

Evaluation of quality of life in patients after cochlear implantation surgery in 2014–2017

Hanna Czerniejewska-Wolska¹, Magdalena Kałos¹, Maria Bratumiła Gawłowska², Alicja Sekula¹, Patrycja Mickiewicz², Bożena Wiskirska-Woźnica¹, Michał Karlik¹

¹Katedra i Klinika Foniatrii i Audiologii Uniwersytetu Medycznego im K. Marcinkowskiego w Poznaniu

²Medicus Sp. z o.o., Wrocław

Article history: Received: 25.11.2018 Accepted: 19.02.2019 Published: 26.02.2019

ABSTRACT:

Introduction: Profound hearing loss significantly affects the quality of life of deaf people as well as their families. Observation of the benefit from the use of cochlear implants in deaf patients allows to assess the success of treatment with this method and its impact on the quality of life of these patients. The aim of this study was to determine the quality of life in patient after the cochlear implantation in the material of Department of Phoniatics and Audiology of the Medical University in Poznań.

Material and methods: The study involved implanted patients who voluntarily joined to the project entitled „Observational study of the implanted patient (Cochlear-IROS)”. It has a prospective character, it is an international and long-term study, covering the observation of patients up to three years after implantation. Standardized HUI and SSQ questionnaires were used. 70 patients were included in the analysis, the mean age at the time of the cochlear implantation was 47.6 years. In the research group there were 33 men and 37 women. In the whole group, the patients' age at implantation was at least 18 years, max. 80 years.

Results: The results of the SSQ questionnaire, which deals with the self-assessment of hearing ability in everyday situations, indicate that in the subjective assessment of patients one year after surgery the speech hearing improved by 77%, spatial hearing by 84%, and the quality of hearing by 49%. The general quality of life before the first connection of the sound processor according to the HUI questionnaire, the patients rated at 0.49 (0–1 scale, where 0 – corresponds to the death condition and 1 – full health). After one year from the implantation, this rating increased to 0.56.

Conclusions: Implantation of the cochlear implant significantly increases the patient's quality of life, his physical and emotional functioning. Statistically significant better self-assessment of patients mainly concerned hearing speech and spatial hearing - especially after 1 year of connecting the speech processor.

KEYWORDS:

quality of life, quality of hearing, profound hearing loss, cochlear implant

ABBREVIATIONS

IROS – Cochlear – Implanted Recipient Observational Study

HUI – Health Utilities Index Mk. III

SSQ – Speech, Spatial and Qualities of Hearing Scale

INTRODUCTION

Nowadays, with such a developed and still developing level of medicine, when deciding on the form and method of patient treatment, not only the effect of the procedure, the duration of treatment or the risk of complications are taken into account, but also - and even above all - the quality of life after treatment. In the case of patients with bilateral profound sensorineural hearing loss or deafness, the commonly used and safe procedure is treatment with placement of cochlear implant. Cochlear implants are used in both children and adults. Every patient undergoes a complete protocol of qualifying examination before the procedure, as well as follow up after surgery. Evaluation which is measurable thanks to a series of objective and subjective audiological tests allows to

determine and evaluate the rehabilitation progress and the effects of the treatment applied. Thanks to the use of a number of standardised questionnaires, the patient's quality of life after application of a given medical procedure is assessed.

Today, the term 'quality of life', or QoL, and in medicine – 'health related quality of life', or HRQL are concepts that put a lot of emphasis on the use of various types of medical procedures. On the basis of the definition of quality of life, the World Health Organisation (WHO) states, that it is constituted by 'subjective assessment of the patient's life situation in reference to the culture in which he lives, his system of values, goals, expectations, interests'. The second definition of health related quality of life according to WHO is: 'A state of complete physical, mental and social well-being, not just the absence of illness' [26]. An attempt to assess the quality of life that is obtained with the help of tools prepared for this purpose allows for a holistic look on the dependencies between the patient, the disease, the medical procedure, effects in both the medical and psychophysical aspects of the patient, and finally the economic [21, 25]. This study aimed to analyse the real impact of treatment applied in adult patients using a cochlear implant system on their

quality of life through the use of a selected algorithm of repeatable questionnaire studies.

MATERIAL AND METHODS

The research material includes patients from the Chair and Clinic of Phoniatics and Audiology at the University of Medical Sciences in Poznań from 2014-2017, who agreed to participate in surveys as part of the 'Implanted Recipient Observational Study (Cochlear IROS) project'. IROS is prospective, it is an international and long-term study, because it assumes the observation of patients up to three years from the moment of implanting. In Poland, the Chair and Clinic of Phoniatics and Audiology is one of 10 centres which participate in this project. Each patient either with an implanted cochlear implant or bone conduction implant who was at least 10 years old at the time of surgery may be admitted to examination. Enrolment in the programme begins upon connection of the processor, i.e. usually around week 4 - 6 from placement of cochlear implant.

Currently, there are 1,285 patients are under observation in the international base. In Poland, there are 193 patients among all centres that participate in the project. In its observation, the Poznań Centre currently involves a group of 70 patients.

All patients who volunteered for the study were subject to the same algorithm. It included: a subjective examination with full preoperative history and collection of etiological factors of hearing loss, physical examination and a diagnostic survey using standardized HUI questionnaires (HUI, or Heath utility index MK. III), as well as SSQ (Speech, Spatial and Qualities of Hearing Scale). Overall assessment of patient's quality of life is based on the HUI questionnaire and consists of eight subcategories: sight, hearing, speech, mobility, fitness, emotions, cognitive functions and pain.

Assessment of hearing ability is based on the SSQ questionnaire and relies on self-assessment of the ability to hear in everyday situations. SSQ questionnaire relates to hearing and understanding speech in various acoustic conditions, spatial hearing (evaluation of the direction and distance of the sound source) and the quality of hearing (natural speech, the ability to distinguish individual sounds).

Our group of respondents included users of Cochlear-branded implants: 64 of them implanted unilaterally and 6 bilaterally. Among the devices implanted in patients, the following can be distinguished: CI1512 - 14 people (including 4 left-sided implantations), CI532 - 8 people (including 3 left-sided), CI24RE (CA) - 49 people (including 25 left-sided), CI24REH - 3 people (including 1 left-sided), CI24M - 1 right-sided implantation and CI24RE (ST) - 1 right-sided implantation (the sum of all placed implants is 76 due to 6 patients implanted bilaterally).

There were 33 men and 37 women in the study group. The average age of patients at the time of implantation was 47.6 years (min. 18 years, max. 80 years).

In 43 cases, the left ear was implanted and 33 patients were implanted on the right side; this includes 6 patients with a bilateral implant.

Etiological factors of implanted patients' hearing loss are shown in Tab. I.

The use of hearing aids in pre-operative period was also analysed. It was shown that 27 patients wore hearing aid in the right ear and 32 wore hearing apparatus in the left ear (in this group the cochlear implant was used for the nonimplanted ear), and 13 used hearing aids on both sides. The patient's attempt to determine the suitability of used hearing aids revealed the following degree - Tab. II.

Another very important aspect affecting the implanted patients' quality of life was the coexistence of tinnitus and dizziness. Observations also included such activities related to the patients' daily functioning as the ability to use the phone or listen to music. They were also subject to analysis.

The results obtained before the first connection of the speech processor with those obtained at subsequent stages of the study were compared. Student's t-test was used and results of $p < 0.001$ were deemed statistically significant.

RESULTS

All data collected so far were analysed, both at the initial stage, and after one and two years from the moment of establishing and switching on the cochlear implant system. Most data were collected after the first year of using the system. Analyses of the obtained data are as follows: group guaranteeing the set of data for analysis in the period of 1 year after connecting the processor includes $N = 26$ patients, including 10 patients over 60 years of age and 16 under 60 years of age (3 patients up to 29 years of age and 13 from 30 to 59 years of age). The average patient age is 49.5 years (min 18, max 80 years). The use of hearing aid on a nonimplanted ear in a group is shown in Tab. III.

All patients use the cochlear implant for almost the same length of time regardless of the implanted side: on average, 13.7 hours per day - right ear and 13.4 hours - left ear, total 13.6 hours.

In the first year of use, it was also examined whether simultaneous use of the implant and hearing aid ensure better hearing quality than the implant itself. The results indicate that 13 out of 17 patients claim that bimodal stimulation provides better hearing quality in comparison to using just the implant alone in one ear.

Tinnitus was annoying for all patients who had previously reported it. In observation of the first 12 months of using the cochlear implant system, the majority of patients stated that they were less annoying ($n = 10$) after implantation and remained the same in 8 cases. Only 1 patient claimed that they were more annoying to him.

The observation of coexisting dizziness indicated a noticeable decrease in the perception of these symptoms after the first year of system use. Most patients believe that they are less annoying ($n = 7$) or the same ($n = 3$), while they were experienced as more troublesome in 2 cases.

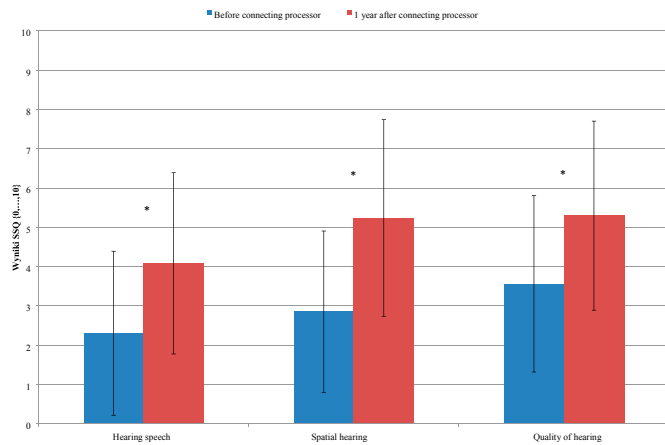


Fig. 1. The SSQ outcomes at baseline (before the first switch-on of sound processor) and 1 year follow up; an average with SD (standard deviation) n=26, statistically significant difference, p value <0,001.

The surveys' rate of return after 2 years of use is quite low - 16 questionnaires were received. In detailed analysis of the entire group across this period of time in the indicated control time-points, the below results were obtained.

The problem of tinnitus in the whole patient group was as follows: before surgery, 45 patients complained of tinnitus, one year after surgery 19 of 26 patients declared a further problem with tinnitus, at the same time indicating that they were less distressing in 10 patients, 8 showed no change, and 1 patient reported its intensification. Two years after surgery, 10 of 16 patients still complained of noise - 5 declared it as annoying, but a bit less in the last 12 months. In turn, dizziness occurred before surgery in 29 patients. After a year, the problem was still reported by 12 of 26, and after 2 years, only 9. As in the case of tinnitus, these ailments were less severe (after a year in 7 patients and after 2 years in 2) or the same (3 and 4 patients, respectively).

Another observation was the possibility of using the telephone. Before surgery, 40 patients could use it; after one year of use, 17 of 26 declared such a possibility, and after 2 years 11 of 16. The ability to hear over the phone compared to the pre-operative situation was determined by patients as marginal after a year of use and as much better in 10 of 17 people.

The possible benefits of listening to music were observed by 24 of 70 respondents. After a year, 15 of 26 people, and after 2 years, 10 of 16 people. The ability to listen to music compared to the situation before surgery was marginal or much better among 14 people, and after 2 years, in 9 of 10 patients. The analysis of collected data from the HUI questionnaire and SSQ during the observation period allowed for overall assessment of the patient's quality of life.

SSQ questionnaire is related to self-assessment of the ability to hear in everyday situations, including hearing and understanding speech in various acoustic conditions, spatial hearing (evaluation of the direction and distance of the sound source) and the quality of hearing (natural speech, the ability to distinguish individual sounds), which allows to assess the changes in hearing ability as a function of time. Figure 1 and Table IV demonstrate the results

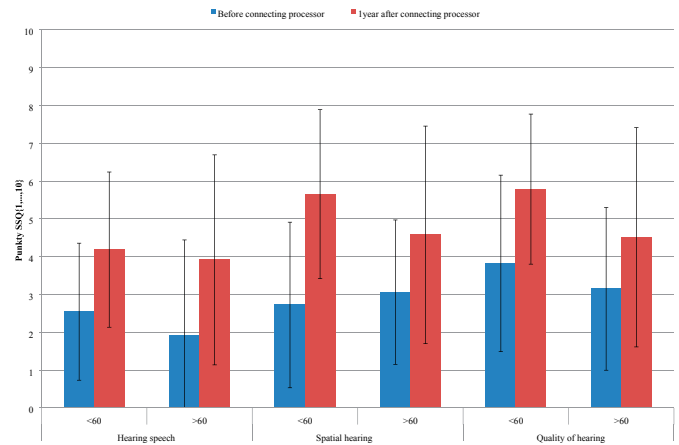


Fig. 2. The SSQ outcomes at baseline (before the first switch-on of sound processor) and 1 year follow up with the division into two age groups – below and over 60 years of age; an average with SD (standard deviation) n=26, no statistically significant differences between groups.

Tab. I. Etiological factors of hearing loss of patients with a percentage of total.

ETIOLOGICAL FACTOR	TOTAL (N)	TOTAL (%)
Bacterial infection	4	5.7%
Family/Genetic	3	4.3%
Exposure to noise	4	5.7%
Other	4	5.7%
Otosclerosis	2	2.9%
Ototoxic drugs	4	5.7%
Rubella	2	2.9%
Injury	4	5.7%
Unknown	41	58.6%
Viral	2	2.9%

Tab. II. The degree of usefulness of hearing aids before cochlear implantation.

THE DEGREE TO WHICH THE HEARING AID WAS USEFUL	RIGHT EAR	LEFT EAR
Extremely	4	3
Very much	7	9
Moderately	7	7
To a small degree	3	7
Not at all	6	6

of the SSQ questionnaire after the first year of CI use with a clearly marked upward trend in every aspect of the assessment. There are statistically significant differences in each domain (p <0.001). Figure 2 presents detailed results of data collected from the SSQ questionnaire after the first year of use of cochlear implants divided into age groups (below 60 years of age (<60) and above 60 years of age (>60). No statistically significant differences. By comparison, Figure 3 presents the results of SSQ for users after the first and second year of use of cochlear implant systems, where it was demonstrated that there is no such significant increase in improvement in the analysed aspects after the second year of CI use. No statistically significant differences. HUI questionnaire consists of eight subcategories: sight, hearing, speech, mobility, fitness, emotions, cognitive functions, pain.

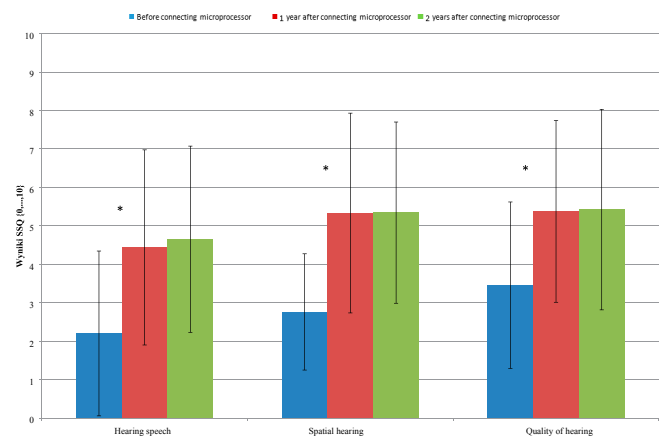


Fig. 3. The SSQ outcomes of the 2-year evaluation: before the first switch-on of the processor, 1 year and 2 years follow up; an average with SD, n = 16; statistically significant differences only between the baseline and 1 year follow up visit, p < 0,001.

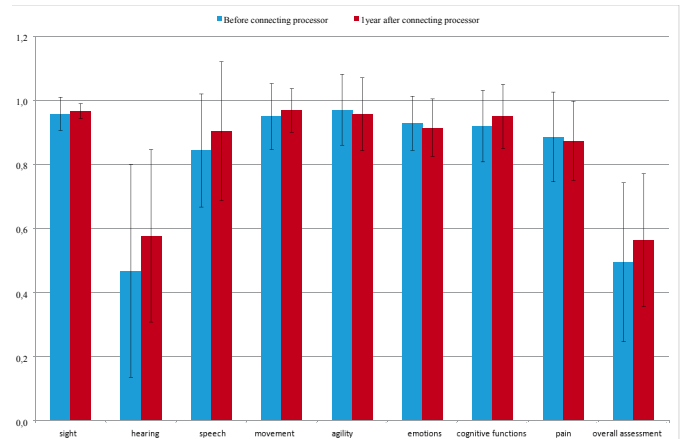


Fig. 4. The HUI outcomes at the initial assessment - before first switch-on of the sound processor - and 1 year follow up; an average with standard deviation, n = 26.

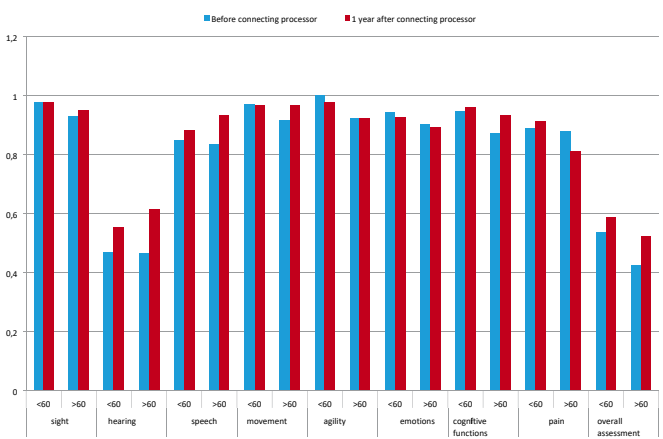


Fig. 5. The HUI outcomes at the initial assessment and 1 year after first switch-on of the processor with the division into two age groups – below and over 60 years of age; n = 26.

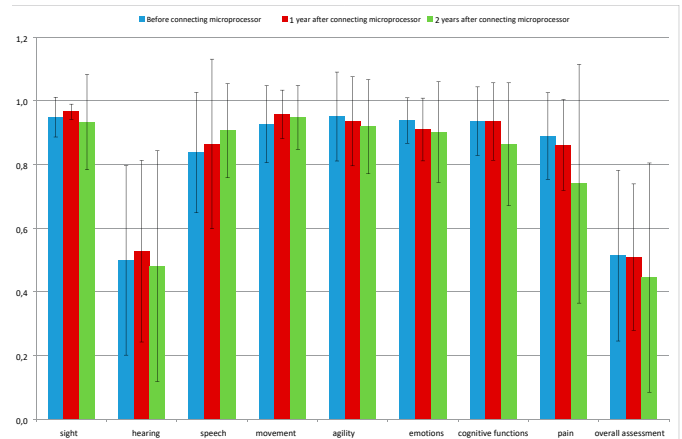


Fig. 6. The HUI outcomes of the 2-year evaluation: before the first switch-on of the processor, 1 year and 2 years follow up; an average with standard deviation, n = 16.

Figure 4 demonstrates detailed data of HUI results after the first year of use of cochlear implants. Analysis of individual components constituting the general assessment of the quality of life shows significant growth tendencies, especially in the aspect of hearing and speech (communication).

Due to insufficient data and limitations resulting from the application of HUI questionnaire, the statistics of the results obtained were not calculated, and the values included in the charts only demonstrate the average of the results obtained as well as the trend that appears after a year of using the cochlear implant system.

Figure 5 shows the results showing detailed data of HUI results after the first year of use of cochlear implants with division into age groups (<60 years of age and > 60 years of age). The upward trend in the category of hearing and speech is noticeable in both age groups with a predominance in the group > 60 years of age.

For comparison, Figure 6 shows illustrative HUI results for users after the 1st and 2nd year of use of cochlear implant systems with a clear indication of the absence of such a significant increase in the analysis of the above categories after the second year of CI use. The graph is used to visualise the trend that appeared in the surveyed patients.

DISCUSSION

It is well known that the benefits of using cochlear implant systems in the deaf/hearing impaired group must not be underestimated., regardless of age. Research conducted for many years in many centres in the world confirms that this method of treatment has an extraordinary influence on improving these patient's quality of life, and not only in the aspect of hearing alone [1, 12, 9, 22, 23, 20]. Each centre dealing with the treatment of hearing-impaired and deaf patients has at its disposal a package of various standardised questionnaires to conduct an assessment of the impact of the applied treatment technique on quality of life [19, 6, 8, 14, 5, 7, 18].

An extremely important pre-operative aspect is to conduct a thorough qualification, conversation, familiarisation with the system and the proposed treatment procedure, i.e. the patient's complete pre-operative preparation. Such an approach increases the chance of an efficiently performed procedure, minimises undesirable effects (especially in the psychological aspect), and most importantly, it increases the chance of improving the quality of life. The treatment plan developed by the Poznan centre for patients after treatment with the cochlear implant method meets the standards recognised globally.

The conducted analyses of the collected results from the reference point (before connecting the processor), after the first and second year of use of cochlear implant systems in various categories show that the quality of life is indisputably improved. Individual categories of the HUI questionnaire, showing the overall assessment of quality of life, and the SSQ questionnaire applied simultaneously, concerning the self-assessment of hearing ability in everyday situations, together confirm a clear improvement after cochlear implant placement especially visible after the first year of use. The upward trend in the improvement of quality of life persists in analyses after the second year - but it is noticeably smaller. The obtained results of the conducted analyses are comparable to those presented in the international literature over the years. [11, 3, 2, 10, 16]. Confirmed on the basis of many years of global research, it is obvious that treatment of deaf patients as well as those affected by profound hearing loss by implanting cochlear implants is possible regardless of age with good auditory effects and improved quality of everyday life [9, 13, 24, 17]. Analysing the collected data with division into age groups, there is a tendency to obtain better benefits in assessing the quality of life in the group over 60, which is also confirmed by international literature. [15, 4].

The overriding aim of the treatment technique of deaf patients as well as those affected by profound hearing loss with the cochlear implantation method is to provide or restore resonant communication in society, and thus to restore the afferent path – that is, in simple terms – hearing, so that the central nervous system could learn, decode the received signals, process them and, consequently, start/use the efferent path - meaning speech. The whole medical team monitors the proper course of this complicated procedure, from the moment of diagnosis, surgical treatment, to proper stimulation and rehabilitation, but most importantly - the immediate environment. The effects of the work of all people involved in the process are visible and measurable, the evidence of which are somewhat the results of the above work and, among others, all the authors quoted worldwide. The above work sums up and confirms previously marked and gradually published articles on the subject-matter along with data incoming to Poznań and cooperating centres. These publications demonstrate the benefits of improving the quality of life considered in various aspects of everyday life in patients treated with cochlear implants [27, 28].

REFERENCES

1. Aaron C. Moberly, Michael S. Harris, Lauren Boyce, Kara Vasil, Taylor Wucnich, David B. Pisoni, Jodi Baxter, Christian Ray, Valeriy Shafiro: Relating Quality of Life to Outcomes and Predictors in Adult Cochlear Implant Users: Are We Measuring the Right Things?. *Laryngoscope*, 2018;128:959-966;
2. Cohen SM, Labadie RF, Dietrich MS., Haynes DS.: Quality of life in hearing –impaired adults: the role of cochlear implants and hearing aids. *Otolaryngol Head Neck Surg* 2004;131:413-422
3. Chung J, Chueng K., Shipp D., Friesen L., Chen JM., Nedzelski JM., Lin VY.: Unilateral multi-channel cochlear implantation results in significant improvement in quality of life. *Otol Neurol* 2012;33:566-571.
4. Di Nardo W., Anzivino R., Giannantonio S., Schinaia L., Paludetti G: The effects of cochlear implantation on quality of life in the elderly. *Eur Arch Otorhinolaryngol* 2014;271:65-73.
5. Djalilian H.R., King T.A., Smith S.L., Levine S.C. Cochlear implantation in the elderly: results and quality of life assessment. *Ann OtolRhinolLaryngol* 2002;111:890-895.

Tab. III. The number of patients using hearing aids on an un-implanted ear along with the average daily usage time.

PATIENT RESPONSES	NUMBER OF PEOPLE USING HEARING AIDS	AVERAGE TIME OF USE OF THE HEARING AID [HOURS]
No response	2	-
No	7	-
Yes, including	17	13.3
Left ear	6	10.3
Right ear	11	14.9
Total	26	13.3

Tab. IV. Results of the SSQ questionnaire in three categories at baseline (before the first switch-on of sound processor) and 1 year follow up together with the results of Student's T-Test. p value and percentage increase of the results at baseline vs 1 year follow up.

SSQ RESULTS	HEARING SPEECH	SPATIAL HEARING	QUALITY OF HEARING
Before connecting the processor	2.31	2.85	3.56
1 year after connecting the processor	4.08	5.24	5.30
t-test	0.0006302	0.000061889	0.000807785
p	<0.001	<0.001	<0.001
Increase in the value of assessment [%]	77%	84%	49%

CONCLUSIONS

1. Collected results of SSQ questionnaire – i.e. self-assessment of hearing ability in everyday situations reveals a marked improvement in the statistically significant differences obtained, particularly significant after the first year of using the cochlear implant system and those sustained, though slightly smaller after the second year of implant usage.
2. The age of implanted patients does not constitute a contraindication to the procedure, if the general condition of the patient allows it, which is confirmed by the results of our surveys; there is a tendency to achieve better effects of implantation on the overall quality of life in patients over 60 years of age than in the group of <60 years of age.

6. Facer G.W., Peterson A.M., Brey R.H. Cochlear implantation in the senior citizen age group using Nucleus 22-channel device. *Ann OtolRhinolLaryngol* 1955;166:187-190.
7. Francis H.W., Chee N., Yeagle J., Chen A., Niparko J.K. Impact of cochlear implants on the functional health status of older adults. *Laryngoscope* 2002;112:1482-1488.
8. Kelsall D.C., Shalloo J.K., Burnelli T. Cochlear implantation in the elderly. *Am J Otol* 1955;16:609-611.
9. Klop WM, Briaire JJ, Stiggelbout AM, et al. Cochlear implant outcomes and quality of life in adults with prelingual deafness. *Laryngoscope* 2007;117:1982-7.
10. Kuthubutheen J., Mittmann N., Amoodi H., Qian W., Chen JM.: The effect of different utility measures on the cost-effectiveness of bilateral cochlear implantation. *Laryngoscope* 2015;125:442-447.
11. Looi V., Mackenzie M., Bird P., Lawrenson R.: Quality-of-life outcomes for adult cochlear implant recipients in New Zealand. *NZ Med J* 2011;124:21-34.

12. Louise V. Straatman, Wendy J. Huinck, Margreet C. Langereis, Ad F. M. Sink, Jef J. Mudler: Cochlear Implantation in Late-Implanted Prelingually Deafened Adults: Change in Quality of Life. *Otology&Neurotology* 2014;35:253-259;
13. Loy B., Warner-Czyz AD., Tong L., Tobey EA., Roland PS.: The children speak: an examination of the quality of life of pediatric cochlear implant users. *Otolaryngol Head Neck Surg* 2010;142:247-253.
14. Mosnier I., Bebear J.P., Fraysse M.M.B, Truy E., Lina-Grande G., Mondain M., Sterkers-Artières F., Bordure F., Robier A., Godey B., Meyer B., Frachet B., Poncet C., Bouccara D., Sterkers O. Predictive Factors of Cochlear Implantation Outcomes in the Elderly. *Audiol Neurotol* 2014;19:15-20.
15. Olze H., Gräbel S., Förster U., Zirke N., Huhnd LE., Haupt H., Mazurek B.: Elderly patients benefit from cochlear implantation regarding auditory rehabilitation, quality of life, tinnitus, and stress. *Laryngoscope* 2012;122:196-203.
16. Olze H., Szczepek AJ., Haupt H., Förster U., Zirke N., Gräbel S., Mazurek B.: Cochlear implantation has a positive influence on quality of life, tinnitus, and psychological comorbidity. *Laryngoscope* 2011;121:2220-2227.
17. Ramos A., Guerra-jimenez G., Rodriguez C., Borkoski S., Falcon JC, Perez D.: Cochlear implants in adults over 60: a study of communicative benefits and the impact on quality of life. *Cochlear Implants Int* 2013;14:241-245.
18. Shinn Y.J., Fraysse B., Deguine O., et al. Benefits of cochlear implantation in elderly patients. *OtolaryngolHead Neck Surg* 2000;12:602-606.
19. Sladen D.P., Zappler A. Older and Younger Adult Cochlear Implant Users: Speech Recognition in Quiet and Noise, Quality of Life, and Music Perception; *American Journal of Audiology*, 2015;24:31-39.
20. Teoh SW, Pisoni DB, Miyamoto RT. Cochlear implantation in adults with prelingual deafness. PII. Underlying constraints that affect audiological outcomes. *Laryngoscope* 2004;114:1714-9.
21. Turska W.; Metodyka oceny jakości życia; *Farm Pol* 2009; 65(8): 572–580.
22. Van Dijkhuizen JN, Beers M, Boermans PP, et al. Speech intelligibility as a predictor of cochlear implant outcome in prelingually deafened adults. *Ear Hear* 2011;32:445-58
23. Vermeire K, Brokx JP, Wuyts FL, et al. Quality-of-life benefit from cochlear implantation in the elderly. *Otol Neurotol* 2005;26:188-95
24. Warner-Czyz AD., Loy B., Tobey EA., Nakonezny P., Toland PS.: Health-related quality of life in children and adolescents who use cochlear implants. *Int J Pediatr Otorhinolaryngol* 2011;75:95-105.
25. Wdowiak L, Stanisławek D, Stanisławek A; Jakość życia w stacjonarnej opiece długoterminowej; *Medycyna Rodzinna* 2001; 4: 49–63
26. WHO: Constitution of the World Health Organization, Basic Documents, Forty-fifth edition, Supplement, October 2006.
27. Czerniejewska-Wolska H., Kałos M., Sekula A., Piszczatowski B., Rutkowska J., Rogowski M., Zadrozniak M., Szymański M., Klatka J., Durko M., Pietruszewska W., Gawłowska M.B., Kuśmierczyk J., Kruk-Krzemień A., Wiskirska-Woźnica B.: Quality of life and hearing after cochlear implant placement in patients over 60 years of age. *The Polish Otolaryngology* 2015; 69(4), 34-39.
28. Lenarz T, Muller L., Czerniejewska-Wolska H., Varela H. V., Dotú C. O., Durko M., Irujo H. A., Piszczatowski B., Zadrozniak M., Irwin C., Graham P.L., Wyss J.; Patient-related benefits for adults with cochlear implantation: a multicultural longitudinal observational study. *Audiology and Neurotology* 2017; 22(2): 61-73.

Word count: 3570 Tables: 4 Figures: 6 References: 28

Access the article online: DOI: 10.5604/01.3001.0013.0400 Table of content: <https://otolaryngologypl.com/issue/11772>

Corresponding author: Hanna Czerniejewska-Wolska; Katedra i Klinika Foniatrii i Audiologii Uniwersytetu Medycznego im K. Marcinkowskiego w Poznaniu; ul. Przybyszewskiego 49; 60-355 Poznań; e-mail: hannaczerniejewska@gmail.com

Copyright © 2019 Polish Society of Otorhinolaryngologists Head and Neck Surgeons. Published by Index Copernicus Sp. z o.o. All rights reserved.

Competing interests: The authors declare that they have no competing interests.

Cite this article as: Czerniejewska-Wolska H., Kałos M., Gawłowska M. B., Sekula A., Mickiewicz P., Wiskirska-Woźnica B., Karlik M.: Evaluation of quality of life in patients after cochlear implantation surgery in 2014–2017; *Otolaryngol Pol* 2019; 73 (2): 11-17
