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The survey of parents' and adults recipients' satisfaction with cochlear implantation determined by the place of residence

Authors' Contribution:
A – Study Design
B – Data Collection
C – Statistical Analysis
D – Data Interpretation
E – Manuscript Preparation
F – Literature Search
G – Funds Collection

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ABSTRACT:

Introduction: The use of cochlear implants (CI) has been a remarkable success in reducing disabilities in patients with impaired hearing. The definition of success for those patients means improvement of hearing ability for adults, possibility to develop speech and language for children, quality of life improvement and satisfaction with the whole CI implantation procedure.

The aim: To examine patient satisfaction, determined by their place of residence, with all activities in progress during CI implantation including care in subsequent years.

Material and methods: The study was conducted prospectively. Online surveys were sent to 1,906 CI patients, with the response rate reaching 33%; thus 630 surveys were analyzed. Demographic data of the respondents were collected: gender, age of implantation, one- or two-sided implantation, place of residence and implanting clinic. A detailed statistical analysis of the obtained data was performed.

Results: One of the problems observed was the aspect of waiting time for qualification, implantation and replacement of the speech processor. The second problem was the travel time to the CI center and that was strictly connected with the place of the residence of a patient. Patients' satisfaction with the control visit was high for majority of them.

Conclusions: This research highlighted the limitations of the current CI service delivery. Significant differences concerning the CI pathway were found for particular regions of Poland. One of the future goals for healthcare providers should be to level out the differences in access to CI services between different regions of Poland.

KEYWORDS: cochlear implants, patients' satisfaction, quality of visits, reimbursement, speech processor upgrade, survey of patient satisfaction, waiting time

ABBREVIATIONS

CI – cochlear implants
EHDI – Early Hearing Detection & Intervention

INTRODUCTION

The use of cochlear implants (CI) has been a remarkable success in reducing disabilities in those with impaired hearing, which led to a significant change in their quality of life. Alongside this intervention, rehabilitation, as well as family and community support are necessary [1–6]. The ultimate measure of success for the entire endeavor is improved quality of life of the patient and his/her family. Logistics, i.e. efficient CI implantation pathway: qualification, implantation and rehabilitation process, remains an important component of the entire undertaking [6]. The measure of patient-friendliness of the implantation pathway is the waiting time for surgery and control visits, the length of travel to the operating and rehabilitation center, frequency and quality of fitting visits, and availability of the device service. From the patient and family point of view, these are common aspects of broadly understood satisfaction with CI implantation.

The primary goal of the work is to examine patient satisfaction, determined by their place of residence, with CI implantation pathway and quality of care in subsequent years. The specific objectives of the work are to analyze the online survey of patient satisfaction in the field of logistics (waiting lists, distance and journey time to the facility, number of visits, time of visits) in particular voivodeships, indicating places on the map of Poland where improvement would be needed.

MATERIAL

The study was conducted prospectively. Online surveys were sent to 1,906 patients with CI and the return rate was 33%, thus 630

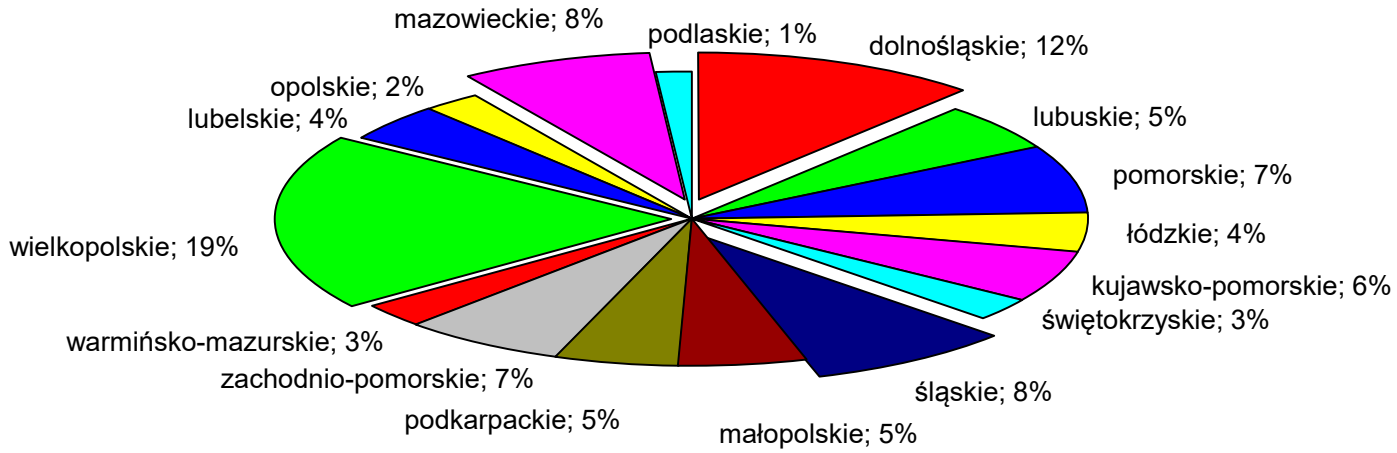

Fig. 1. Percentage of CI respondensts according to the place of the residence (the voivodeship).

surveys were analyzed. Demographic data of the respondents were collected: gender, age of implantation, one- or two-sided implantation, place of residence (presented in Fig. 1.) and implanting clinic. Among the respondents there were 498 unilateral implanted patients and 132 bilateral implanted patients. Patients represented 42% of our respondents and their caregivers – 58%. The gender distribution – men /women – was equal, 50%/50%. The age of CI recipients was analyzed separately: 35% of children were implanted between 7–18 months, 9% under 6 months. Among adults 25% were between 19–40 years of age, 19% between 41–60, and 12% between 61–80.

The age at CI implantation was analysed for all regions of Poland, separately for children and for adults. There were no statistically significant differences between the number of younger and older adults in particular voivodeships (Chi^2; P = 0.07166). Among children there was a significant difference (Chi^2; P = 0,04295), depending on the voivodeship. In warminsko-mazurskie, 75% of children were implanted before the age of 2 years – this is the best result regarding early intervention/implantation. On the second place there is podkarpackie with 72%, and swietokrzyskie ex aequo with podlaskie – 67%. The worse results for "age at implantation" among children was observed in dolnoslaskie – 73% of children were implanted between 3–18 years, in malopolskie (62.5%) and in kujawsko-pomorskie (60%). As concerns early implanted children, the majority of them came from wielkopolskie (19%), pomorskie, slaskie (10%) and from mazowieckie and zachodnio-pomorskie (9%). Regarding the mean age at implantation in the group of younger children – the shortest time to surgery was observed in podlaskie (mean: 1.0 year of age) and the longest time in dolnoslaskie and lodzkie (mean: 1.6 year). These differences were not statistically significant (K-W test; P = 0.4907). In the group of older children, the shortest time to surgery was noticed in podkarpackie (mean: 4.2 years) and swietokrzyskie (4.0) and the longest – in lubuskie (10.4) and malopolskie (10.3). These differences were not statistically significant either (K-W test; P = 0.0798).

METHOD

The online questionnaire contained closed questions. The study was carried out in accordance with Poznan Medical University ethics procedures which follow the ethical guidelines for research. Demographic data of the patient/parent according to the region of Poland: age of children and adults, gender, unilateral/bilateral implantation, distance to the facility, time of the journey, waiting time for qualification, waiting time for CI surgery, waiting time for processor fitting, satisfaction with the frequency of visits and their duration, processor usage time, waiting time for exchange, willingness to attend to the facility closer to the place of residence, the ability to pay for matching the processor were examined. The place of residence (voivodeship of the CI recipient) was the overriding variable.

Primary outcome measures were the components of patients' logistics: timing of CI implantation process, distance to the facility, time of journey in relation to the place of residence. Secondary outcome measures were the satisfaction with post-operative care and willingness to introduce the potential modifications in CI medical services.

Statistical assessment was made with the use of Statistica ver. 13 software (StatSoft Poland) applying the U Mann-Whitney tests (U M-W), Kruskal-Wallis (K-W) tests and Chi^2 test depending on the type of analyzed groups of data.

RESULTS

The row data obtained in on-line surveys indicate that the journey to the facility was crucial for the majority of CI recipients. The distance to the implanting center/facility was longer than 100 km for 74%, 50–100 km for 11% and less than 50 km for 15% of CI recipients, respectively. Travel time to the implanting center was >3 hours for 52%, 2–3 h for 18%, and <2 h for 15% of CI recipients, respectively.

Distance to the CI center and the journey time in relation to different regions of Poland.

Patients from voivodships opolskie, swietokrzyskie, podkarpackie, dolnoslaskie, malopolskie, lubuskie had the longest distance to their clinics in comparison to patients from mazowieckie, wielkopolskie, kujawsko-pomorskie and lodzkie. These differences are

statistically significant especially for voivodeship wielkopolskie and mazowieckie in comparison to dolnoslaskie, slaskie, and podkarpackie (K-W; P < 0.001).

The longest time of journey was recorded in case of patients from the following voivodeships: podkarpackie, opolskie, malopolskie, pomorskie, warminsko-mazurskie, slaskie, dolnoslaskie, zachodnio-pomorskie and lubuskie. Patients from wielkopolskie, mazowieckie and lodzkie had the shortest journey. These differences are also statistically significant for voivodeship: wielkopolskie and mazowieckie in comparison to dolnoslaskie, pomorskie, slaskie, malopolskie, and podkarpackie and for voivodeship malopolskie and podkarpackie in comparison to wielkopolskie, mazowieckie and lodzkie (K-W; P < 0.001).

We studied the timing of the whole process of CI implantation, starting from the qualification visit to the first fitting of the processor. Awaiting time for hospital qualification was longer than 3 months for 42%, 1–3 months for 41%, 2–4 weeks for 11%, less than 2 weeks for 6% of future CI recipients respectively. Awaiting time for surgery was < 3 months for 43%, 3–6 months for 30%, 6–12 months for 17%, <12 for 10% of CI recipients respectively. Time of processor first matching: <2 weeks for 10%, <4 weeks for 50%, <6 weeks for 31%, >6 weeks for 9% of CI recipients respectively. Processor usage time was <5 years in 30%, 5–7 years in 21%, 8–10 years in 21%, >10 years in 28% of CI recipients respectively. Waiting time for processor replacement was: 0–3 months in 3%, 3–6 months in 3%, 3–12 months in 7%, 12–24 months in 20%, >2 years in 40% of CI recipients respectively. Twenty-seven percent of patients did not apply for processor replacement.

Waiting time for CI surgery

Waiting time for CI surgery vs age of CI implantation and versus region of Poland showed marked differences. Statistical analysis of these data showed that between the group of children under 2 years of age (at the time of surgery) and the group between 3 and 18 years old there was a significant difference in waiting time for implantation (UM-W test; P = 0.003762). The median waiting time for an implant was 3 to 6 months for both groups, however, 75% of younger children were implanted within 6 months of hospital qualification, and older children reached 75% within 12 months after qualification.

Most voivodeships performed similarly in terms of "waiting for surgery", i.e. the median waiting time was 3–6 months, and 75% of the surveyed patients were implanted within a maximum of 12 months after hospital qualification (dolnoslaskie, lubuskie, lodzkie, kujawsko pomorskie, slaskie, malopolskie, wielkopolskie, mazowieckie, podlaskie). The best results in the statistics were obtained in case of patients from opolskie, swietokrzyskie, podkarpackie and pomorskie, where the analysis showed a median time of waiting of 0–3 months, and 75% of operations took place within a maximum of 6 months of hospital qualification. The worst situation was in warminsko-mazurskie voivodeship, because the median waiting time for surgery was 6–12 months, and only 50% of the patients were implanted within 6–12 months after hospital qualification.

Waiting time for CI surgery vs waiting time for qualification to CI showed interdependence, pointing to the organizational capacity of the hospital. For the patients awaiting hospital qualification for up to 3 months, the median waiting time for surgery was 0–3 months; 75% of patients were implanted no later than 6 months after qualification, while those who waited for more than 3 months for the qualification visit also waited longer for surgery implantation – median 3–6 months; 50% of them were implanted within 6–12 months after qualification (KW test; P < 0.00003).

The time of: first fitting visit, processor usage and processor replacement regarding different regions of Poland

First fitting of a sound processor

Patients from swietokrzyskie voivodeship waited shorter for the first fitting than the other. Every third patient had the first fitting visit within up to 2 weeks after CI implantation. The longest time was seen for patients from dolnoslaskie, where nearly 40% were waiting 6 weeks and the other 40% – 4 weeks. Those differences were clear but did not achieve statistical significance (P = 0.0386; K-W test).

Sound processor usage time

Patients from voivodships opolskie and podlaskie had the longest processor usage times – more than 10 years: 67% and 44% of patients from these voivodeships, respectively. The shortest processor usage time was seen in lubuskie voivodeship, with 42% of patients using the processor for less than 5 years. The differences did not achieve statistical significance (P = 0.3589; K-W test).

Upgrade of a sound processor

Nearly 50% of patients from voivodeships podlaskie, slaskie, dolnoslaskie, lubelskie and mazowieckie had the longest waiting time for sound processor upgrade – above 2 years. Over 83% of patients from opolskie voivodeship waited for the upgrade more than 12 months. It was also easy to notice that nearly 40% of respondents from zachodnio-pomorskie, podlaskie, podkarpackie and lodzkie did not submit an application for sound processor upgrade. The differences did not achieve a statistical significance (P = 0.6013; K-W test).

Satisfaction with the frequency of visits

For 74% of patients, visits were sufficiently frequent and for 24% of respondents – too rare. Satisfaction with the frequency of visits did not correlate significantly with the age of adult patients, sex, waiting time for qualification for implantation, or time of the first matching of the processor.

Satisfaction with the frequency of visits of processor matching varied statistically between responses of parents and adult recipients. According to most of them (80%), these visits take place often enough [Mann-Whitney U test (UM-W), P = 0.019426], and too rarely according to 19%. Proportions among adult recipients' satisfaction were 66% (often enough) and 34% (too rare). So, in this group it would be advisable to ensure a higher frequency of visits.

Comparison of satisfied and dissatisfied parents depending on the distance, travel time and processor usage time

There was no statistical significance between parents' satisfaction with the frequency of visits and distance to the facility, time of journey and willingness to use online services. Just like in a group of adult recipients here we also found a strong correlation between satisfaction with the frequency of visits and processor usage time (P = 0.00073; Chi^²). The proportion of satisfied vs unsatisfied parents was the highest for short processor usage time (less than 5 years) – 91% vs 9%, and it changed with increasing processor usage time for 85% vs 15% and 70% vs 30%. Among the patients with the longest usage time (more than 10 years) there was an increase in satisfaction (75% vs 25%), however regarding the group of unsatisfied parents the majority of them was unsatisfied especially when the processor usage time was longer than 8 years – it was 72%.

Differences between patients satisfied and unsatisfied with the frequency of visits and duration of visits at the same time was strongly related to processor usage time (P = 0.00399; Chi^²). The number of patients unsatisfied with the frequency and duration of visits increases with time of processor usage – 10% of unsatisfied patients used the processor for less than 5 years, 22% from 5 to 7 years, 25% from 8 to 10 years and 42% for more than 10 years.

Among 29 patients satisfied with the frequency of visits but unsatisfied with their duration almost each third patient (32%) had the lowest experience with sound processor – less than 5 years; and similarly 29% with the greatest experience – more than 10 years. In the analysed group there were almost twice more patients unsatisfied with the frequency and duration of visits than satisfied with the frequency but unsatisfied with the duration of visits with an exception of a subgroup of patients using their processor for more than 10 years P=0.02685, Chi^² (inverse relation).

Patients from voivodships lubuskie, pomorskie, swietokrzyskie and zachodnio-pomorskie presented a higher level of satisfaction from the frequency of visits (more than 80% of satisfied patients) than patients from podlaskie and lodzkie (less than 67% of satisfied patients), with differences being easy to notice in the table of distribution of individual responses but not achieving statistical significance. More than 25% of respondents from voivodeships lodzkie, podlaskie, kujawsko-pomorskie, warminsko-mazurskie, wielkopolskie, lubelskie, opolskie, mazowieckie claimed that the visits were too rare – especially at podlaskie and lodzkie (>33%). More than 6% of the unsatisfied patients from malopolskie and dolnoslaskie would prefer less frequentl visits (differences were not statistically significant, P = 0.9323, K-W test).

Satisfaction with the duration of visits

The duration of the visit was appropriate for 86% and too short for 14% of patients. Satisfaction with the duration of the visits did not depend on the person responding, i.e. parent/adult recipient, age of adult patients, sex, waiting time for qualification for implantation and surgery, time of the first adjustment of the processor, time of using the processor, time of waiting for the replacement of the processor. Patients from voivodships warminsko-mazurskie and lodzkie presented a lower level of satisfaction from visit duration than patients from other regions – almost every third and every fourth patient (respectively) claimed that visits were too short. These differences did not achieve statistical significance (P = 0.4658; K-W test).

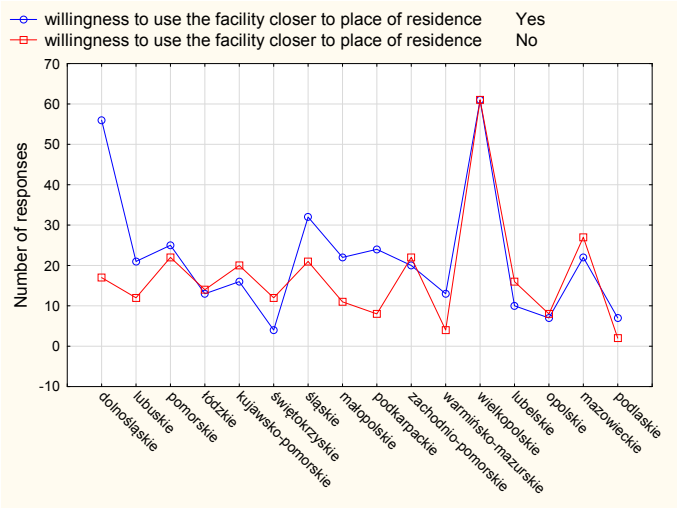

Fig. 2. Willingness to use the facility closer to the place of residence in relation to the patient's place of residence.

Willingness to attend to a facility closer to the place of residence

If there was an implanting hospital closer to home, 56% of patients would use this facility. The declaration of willingness to choose a closer hospital did not depend on the person responding, i.e. parent/adult recipient, age of adult patients, sex, waiting time for qualification for implantation, surgery, first-time processor matching, processor usage time, and waiting time for processor replacement. Willingness to use a facility closer to the place of residence was strictly bound with the region of Poland – results are clearly visible in Fig. 2. In general, 56% of respondents would benefit from an implanting center closer to home, however, a thorough statistical analysis of the distribution of responses relative to patient's home (more precisely – voivodship) showed a statistically significant (Chi^² test; P = 0.00016) relationship between these factors. It is clearly visible that patients from voivodships with large clinical centers with a hearing implant program do not have such a strong need for centers closer to their place of residence (e.g. wielkopolskie – Poznan: yes_50% – no_50%, zachodnio-pomorskie – Szczecin: 48% – 52%, mazowieckie – Warsaw, Kajetany: 45% – 55%, lodzkie – Lodz x2: 48% – 52%, lubelskie – Lublin: 38% – 62%). The situation is different, for example, in the dolnoslaskie voivodeship, where over 76% (n = 56 out of 73) were in favor of the center closer to home, in slaskie – 60%, lubuskie – 64%, malopolskie – 67%, podkarpackie – 75%, warminsko-mazurskie – over 76%, podlaskie – 78%.

The factors connected with the place of residence and the desire to use a center closer to the place of residence: distance to the implanting clinic and travel time to this facility were analyzed. Willingness to use a facility closer to the place of residence vs distance to the facility was analyzed. The desire to use a center

closer to the place of residence is univocally related to the distance to the current facility (Chi^² test; P = 0.01306). Over 78% of the respondents in favor of a closer center now, have a distance of over 100 km to their facility (278/469) and 10% (35/69) cover the distance of 50–100 km, however, it is less than 60% of patients who declare a distance of over 100 km to their facility; 40% (n = 191) of patients despite the distance of > 100 km did not want to attend a center closer to their place of residence.

Willingness to use a facility closer to the place of residence vs time of journey showed a similar dependence. Travel time to the implantation center turned out to be a statistically significant factor influencing the desire to be treated closer to home (Chi^² test; P = 0.00155). Over 62% of patients (206/330) commuting to the center for more than 3 hours were in favor of the center closer to their place of residence, which constitutes more than 58% of all in favor of creating new centers (n = 353). Of 277 individuals who want no change, 124 (45%) travel >3 h, 50 (18%) 2–3 h, 52 (19%) 1–2 h and 51 (18%) <1 h.

Willingness to use a facility closer to the place of residence vs satisfaction with the frequency of visits were bound together. The frequency of visits influenced the decision to have an implantation center closer to home (Chi^² test; P = 0.00102). For 469 patients, visits are often enough, but 248 (53%) would like to have a center closer. As many as 149 patients would like to see specialists more often, but 62% of them (n = 93) would like to have a center closer at the same time, and 38% (n = 56) would be willing to continue commuting. As many as 12 people would like to have visits less often, with everyone declaring their desire to have a center closer.

Willingness to use a facility closer to the place of residence and ability to pay from private funds for matching the processor constituted two separate features demonstrating the desire to change the organization of CI implantation system. Among patients ready to pay from private funds, the majority, i.e. about 66% (n = 167) were in favor of having a center closer to their place of residence, which was statistically significant (Chi^² test; P = 0.00004). Among the group not declaring readiness to pay from private funds, the emergence of a new center closer to the patient's place of residence did not play a significant role – the distribution of answers (for and against) was around 49% vs 51% respectively.

Readiness to pay for processor matching

Readiness to pay from private funds was indicated by 40% of respondents (n = 253). The declaration of willingness to pay from private funds did not correlate significantly with the person responding – i.e. parent/adult recipient, age of adult patients, sex, waiting time for qualification for implantation, surgery, first processor matching, time of processor usage, time of waiting for processor replacement.

Readiness to pay from private funds was related to the region of Poland. A detailed statistical analysis showed voivodships in which patients did not declare any willingness to pay for the visits (Chi^2 test; P = 0.02425) and they included swietokrzyskie (88% against), kujawsko-pomorskie (75%), lubelskie (69%), mazowieckie, podlaskie, lodzkie, lubuskie, wielkopolskie and warminsko-mazurskie (64 to 67% each). An exception was malopolskie, with 61% of patients being able to pay for such a visit, and dolnoslaskie and pomorskie (52% and 51% respectively), where such a distribution was symmetrical – clearly visible in Fig. 3.

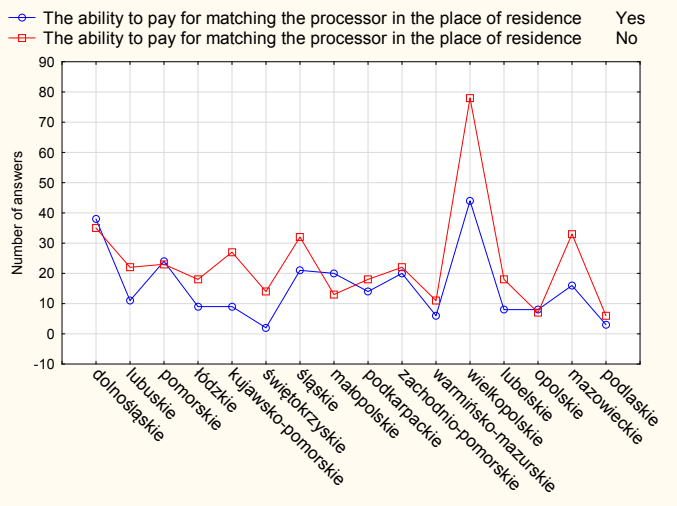

Fig. 3. The ability to pay for matching the processor at the place of residence in relation to patient's voivodeship..

DISCUSSION

This study explored patients' opinions on current CI pathway services, depending on the place of residence of CI recipients. Poland, the country with a population of approximately 38.4 million people and an area of 312 705 km² [7] has few tertiary referral CI centers, which makes the CI recipients travel long distances. There are also scarce human/specialist resources to provide permanent services of CI. Therefore, we aimed to analyze the time of travel and distance to CI centers and subjective measures, like patients' satisfaction and expectations. The on-line survey method was used as the most objective one.

The quality of life of CI recipients has been widely examined, but in aspects predominantly related to the restored function of hearing [4, 5, 8, 9] and the close cooperation among different professionals for the success of the CI program [1, 10]. However, for patient's satisfaction, certain basic conditions must be met, constituting so called "logistics". This was a premise to investigate the previously unexplored logistic parameters, such as distance and travel time, waiting time at subsequent stages of treatment (qualification, implantation, fitting, processor replacement). Through surveys, we examined the impact of logistics on the overall level of satisfaction with the organization of the implantation process depending on the place of residence of CI recipients.

Time is an important factor at all stages of qualification, implantation and rehabilitation of CI recipients and occurred to be bound with the region of Poland. The first issue was the age of implantation, although it was not the specific subject of this study. Waiting time for implantation in the youngest patients in the study group was less than 6 months and the implantation age did not

exceed 18 months; however, this waiting time could be even shorter to provide better results of cochlear implantation. According to the current standards, the cochlear implant should be placed immediately after qualification [11]. The lower age limit is actually considered to be 12 months worldwide, also in Poland [9]. According to The Early Hearing Detection & Intervention (EHDI) 1-3-6 guidelines, children should be examined at 1 month of life, diagnosed not later than up to the 3rd month of life and get involved in the audiological programs and rehabilitation at 6 months of life [12]. All these steps should provide early hearing detection and intervention [13], resulting in early implantation and good rehabilitation results of children with hearing loss.

The best practices were found among patients from opolskie voivodeship (median: up to 3 months) and the worst in malopolskie (median: 6–12 months). However, in the group of older children the waiting period for CI should be minimized and situations of a child aged 1–2 years waiting over 12 months for an implant should be prevented. The shortest waiting time for older children was in swietokrzyskie voivodeship (median: up to 3 months) and the longest was in slaskie (median: 6–12 months). According to Bruijnzeel et al. [14], regardless of great heterogeneity in European practice, reasons for the delay should be identified on a national level and possibilities to prevent avoidable future implantation delays should be explored to prepare national recommendations.

The design of our study focused on technical issues like distance to the facility and travel time, although subjective points of view of CI recipients such as their satisfaction were also examined. The place of residence of CI recipients was the variable essential for all analyses. Satisfaction with visits was assessed based on two components, their frequency and duration. Satisfaction with the frequency of visits varied between responses of parents and adult recipients, 66% and 34% respectively. The best score was gained in lubuskie and the lowest level of satisfaction was in lodzkie and podlaskie. Detailed analysis of satisfied and unsatisfied adult patients shows that their answers were dependent on processor usage time. The more experienced the patient, the less satisfied he/she was with the frequency of visits (especially those using their processor for more than 10 years). The visit duration was appropriate for majority (86%) of patients. Satisfaction with the duration of the visit did not depend on the person responding – i.e. parent/adult recipient or any other variables. The most numerous satisfied recipients were from lubuskie and the least from warminsko-mazurskie voivodship.

Financial issues were the most frequent reason for which implant programs failed in many countries [15–18]. Some studies constitute a real call for action regarding financial and educational support for pediatric CI recipients, with a strong stress to the CI device maintenance [18]. According to the recipients, processor upgrade is one of the most important issues for the whole CI process [19, 15]. Physicians who learn and use supply chain and revenue management methods can try to ensure that their patients have continued access to cochlear implant surgery and clinical services [16]. In our sample, the processor usage time was longer than 5 years for 451 of 630 (72%) recipients, including 187 CI recipients using a sound processor for more than 10 years (30%). Every fourth patient with an older sound processor (over 5 years) did not submit an application for processor upgrade and 41% of patients were waiting for a new processor for more than 2 years. It seems obvious that patients who did not submit an application for an upgrade are potential candidates for waiting lists in other clinics. The situation concerns most voivodeships, i.a. zachodnio-pomorskie, podlaskie, podkarpackie and lodzkie, where nearly 40% of the respondents did not submit an application. The longest waiting time for an upgrade was declared in podlaskie (50% of respondents) and lubelskie, mazowieckie, slaskie and dolnoslaskie (48% each). Most of the patients declaring the shortest waiting time for an upgrade – up to 6 months (n = 31, 6%) came from dolnoslaskie (5) and pomorskie (4) voivodeship. These differences between each region of our country did not achieve a statistical significance.

CONCLUSION

To summarize, this research highlighted the limitations of the current CI service delivery. Significant differences concerning the CI pathway for particular regions of Poland were found. The most satisfied were patients from lubuskie voivodeship and the least from lodzkie; and those differences were well visible and repeatable but not statistically significant. At the same time, significant regionalization was found in the desire to participate in the costs of fitting the speech processor and readiness to change the facility.

We also showed that the CI pathway could be shorter, especially in warminsko-mazurskie voivodeship. Waiting time for qualification, implantation and replacement of speech processors should be reduced, but this depends mainly on the available reimbursement and processing capacity of CI facilities. The second problem is the travel time to the facility. Although the quality of visits was rated high, there are communication and transport barriers for a vast majority of recipients. The travel distance and time was longest for dolnoslaskie, slaskie and podkarpackie voivodeships and shortest for wielkopolskie and mazowieckie; those differences were well repeatable, well documented and significant. One of the future goals for healthcare providers should be to level out the differences in access to CI services between different regions of Poland.

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