectives of this study.

To recapitulate, the method of focus groups is an “open” form of interviewing: The participants can announce their arguments and views in their own words, not biased in any way. The biggest benefit is to get the information of the participants in their own context, with their own rank of importance and point of view. Furthermore important is the fact that it is easily possible to get new (but for the participants relevant) facts into the discussions. This would be impossible with questionnaires or “closed” interviews, where the participants only can put their answers in the structure given by the questionnaire/interviewer.

The proposed Scientific Opinion (Appendix A) is well suited for hearing aid fitting, all important elements are included. Nevertheless the importance of the various elements is ranked differently by the three participating groups – in the following some important points are summarised:

The vision of the hearing aid dispensers in Germany for an “ideal medical care with hearing aids” is close to the initial Scientific Opinion. Most complaints were about speech-audiometry. The hearing aid dispensers want the Freiburger Speech-Test to be replaced by a more contemporary, state of the art and standardised test.

The hearing aid dispensers classify as especially relevant those procedures that give the best information to guide the fitting procedure itself: Besides the objective measurements, the ratings done by the hearing impaired are most important.

During the presentation of the elements of the Scientific Opinion it became obvious that some measurements are at present usually not performed at all or are performed only rarely. These include: questionnaires, horizontal localization and loudness-scaling for the unaided measurements; in-situ-measurement (real ear measurements) for hearing aid fitting; in-situ-measurement (real ear measurements), horizontal localization, loudness-scaling and questionnaires for the aided (evaluation) measurements; and questionnaires during the follow-up.

During the discussions it became clear, that the hearing impaired participants generally would readily invest “all time of the world” if it finally led to an improved result.

The hearing impaired people who were not using hearing aids, attributed their non-use to their experience of relatively low psychological strain: “So far I come to grips with it”; “if it gets necessary, I will obtain one”. Other participants had had bad experiences in a test phase or know persons who
are dissatisfied with their hearing aids. During the fitting-procedure they think that the physical / technical measurements are more important than counselling.

Hearing aid users attribute a high importance to pure-tone audiometry. Presumably they consider this procedure as a basic entrance into hearing aid fitting.

Very important is the fact that the hearing impaired users assess the methods for checking the intelligibility of speech in noise or in quiet much higher than the HAD do. This is because the ability to communicate is very important for the hearing impaired, for most of them it is by far the most important issue.

Experienced hearing aid users estimate the test of the hearing aids in everyday life as very important.

The hearing impaired participants who had not used hearing aids put the focus onto the search for the best hearing aid. All hearing impaired estimate the possibility to test at least 3 hearing aids especially high. “Finding” the right hearing aid seems to be very important, more important than verifying if the fitted aid is effective and more important that making an optimal fit for a “first-guess” hearing aid.

13.6 (Initial) Scientific Opinion, collected by the Project Partners

<table>
<thead>
<tr>
<th>Unaided measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Counselling and preliminary audiological talk</strong></td>
</tr>
<tr>
<td><strong>Medical anamnesis</strong></td>
</tr>
<tr>
<td>• Counselling/information about course of hearing aid provision.</td>
</tr>
<tr>
<td>• General information about assets and drawbacks of hearing aids, specific characteristics, possible applications.</td>
</tr>
<tr>
<td>• Free interview about problems and expectations.</td>
</tr>
<tr>
<td>• Informing / Integrating the family of the customer</td>
</tr>
<tr>
<td>• Structured interview about medical history and complaints (e.g. sudden deafness, otitis media, ear pain, ear surgery, tinnitus, congenital hearing loss, dizziness</td>
</tr>
<tr>
<td>• Otoscopy</td>
</tr>
<tr>
<td>• Tuning fork testing (optional)</td>
</tr>
<tr>
<td>• Tympanometry (optional)</td>
</tr>
</tbody>
</table>
### Questionnaire
- Collecting individual problems and aims, e.g.:
  - COSI, "Oldenburg Inventory I
  - Glasgow Hearing Aid Benefit Profile (GHABP) initial assessment;
  - Speech, Spatial and Qualities of Hearing Scale (SSQ).

### Standard audiometry in quiet (headphones)
- Pure tone audiogram air and bone conduction with adequate masking.
- Speech audiogram with monosyllabic words (complete performance intensity functions from threshold to uncomfortable loudness level, intelligibility at 65 dB SPL)
- Comparison pure tone audiogram and speech audiogram.

### Speech audiometry in noise (headphones)
- Assessment of the critical signal to noise ratios for sentences per ear in both stationary and fluctuating noise with the same long-term average spectrum as the speaker, $S_{0N90}$ or $S_{0N90}$. Materials e.g.:
  - Adaptive Göttingen or Oldenburg sentence test, noise presentation level 65 or 75 dB SPL
  - Plomp and Mimpen (1979)
  - Versfeld et al. (2000) with an adaptive procedure.

### Loudness scaling
- Adaptive loudness scaling per ear using the ACALOS-procedure for the following signals (alternative):
  - Narrow band at 0.5, 1.5, 4 kHz
  - narrow band Low-Noise Noise (LNN) at 0.75 and 3 kHz;
  - broad band low-noise noise (speech spectrum).
- Preferred setting through headphones. In case of free field measurements, earplug in ear contralateral to test ear.

### (Horizontal) localization
- Short noise bursts are presented from different azimuths (usually presented by nine to thirteen loudspeakers in half a circle from -90 to +90°).

During the focus group discussion the following point was added due to the opinion of the present hearing aid dispensers:

### Speech-tests in quiet
- Other than “Freiburger”-speech-test materials
**Hearing aid fitting (+ Defining goals for rehabilitation and technical options)**

| Defining goals                          | • Defining goals for rehabilitation based on anamnestic data, the unaided measurements, results of the questionnaires.  
|                                        | • Counselling about realistic expectations. |
| Technical options                      | • Choice of ear(s) to be fitted.  
|                                        | • Choice of type of hearing aid(s).  
|                                        | • Specification of type of earmould. |
| Earmould                               | • Taking ear-impressions, Administration for production of earmould. |
| Fitting and fine tuning                | • Prescriptive fitting of at least 3 hearing aids according to manufacturer or generic fitting rules (usually one basic aid with full reimbursement of the costs and one more complex hearing aid with an own financial contribution).  
|                                        | • Testing at least 3 hearing aids in everyday life.  
|                                        | • First rating of speech intelligibility and sound quality.  
|                                        | • Fine tuning of at least one hearing aid (in several sessions).  
|                                        | • If necessary, gradual build-up.  
|                                        | • Real-ear measurements |
| Questionnaires (optional)              | • Rating of hearing aid system: “Oldenburg inventory R + I“, COSI |
| Counselling                            | • Explanation of handling and care, service, and usage. |

**Evaluation measurements (“Aided Measurements”)**

| Selection                                    | • The subjectively favoured hearing aid is measured as result of fitting. If several hearing aids are rated subjectively the same, a sentence test in noise or a loudness scaling can be comparatively performed. |
| Speech audiometry in quiet (free field)     | • Intelligibility measured for each individual aided ear (contra-lateral ear blocked) and for both ears bilaterally fitted with hearing aids, if applicable.  
|                                            | • The speech is presented at different levels and the hearing aids are used in the preferred gain setting. |
| Speech audiometry in noise (free field)     | • Permanent noise at 65 and 75 dB SPL. |
### Aided loudness scaling (free field)
- Adaptive loudness scaling (free field) per ear using e.g. the ACALOS-procedure.

### Horizontal localization (free field)
- Short noise bursts are presented from different azimuths (usually presented by nine to thirteen loudspeakers in half a circle from -90 to +90 degrees).

### Questionnaire
- Inventory of hearing aid benefit in real life (Oldenburg Inventories, COSI)

### Documentation
- Settings of the selected hearing aids
- Insertion gain measurements ↔ Real-ear measurements (at different levels, with basic features switched on/off) → The selected hearing aids are characterised with real-ear measurements using a broadband speech noise at three levels: 55, 65, and 80 dB SPL. The hearing aids are used in the preferred gain setting. The hearing aids are measured after deactivation of noise reduction circuitry in an omni-directional mode. The curves obtained are compared with generic prescription rules for non-linear hearing aids (usually NAL-NL1 of DSL i/o).

During the focus group discussion the following point was added due to the opinion of the present hearing aid dispensers:

<table>
<thead>
<tr>
<th>Speech-tests in quiet</th>
<th>Other than “Freiburger”-speech-test materials</th>
</tr>
</thead>
</table>

### Follow-up

**Closing of provision**
- Explain handling and care of the hearing aid to the user
- Arrange regular checkups
- Hearing pass as documentation for the user
- Present information about accessories to the user
- Complete formal fitting documentation

**Additional rehabilitation needs**
- Counselling about other training (speech-reading, hearing strategies and communication training).
- Strategies to encourage the hearing impaired to wear the hearing aids (intrinsic motivation).
- Determine need of other action (compare expectation with achieved aims), e.g. audiological therapy, psychosocial consulting.
### Follow-up appointments along 5 years
- Open repair-service (without appointment)
- After half a year: Monitoring the user contentment (COSI, IOI-HA)
- 2 check-up dates (hearing device) per year
- 2 check-up dates (handling) per year
- 2 check-up dates (outer ear with and without hearing device with regards to dents and skin irritation)
- Service

During the focus group discussion the following point was added based on input from the participating hearing aid dispensers:

| Closing of provision | • Integrating the family of the customer |
13.7 B: Questionnaire for the hearing aid dispensers (HAD) concerning the methods and course of hearing aid fitting.

Prior to the focus group discussions the hearing aid dispenser (HAD) had to fill out a questionnaire at home. The questionnaire surveys the currently used methods and the typical course of hearing aid fitting in everyday practice. The questions and results are shown here. The original language was German, here everything is translated in English:

I. Which Strategy do you use for Hearing Aid Fitting?

II. How many different hearing aids (HA) do you use on average in fitting one hearing impaired person?
III. Do you let the hearing impaired person try high quality hearing aids although he mentioned that he do not want to spend an own financial contribution?

IV. Do you follow the recommendation of the hearing aid company about the earmould? E.g.

venting, horn, hook

V. Do you include the earmould characteristics in the gain calculation, if the hearing aid company asks for?

Reasons:
- reasonable
- less work
- no occlusion-effects
- Better compensation for low frequencies

VI. Do you use the fitting rule proposed by the hearing aid company?
VII. Do you use a fitting rule of your own choice?

- Yes, Always
- Yes, Sometimes
- No

VIII. If the hearing aid company provides both proprietary and generic fitting rules like e.g. NAL, do you use the proprietary or the generic fitting rules?

- Proprietary
- Generic
- Both

IX. Which fitting rules except the proprietary rules do you use?

- NAL
- NAL-NL1
- DSL I/O
- POGO (II)
- Berger

X. Would it help you if all hearing aid companies would use the same fitting rule for a better comparison of hearing aids?

- Yes
- No
XI. If the hearing aid companies provide extra tests or materials, do you use these?

- Verification of interactive fitting
- Optimizing the settings
- Better spontaneous acceptability
- Simulation of sounds (everyday life situations?)
- Fine tuning
- Informations about product
- Demonstration of specific features (e.g. directivity <-> omni-directivity)

Reasons:

Yes, Always: 80%
Yes, Sometimes: 15%
No: 5%

XII. Do you change the preset of the hearing aid companies already before the fitting? E.g. increase the gain

- Decreasing (total) gain
- No max. tonal equalisation
- Gain for low frequencies
- Reduction of MPO

Reasons:

Yes, Always: 40%
Yes, Sometimes: 35%
No: 25%

XIV. Do you use the expert/enhanced mode for hearing aid fitting?

- More settings (parameters)
- Enhanced possibilities to change settings
- Finer tuning of the settings
- Better overview of settings
- No associated changes between parameters
- To account for customer preferences right from the start

Reasons:

Yes, Always: 85%
Yes, Sometimes: 10%
No: 5%

XV. What are the most common reasons why you perform fine tuning? Please order by numbering

- Own voice
- Speech in noise not intelligible well enough
- Sound of hearing aid
- Speech in quiet not intelligible well enough
- Traffic Noise

Other Reasons:
- Ambient noise
- Intelligibility of TV-set
- Intelligibility over "longer distances"
XVI. How often do you perform fine tuning per hearing aid?

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Rel. Quota [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 times</td>
<td>10</td>
</tr>
<tr>
<td>3-4 times</td>
<td>70</td>
</tr>
<tr>
<td>More than 4 times</td>
<td>20</td>
</tr>
</tbody>
</table>

XVII. What do you change during fine tuning?

<table>
<thead>
<tr>
<th>Change</th>
<th>Rel. Quota [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting of Hearing Aid</td>
<td>0</td>
</tr>
<tr>
<td>Earmold</td>
<td>60</td>
</tr>
<tr>
<td>Both</td>
<td>40</td>
</tr>
</tbody>
</table>

XVIII. What do you change more often?

<table>
<thead>
<tr>
<th>Change</th>
<th>Rel. Quota [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hearing Aid</td>
<td>90</td>
</tr>
<tr>
<td>Earmold</td>
<td>10</td>
</tr>
</tbody>
</table>

XIX. Do you use the Freiburger speech test (monosyllables) in quiet at 65 dB in free field?

<table>
<thead>
<tr>
<th>Use</th>
<th>Rel. Quota [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>100</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
</tr>
</tbody>
</table>
XX. Do you use another speech test in quiet?

XXI. Do you use the Freiburger speech test (monosyllables) in noise at 65 dB in free field?

XXII. Do you use another speech test in noise?

XXIII. Do you perform real ear measurements?
XXIV. Do you perform loudness scaling?

XXV. Do you measure the aided audiogram?

XXVI. Do you use questionnaires?

XXVII. Do you perform other measurements that were not mentioned here?

- "Toleranztest" (? = UCL?)
- Localisation
- Visible Speech
13.8 C: Results of the International Outcome Inventory for Hearing Aids (IOI-HA)

In the following are the results for the 6 participants of the focus groups “aided hearing impaired” persons. The participants used the German version of this questionnaire. The results were translated into English.

1.) Think about how much you used your present hearing aid(s) over the past two weeks. On an average day, how many hours did you use the hearing aid(s)?

![Bar chart showing the number of participants for different hours of hearing aid use.]

- none
- less than 1 hour a day
- 1 to 4 hours a day
- 4 to 8 hours a day
- more than 8 hours a day

<table>
<thead>
<tr>
<th>Hours of Use</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>2</td>
</tr>
<tr>
<td>less than 1 hour a day</td>
<td>3</td>
</tr>
<tr>
<td>1 to 4 hours a day</td>
<td>0</td>
</tr>
<tr>
<td>4 to 8 hours a day</td>
<td>1</td>
</tr>
<tr>
<td>more than 8 hours a day</td>
<td>0</td>
</tr>
</tbody>
</table>
2.) Think about the situation where you most wanted to hear better, before you got your present hearing aid(s). Over the past two weeks, how much has the hearing aid helped in those situations?

- 0: helped not at all
- 1: helped slightly
- 2: helped moderately
- 3: helped quite a lot
- 4: helped very much

Number of participants:

3.) Think again about the situation where you most wanted to hear better. When you use your present hearing aid(s), how much difficulty do you STILL have in that situation?

- 0: no difficulty
- 1: slight difficulty
- 2: moderate difficulty
- 3: quite a lot of difficulty
- 4: very much difficulty

Number of participants:
4.) Considering everything, do you think your present hearing aid(s) is worth the trouble?

- not at all worth it
- slightly worth it
- moderately worth it
- quite a lot worth it
- very much worth it

5.) Over the past two weeks, with your present hearing aid(s), how much have your hearing difficulties affected the things you can do?

- affected very much
- affected quite a lot
- affected moderately
- affected slightly
- affected not at all
6.) Over the past two weeks, with your present hearing aid(s), how much do you think other people were bothered by your hearing difficulties?

- bothered very much
- bothered quite a lot
- bothered moderately
- bothered slightly
- bothered not at all

7.) Considering everything, how much has your present hearing aid(s) changed your enjoyment of life?

- worse
- no change
- slightly better
- quite a lot better
- Very much better