

This item is the archived peer-reviewed author-version of:

The knowledge and beliefs regarding practical aspects of cochlear implants : a study of otorhinolaryngologists in a secondary setting in a multi-country study

Reference:

D' Haese Patrick, Van Rompaey Vincent, De Bodt Marc, Van de Heyning Paul.- The know ledge and beliefs regarding practical aspects of cochlear implants : a study of otorhinolaryngologists in a secondary setting in a multi-country study
Cochlear implants international - ISSN 1467-0100 - 19:1(2018), p. 14-21
Full text (Publisher's DOI): <https://doi.org/10.1080/14670100.2017.1385141>
To cite this reference: <https://hdl.handle.net/10067/1529550151162165141>

The knowledge and beliefs regarding practical aspects of cochlear implants: a study of Otorhinolaryngologists in a secondary setting in a multi-country study

Patrick S.C. D’Haese M.B.A.¹, Vincent Van Rompaey MD, PhD^{2,3}, Marc De Bodt, PhD^{2,4}, Paul Van de Heyning MD, PhD^{2,4}.

Cochlear Implants Int. 2018 Jan;19(1):14-21. doi: 10.1080/14670100.2017.1385141. Epub 2017 Oct 10.

¹MED-EL GmbH, Innsbruck, Austria.

²Antwerp University Hospital – University of Antwerp, Edegem, Antwerp, Belgium

³Faculty of Medicine and Health Sciences, University of Antwerp, Antwerp, Belgium

⁴Department of Speech, Language and Hearing Sciences, Ghent University, Ghent, Belgium

Corresponding author:

Patrick D’Haese

Address: Fuerstenweg 77a, 6020 Innsbruck, Austria

Telephone: +43577885237

Email: patrick.dhaese@medel.com

Biographical note: Patrick D’Haese is the Corporate Director of Awareness and Public Affairs for MED-EL. Over the last 20 years, he has been working in the field of hearing implants. He holds a degree in speech and language pathology, audiology and business administration. Over the years,

he has lectured and published widely on cochlear implants and has been involved in several research studies and clinical investigations.

Paul van de Heyning

Address: Wilrijkstraat 10, 2650 Edegem, Belgium

Telephone: +323821 33 85

Email: paul.van.de.heyning@uza.be

Biographical note: Professor in tenure and Chairman of the University Department of Otorhinolaryngology and Head and Neck Surgery of the Antwerp University Hospital and University of Antwerp. He is strongly focused on otology - neurotology and cochlear implantation and is the scientific chairman of the HEARRING network. In June 2018, he will be the President of the 15th International Conference on Cochlear Implantation and other Implantable Devices in Antwerp, Belgium. He is author/co-author of more than 400 peer reviewed international publications and has supervised more than 50 PhD theses.

Marc De Bodt

Address: Wilrijkstraat 10, 2650 Edegem, Belgium

Telephone: +323821 33 85

Email: Marc.DeBodt@uza.be

Biographical note: Professor at the University of Antwerp, Antwerp, Belgium and at Ghent University, Ghent, Belgium. He is the director of the Rehabilitation Center for Communication Disorders at the University Department of Otorhinolaryngology and Head and Neck Surgery of the Antwerp University Hospital. He has published and lectured widely.

Vincent Van Rompaey

Address: Wilrijkstraat 10, 2650 Edegem, Belgium

Telephone: +323821 33 85

Email: vincent.vanrompaey@uza.be

Biographical note: Prof. Vincent Van Rompaey has been appointed as an otolaryngologist at the Antwerp University Hospital, chaired by prof. Paul Van de Heyning. He is dedicated to specialized care and surgical rehabilitation of patients suffering from otologic and neurotologic diseases, as well as benign and malignant tumours of the skull base. Vincent Van Rompaey performed his PhD-research on quality assurance in middle ear surgery and has currently published over 50 peer-reviewed journal articles.

Contributors: All authors contributed the planning, study design, interpretation of the data and/or review of the final paper.

Funding: MED_EL GmbH provided funding for the study

Conflicts of Interest Patrick D’Haese is an employee of MED-EL GmbH, Innsbruck, Austria. Prof. Van de Heyning receives grants to the institution from MED-EL and Cochlear.

Ethical Approval: No ethical board approval was required for this study.

Word Count: 3,890

Key Words: Elderly adults, health belief model, cochlear implant, internet, utilization, referral rates, penetration

Abstract:

Objective: The main goal of this study was to determine the knowledge and beliefs of otorhinolaryngologists in a secondary setting in selected economically advanced European countries concerning severe hearing loss, hearing aids, and cochlear implants. Secondary goals of the study looked into the information sources of the otorhinolaryngologists and into key topics of importance for these professionals. In Europe many adults who could benefit from a cochlear implant do not have one despite their availability via national health care systems. This lack of coverage might be due, in part, to the knowledge and beliefs of otorhinolaryngologists.

Methods: Otorhinolaryngologists in a secondary setting in Germany, England, France, Austria, and Sweden were emailed a custom- made questionnaire on their knowledge and beliefs regarding hearing loss and its treatments. Results were presented in relative frequencies (%) according to each nation.

Results: 240 otorhinolaryngologists responded (50 from each nation except Sweden). Each nation regarded rehabilitation and hearing preservation as particularly important in cochlear implants. National and international conferences and conversations with colleagues were much more popular methods of keeping abreast of medical issues than other information sources such as online media or company information.

Conclusion: The otorhinolaryngologists of the surveyed nations share many common beliefs about hearing loss, hearing aids, and CIs, although some national variation in opinion is present.

The otorhinolaryngologists of each nation are knowledgeable but could still benefit from an increased knowledge and awareness of hearing loss treatment modalities.

Keywords: hearing loss, hearing aids, cochlear implants, awareness

Introduction

Cochlear implantation is now a standard treatment for severe sensorineural hearing loss. An estimated 324,200 people have received a cochlear implant (CI); people of all ages are routinely implanted in many countries (NIDCD 2013). The rate of major complications is quite low: generally reported to be between 3%–6% (Ciorba et al. 2011, Stamatiou et al. 2011, Tarkan et al. 2013).

While the extent to which any individual child or adult benefits from receiving a CI depends on a variety of factors, many CI recipients develop the ability to understand and produce speech even to the extent of being able to use a telephone (Anderson et al. 2006, Clinkard et al. 2011, Rigotti et al. 2013) and enjoy music (Kohlberg et al. 2014). CI users enjoy a higher quality of life than they had pre-implantation (Francis et al. 2002, Olze et al. 2011, Arnoldner et al. 2014) and only approximately 3% of CI users elect to stop using their device (Bhatt et al. 2003, Ray et al. 2006, Archbold et al. 2009, Özdemir et al. 2013).

Countered with the drawbacks of getting a CI, namely 1) having to regularly attend post-implantation rehabilitation sessions and 2) that CI users with post-lingual deafness may (initially) find the sound disappointing compared to that which they had enjoyed before the onset of hearing loss; deciding to get a CI would seem an easy choice for eligible and informed candidates, especially in countries where the national health system covers much, if not all of, the cost of cochlear implantation. Yet, only an estimated 5% of potential CI users in Western Europe, the region where one might reasonably expect the highest coverage, have a CI (Briggs 2011).

Patients might not be able to benefit from cochlear implantation if otorhinolaryngologists in a secondary setting are not sufficiently familiar with CIs to provide their patients with accurate and up to date medical advice. The few studies (e.g. Hayman et al. 2000, Hogan et al. 2001, Carron et

al. 2006, Chundu & Buhagiar 2013) that have attempted to discover otorhinolaryngologists' knowledge of and attitudes to hearing technologies have been limited in scope to audiologists, by geography, or by patient type; and, regardless, in a field of rapid technological advancement, this requires periodic re-asking. Further, hearing loss, although already important enough to be listed as a "priority disease" by the World Health Organization (Kaplan et al. 2013), is poised to become an even greater public concern in developed countries, due to their aging populations.

The present article attempts to answer 3 timely questions:

1. What do otorhinolaryngologists know and believe about CIs?
2. How do otorhinolaryngologists inform themselves about developments in hearing treatments?
3. What topics related to CIs and HAs do otorhinolaryngologists regard as important?

Materials and Methods

The creation of the questionnaire

The authors drafted a German-language questionnaire. The custom-created questions were based on an attempt to understand why a low percentage of eligible candidates in developed markets have hearing implants or aids. All questions were closed set. Some questions were answerable with a Likert scale and were related to different factors of the Health Belief Model (Rosenstock et al. 1988) that may influence the beliefs or referral patterns to hearing implants and aids of otorhinolaryngologists in a secondary setting. The Likert scale items were furthermore used to investigate susceptibility, severity, benefits, and barriers towards hearing aids or implants. The questions on severity were related to factors identified as relevant by van den Brink et al. (1996).

Face validity was conducted in German on a small sample of otorhinolaryngologists to ensure the questions were worded clearly and covered the concepts the authors intended.

The final version of the questionnaire was created by Karmasin Motivforschung, a market research company in Vienna. In addition to collecting demographic data (age, sex, work setting, average number of patients per month), the questionnaire posed 13 questions which mainly queried the otorhinolaryngologists' beliefs and experience with different types of hearing loss and treatment modalities.

The final version was a validated translation into the predominate language of each nation it was to be emailed to. A pre-test was done with a small sample of otorhinolaryngologists to evaluate the face validity in each language. The content and terminology were checked for each language and the questionnaire was pretested in the individual countries to ensure its comprehensiveness and clarity. A few questions were felt too unclear and so were reworded or deleted. See the Appendix for the English language version of the questionnaire.

It should be noted that some terms (e.g. "hearing loss", "hearing impairment", "hearing implants") were *not* explicitly defined in the questionnaire.

Questionnaire distribution and subject recruitment

The names and contact details of otorhinolaryngologists in a secondary setting in Germany, England, France, Austria, and Sweden came from existing databases of the Karmasin Motivforschung. Each otorhinolaryngologist in the database was given a unique ID and randomly chosen to receive the questionnaire.

The questionnaire was emailed out in small batches until 50 completed responses from each nation were received.

Consent and Ethics approval

Written consent was obtained from each subject for their data to be included in this study. The study follows the ethical principles laid out in the Declaration of Helsinki

Statistics

Relative frequencies (%) were used to report the questionnaire results for each nation. For Question 1 *“To what extent do you agree with the following statements about hearing aids / hearing implants”* (scaling 1 = “agree completely” to 5 = “do not agree at all”) the answer categories “agree completely” (1) and “agree” (2) were collapsed and the percentage results of agreement are shown for each subquestion.

For question 9 *“How important in your opinion are the following issues with regard to hearing implants”* (scaling 1 = very important to 5 = not important at all), the answer categories “very important” (1) and “important” (2) were added up and the percentage values were calculated for each issue.

In question 10 *“Which aspect with regard to hearing implants is most important (1), second most important (2), third most important (3)”*, etc. the otorhinolaryngologists were asked to rank on a scale from 1 to 9 the importance level, with 9 rated as of highest importance. The median was used to show the importance ranking results.

IBM SPSS Statistics 19 (IBM, Armonik, New York) were used for the analyses. The graph was created in Microsoft Office Excel 2010 (<http://www.microsoft.com>).

Results

Subjects

240 otorhinolaryngologists (4.3% return rate) participated in this study: 50 from Germany, England, France, and Austria; and 40 from Sweden. Participants were randomly selected from a database of otorhinolaryngologists. The selection was controlled to ensure a balance in age and geographical spread (i.e. rural vs city).

Questionnaire findings

1. *Question 1: To what extent do you agree with the following statements about hearing aids/hearing implants?*

Subquestion a: Hearing implants require regular maintenance and adjustment

Most otorhinolaryngologists agreed or agreed completely. 94% of French otorhinolaryngologists agreed or agreed completely. This contrasts markedly with German, Austrian, and Swedish otorhinolaryngologists, 55–64% of whom agreed or agreed completely, and with English otorhinolaryngologists, 44% of whom agreed or agreed completely.

Subquestion b: Hearing aids must be removed when the wearer goes to bed, for example

Most otorhinolaryngologists agreed or agreed completely. For each nation it received, amongst subquestions, the highest or second highest percentage of agreement or complete agreement. 88% of the French otorhinolaryngologists agreed or agreed completely. This contrasts with the otorhinolaryngologists of the other nations, 62.5–76% of whom agreed or agreed completely.

Subquestion c: Hearing aids can be a hindrance when doing sports (they slip, got lost, etc.)

Most otorhinolaryngologists agreed or agreed completely. 84% of German otorhinolaryngologists agreed or agreed completely. This contrasts markedly with the otorhinolaryngologists of the other nations, 47.5–66% of whom agreed or agreed completely.

Subquestion d: Hearing implants can be a nuisance during physical activity

Otorhinolaryngologists were not likely to agree or agree completely with this statement. 54% of French otorhinolaryngologists agreed or agreed completely. This contrasts markedly with the otorhinolaryngologists of other nations, 22.5–38% of whom agreed or agreed completely.

Subquestion e: Hearing aids require a great deal of maintenance

Otorhinolaryngologists were not likely to agree or agree completely with this statement. English (36%) and French (34%) otorhinolaryngologists were more likely than the otorhinolaryngologists of the other nations, especially Germany (12%), to agree or agree completely.

Subquestion f: Qualitatively (in terms of hearing sensitivity) there is no difference between hearing aids and hearing implants

Few otorhinolaryngologists agreed or agreed completely with this statement. French (36%) and Austrian (30%) otorhinolaryngologists were markedly more likely to agree or agree completely than were the otorhinolaryngologists of the other nations, especially Sweden (5%) and Germany (8%).

Subquestion g: Hearing implants are not externally visible

Otorhinolaryngologists were not likely to agree or agree completely with this statement. The Austrian otorhinolaryngologists were most likely to agree or agree completely (42%); Swedish otorhinolaryngologists were the least likely (25%).

Subquestion h: It is usually possible to immediately identify people wearing hearing aids

Otorhinolaryngologists were not likely to agree or agree completely with this statement. 16% of German otorhinolaryngologists agreed or agreed completely. This contrasts with the otorhinolaryngologists of the other nations, 27.5–32% of whom agreed or agreed completely.

Subquestion i: Hearing implants are permanently fitted and so do not need to be removed before going to bed at night

Otorhinolaryngologists were not likely to agree or agree completely with this statement. 18% of French otorhinolaryngologists agreed or agreed completely. This contrasts markedly with the otorhinolaryngologists of the other nations, 42–60% of whom agreed or agreed completely (See Table 1).

[Table 1 near here]

2. Question 2: Do you think there is a difference between a hearing aid and a hearing implant?

The otorhinolaryngologists of each nation clearly believed that there is a difference between a hearing aid and a hearing implant. England was the only nation to answer unanimously. France was the most likely to answer ‘no’ (Table 2).

[Table 2 near here]

3. Question 8: In instances where in your opinion both hearing aids and hearing implants are suitable, do you recommend a hearing aid or a hearing implants to your patients?

The otorhinolaryngologists of each nation would recommend a hearing aid rather than a hearing implant when both technologies are suitable; however, Austrian otorhinolaryngologists were noticeably more likely than their peers to recommend a hearing implant. It might be noteworthy that between 26–75% of ENTs, depending on the nation, didn’t answer the question. (Fig. 1).

[Figure 1 near here]

4. Question 9: How important in your opinion are the following issues with regard to hearing implants?

The otorhinolaryngologists of each nation gave broadly similar answers: “rehabilitation” and “hearing preservation” were regarded as more important than “coding strategy” or a “HI’s ability to enhance the user’s enjoyment of music”. The answers of Austrian otorhinolaryngologists were notable in that, other than for “rehabilitation”, all issues were rated between 46% and 52%. The answers from the otorhinolaryngologists of other nations tended to be more varied.

Austrian otorhinolaryngologists appear to regard “hearing preservation” as less important than do their peers; French otorhinolaryngologists appear to regard “bilateral implantation” as more important than do their peers; and Swedish otorhinolaryngologists regard “hearing implants ability to enhance users enjoyment of music” as less important than do their peers. Austrian otorhinolaryngologists were noticeably less likely their peers to rank “rehabilitation” or “hearing preservation” as very important or important. French otorhinolaryngologists were more likely than their peers to rank “bilateral” and “HI’s ability to enhance the user’s enjoyment of music” as very important or important. Swedish otorhinolaryngologists were very noticeably less likely than their peers to rank “HI’s ability to enhance the user’s enjoyment of music” as very important or important (See Table 3).

[Table 3 near here]

5. Question 10: Which aspect with regard to hearing implants is most important (1), second most important (2), third most important (3), etc.?

Otorhinolaryngologists ranked the same issues in question 9 in the order they believed were most important. Similarly to the findings for question 9 (see Tab. 3 above), otorhinolaryngologists tended to regard “rehabilitation” and “hearing preservation” as more important than the other

issues. 1) Hearing implants’ “ability to enhance the user’s enjoyment of music” and 2) “remote fitting” were generally regarded as less important than the other issues. It may be notable that German (2.4) and Swedish (2.5) otorhinolaryngologists were more likely than were their peers to rank “rehabilitation” higher (i.e. a higher comparative importance). Austrian otorhinolaryngologists gave “hearing preservation” a noticeably lower ranking and “remote fitting” a lower mark than did otorhinolaryngologists of other nations. Swedish and German otorhinolaryngologists were more likely than the otorhinolaryngologists of other nations to give “hearing preservation” a lower mark and “ability to enhance the user’s enjoyment of music” a higher mark. (See Table 4)

[Table 4 near here]

6. Question 13: How do you keep abreast of medical issues?

Otorhinolaryngologists reported that they are most likely to keep abreast of medical issues via national and international conferences, conversations with colleagues, and with specialist articles and books; and least likely to keep abreast via pharmaceutical industry- or manufacturer-supported events, or interactive new media. Austrian otorhinolaryngologists are far less likely than their peers, especially those in England and France, to keep abreast via conferences. German and to a lesser extent French otorhinolaryngologists are more likely than Austrian or Swedish otorhinolaryngologists to keep abreast via specialist articles and books or via specialist training events (Table 5).

[Table 5 near here]

7. Questions 3–7 and 11–12

Questions 3–7 and 11–12 were excluded from the results because they queried topics or treatment modalities outside the scope of this article.

Discussion

The primary aim of this study was to determine the knowledge and beliefs of otorhinolaryngologists in a secondary setting in 5 highly developed European nations. Selected economically advanced European countries concerning severe hearing loss, hearing aids, and hearing implants. Secondary goals of the study looked into the information sources of the otorhinolaryngologists and into key topics of importance for these professionals.

Overall the otorhinolaryngologists exhibited similar levels of awareness about hearing solutions and shared many of the same beliefs. As they all work in well-developed health care systems and enjoy a similar access to the latest technological and methodological/intellectual developments, this was an expected result. Note that differences were non-significant due to the small sample size.

It is essential that otorhinolaryngologists have the training and knowledge to be able to steer their patient toward a hearing aid or a cochlear implant, depending on their patient's individual extent and kind of hearing loss. Question 2 (“Do you think there is a difference between a hearing aid and a hearing implant?”) addressed this directly; astonishingly, 5.4% (13/240) of otorhinolaryngologists answered “no” or “I don't know / not applicable”.

Regarding cochlear implants, French otorhinolaryngologists appeared to be differently informed about the differences between HA and HI and (according to question 1) less well inclined than

were the other nations' otorhinolaryngologists toward HI, being most (or tied for most) likely to regard them as inconvenient: requiring regular maintenance, being a nuisance during physical activity, and being necessary to remove before going to bed at night.

It was also a surprise that 39% of Austrian otorhinolaryngologists and 19% of French otorhinolaryngologists would recommend a HI over a HA (i.e. would recommend the more invasive and resource-intensive option) for cases in which either treatment modality was suitable. The high French rate, while seemingly in contradiction to their results from questions 1 and 2, may show that French otorhinolaryngologists would particularly benefit from an awareness raising campaign.

The otorhinolaryngologists of all 5 nations were unanimous in regarding rehabilitation as being of the utmost importance. This shows an understanding of the fact that rehabilitation programs are a critical means of maximizing CI users' language development and post-operative speech production and understanding; a fact that, unfortunately, has not always been appreciated, although medical centres and professionals are careful to make this clear (e.g. ASHA 2014, GOSH 2014).

Hearing preservation and atraumaticity were also generally regarded as among the most important issues, this suggests that otorhinolaryngologists are keenly aware of the importance of "soft-surgery" and that hearing preservation after implantation has been linked to better post-operative performance (Gantz et al. 2005, Gifford et al. 2013).

In addition to conversations with colleagues, conferences and specialist books/events are the channels through which the otorhinolaryngologists of all 5 nations keep abreast of medical issues. Thus, future campaigns should achieve greater benefit by targeting these channels.

Considering that the study was conducted online via email questionnaire, one might expect that “interactive new media, e.g. online lexicons, internet portals” would benefit from a selection bias. If that was indeed the case, it underscores that interactive new media is a comparatively ineffective way to keep otorhinolaryngologists informed.

Lastly, it may be important to clarify that the ultimate point of this study and the forthcoming awareness raising campaign is and was not to get all the people in the 5 nations who would benefit from a CI, implanted; although such intervention (with the appropriate rehabilitation) would be beneficial for the vast majority of eligible candidates and their nations. Instead, what the authors firmly believe is that if an eligible candidate does not have a CI or a HA, it should be because he/she, after having been presented with the facts by their otorhinolaryngologists, decided against intervention. No other reason but informed choice should prevent eligible candidates from receiving a safe and life-enhancing treatment.

Conclusion

The otorhinolaryngologists of the surveyed nations have similar levels of knowledge and share many common beliefs about hearing loss, hearing aids, and CIs, although some national variation in opinion might be present, particularly with French otorhinolaryngologists. To keep abreast of development in their field, otorhinolaryngologists in the aforementioned nations favour conferences, specialist books, and specialist training events; it would therefore be sensible to target these channels when attempting to raise their levels of knowledge and awareness.

Acknowledgements

The author(s) would like to thank the participating ENTs for taking the time to complete the questionnaire, Mag. Florian Berg (Karmasin Motivforschung Ges.m.b.H) for his project leadership, and Michael Todd (MED-EL) for his medical writing assistance.

References

- Anderson I, Baumgartner WD, Böheim K, Nahler A, Arnoldner C, D'Haese P. 2006. Telephone use: what benefit do cochlear implant users receive? *Int J Audiol.* 45(6):446–53.
- Archbold SM, Nikolopoulos TP, Lloyd-Richmond H. 2009. Long-term use of cochlear implant systems in paediatric recipients and factors contributing to non-use. *Cochlear Implants Int.* 10(1):25–40. doi: 10.1002/cii.363.
- Arnoldner C, Lin VY, Honeder C, Shipp D, Nedzelski J, Chen J. 2014. Ten-year health-related quality of life in cochlear implant recipients: prospective SF-36 data with SF-6D conversion. *Laryngoscope.* 124(1):278–82. doi: 10.1002/lary.24387.
- ASHA: American Speech-Language-Hearing Association. Cochlear Implant Frequently Asked Questions. Available at: <http://www.asha.org/public/hearing/Cochlear-Implant-Frequently-Asked-Questions/>. Accessed: 16-July-2014.
- Bhatt YM, Green KMJ, Mawman DJ, O'Driscoll MP, Saeed SR, Ramsden RT. 2003. Device non-use among adult cochlear implant implantees. *Cochlear Implants Int.* 4 Suppl 1:1–2. doi: 10.1002/cii.84.
- Briggs RJS. 2011. Future technology in cochlear implants: assessing the benefit. *Cochlear Implants Int.* 12 Suppl 1:S22–5. doi: 10.1179/146701011X13001035752291.
- Carron JD, Moore RB, Dhaliwal AS. 2006. Perceptions of pediatric primary care physicians on congenital hearing loss and cochlear implantation. *J Miss State Med Assoc.* 47(2):35–41.
- Chundu S & Buhagiar R. 2013. Audiologists' knowledge of cochlear implants and their related referrals to the cochlear implant centre: Pilot study findings from UK. *Cochlear Implants Int.* 14(4):213–24. doi 10.1179/1754762812Y.0000000025.

- Ciorba A, Bovo R, Trevisi P, Rosignoli M, Aimoni C, Castiglione A, Martini A. 2011. Postoperative complications in cochlear implants: a retrospective analysis of 438 consecutive cases. *Eur Arch Otorhinolaryngol.* 269(6):1599-603.
- Clinkard D, Shipp D, Friesen LM, Stewart S, Ostroff J, Chen JM, Nedzelski JM, Lin VY. 2011. Telephone use and the factors influencing it amount cochlear implant patients. *Cochlear Implants Int.* 12(3):140–6. doi: 10.1179/146701011X12998393351321.
- Francis HW, Chee N, Yeagle J, Cheng A, Niparko JK. 2002. Impact of cochlear implants on the functional health status of older adults. *Laryngoscope.* 112(8 Pt 1):1482–8.
- Gantz BJ, Turner C, Gfeller KE, Lowder MW. 2005. Preservation of Hearing in Cochlear Implant Surgery: Advantages of Combined Electrical and Acoustical Speech Processing. *Laryngoscope.* 115(5):796–802.
- Gifford RH, Dorman MF, Skarzynski H, Lorens A, Polak M, Driscoll CL, Roland P, Buchman CA. 2013. Cochlear implantation with hearing preservation yields significant benefit for speech recognition in complex listening environments. *Ear Hear.* 34(4):413–25. doi: 10.1097/AUD.0b013e31827e8163.
- GOSH: Great Ormond Street Hospital for Children. Cochlear implant programme. Available at: <http://www.gosh.nhs.uk/health-professionals/clinical-specialties/cochlear-implant-information-for-health-professionals/cochlear-implant-programme/?locale=en>. Accessed 16-July-2014.
- Hayman CD, Marsh RP, Potsic WP. 2000. Pediatric audiologists' views on cochlear implantation. *Ann Otol Rhinol Laryngol Suppl.* 185:116–7.

- Hogan A, Taylor A, Westcott S. 2001. Audiologists' attitudes to cochlear implants. *Cochlear Implants Int.* 2(1):17–29. doi: 10.1002/cii.37.
- Kaplan W, Wirtz VJ, Mantel-Teeuwisse A, Stolk P, Duthey B, Laing R. Priority Medicines for Europe and the World – 2013 Update. 2013. WHO Press, Geneva. pp 155–8. Available at http://www.who.int/medicines/areas/priority_medicines/MasterDocJune28_FINAL_Web.pdf.
- Kohlberg G, Spitzer JB, Mancuso D, Lalwani AK. 2014. Does cochlear implantation restore music appreciation? *Laryngoscope.* 124(3):587–8.
- National Institute on Deafness and Other Communication Disorders (NIDCD) website: <http://www.nidcd.nih.gov/health/hearing/pages/coch.aspx> (accessed 14-July-2014).
- Olze H, Szczepek AJ, Haupt H, Förster U, Zirke N, Gräbel S, Mazurek B. 2011. Cochlear implantation has a positive influence on quality of life, tinnitus, and psychological comorbidity. *Laryngoscope.* 121(10):2220–7. doi: 10.1002/lary.22145.
- Özdemir S, Tuncer Ü, Tarkan Ö, Kırğolu M, Çetik F, Akar F. 2013. Factors contributing to limited or non-use in the cochlear implant systems in children: 11 years experience. *Int J Pediatr Otorhinolaryngol.* 77(3):407–9. doi: 10.1016/j.ijporl.2012.11.041.
- Ray J, Wright T, Fielden C, Cooper H, Donaldson I, Proops DW. 2006. Non-users and limited users of cochlear implants. *Cochlear Implants Int.* 7(1):49–58. doi: 10.1002/cii.12.
- Rigotti PP, Costa OA, Bevilacqua MC, do Nascimento LT, Alvarenga Kde F. 2013. Assessment of telephone speech perception in individuals who received a cochlear implant in the period 1993-2003. *Codas.* 25(5):400–6. doi: 10.1590/S2317-17822013000500003.

- Rosenstock IM, Strecher VJ, Becker MH. 1988. Social learning theory and the health belief model. *Health Educ Q.* 15(2):175–83.
- Stamatiou GA, Kyrodimos E, Sismanis A. 2011. Complications of cochlear implantation in adults. *Ann Otol Rhinol Laryngol.* 120(7):428–32.
- Tarkan Ö, Tuncer Ü, Özdemir S, Sürmeliöglu Ö, Çetik F, Kıröolu M, Kayıkçioöglu E, Kara K. 2013. Surgical and medical management for complications in 475 consecutive pediatric cochlear implantations. *Int J Pediatr Otorhinolaryngol.* 77(4):473–9. doi: 10.1016/j.ijporl.2012.12.009.
- van den Brink RH, Wit HP, Kempen GI, van Heuvelen MJ. 1996. Attitude and help-seeking for hearing impairment. *Br J Audiol.* 30(5):313–24.

Tables

Table 1: Question 1: To what extent do you agree with the following statements about hearing aids / hearing implants?

Subquestions (n indicates total number of respondents)	% of respondents who <i>agree</i> or <i>agree completely</i>				
	Germany (n=50)	England (n=50)	France (n=50)	Austria (n=50)	Sweden (n=40)
a. Hearing implants require regular maintenance and adjustment	64	44	94	60	55
b. Hearing aids must be removed when the wearer goes to bed, for example	76	74	88	66	62.5
c. Hearing aids can be a hindrance when doing sports (they slip, got lost, etc.)	84	66	60	58	47.5
d. Hearing implants can be a nuisance during physical activity	38	36	54	32	22.5
e. Hearing aids require a great deal of maintenance	12	36	34	22	22.5
f. Qualitatively (in terms of hearing sensitivity) there is no difference between hearing aids and hearing implants	8	12	36	30	5
g. Hearing implants are not externally visible	36	28	30	42	25
h. It is usually possible to immediately identify people wearing hearing aids	16	32	28	28	27.5
i. Hearing implants are permanently fitted and so do not need to be removed before going to bed at night	46	42	18	48	60

Table 2: Question 2: Do you think there is a difference between a hearing aid and a hearing implant? Answers in %. n/a= don't know or not applicable

(n indicates total number of respondents)	Germany (n=50)	England (n=50)	France (n=50)	Austria (n=50)	Sweden (n=40)
Yes	96	100	90	92	95
No	0	0	10	8	5
n/a	4	0	0	0	0

Table 3: Question 9: How important in your opinion are the following issues with regard to hearing implants. Percentage of subjects who responded with “very important” (1) and “important” (2)

(n indicates total number of respondents)	Germany (n=50)	England (n=50)	France (n=50)	Austria (n=50)	Sweden (n=40)
Rehabilitation	88	88	84	60	77.5
Hearing preservation	78	82	78	50	67.5
Electrodes	70	80	56	52	45
Atraumaticity	62	68	66	52	65
Remote fitting	66	46	42	54	40
Bilateral	60	50	78	50	52.5
Complete cochlear coverage	60	70	74	48	42.5
Coding strategy	60	62	66	54	47.5
Ability to enhance the user's enjoyment of music	38	60	70	46	15

Table 4: Question 10: Which aspect with regard to hearing implants is most important? Ranking of importance from 1 to 9, with 1 rated as of highest importance. In table 5 the mean ranks are depicted.

(n indicates total number of respondents)	Germany (n=50)	England (n=50)	France (n=50)	Austria (n=50)	Sweden (n=40)
Rehabilitation	2.4	3.2	3.9	3.7	2.5
Hearing preservation	3.5	3.7	3.9	5	3.4
Electrodes	4.7	5.5	6.2	5.2	5.8
Atraumaticity	5	5.4	4.4	4.9	4.8
Remote fitting	6.2	6.6	6.7	4.8	5.9
Bilateral	5.3	5.1	4.3	4.6	5.5
Complete cochlear coverage	5.5	4.5	4.9	5.4	5.1
Coding strategy	5.5	5.7	4.9	5.4	5
Ability to enhance the user's enjoyment of music	6.9	5.5	5.8	6	7.1

Table 5: Question 13: How do you keep abreast of medical issues? Percentage of agreement by nation.

(n indicates total number of respondents)	Germany (n=50)	England (n=50)	France (n=50)	Austria (n=50)	Sweden (n=40)
Professional education					
National & international conferences	82	92	96	60	77.5
Conversations with colleagues	88	84	84	78	97.5
Specialist articles, books	92	78	88	64	60
Specialist training events	92	72	82	62	67.5
Education by industry partners					
Manufacturer-supported events, visits from manufacturer reps	60	54	44	36	27.5
Industry-supported events, visits from company reps	60	48	50	44	40
Online media of different partners					
Interactive new media, e.g. online lexicons, internet portals	52	28	56	42	50

Figure legends

Figure 1: Question 8: In instances where in your opinion both hearing aids and hearing implants are suitable, do you recommend a hearing aid or a hearing implants to your patients?