



Social Inequalities in Health: Outcomes of Children's Cochlear Implantation in Lithuania

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Abstract. The aim of this study was to evaluate the demographic, family, and educational differences in children's speech perception development after cochlear (hearing) implantation. The research was conducted in Vilnius University Hospital Santaros Klinikos during the years 2013–2018. Open-set speech perception in quiet surroundings were evaluated during hearing assessments ($n=81$). Information about different factor groups was collected according to the Nottingham Children's Implant Profile questionnaire. Three main factor groups were analysed: (a) demographic, (b) family, and (c) educational. A Bourdieu-based approach was adopted to analyse social inequalities of health of children with cochlear implants. Different factors were operationalized as different forms of capital. Our findings highlight the importance of family's social and cultural capital to children speech perception after cochlear implantation.

Keywords: cochlear implants, deaf children, health inequality, Lithuania, speech perception.

Socialinė sveikatos nelygybė: vaikų kochlearinės implantacijos Lietuvoje rezultatai

Santrauka. Šio tyrimo tikslas įvertinti vaikų su kochleariniais (klausos) implantais kalbos suvokimo raidos demografinius, šeimos ir lavinimo veiksnius. Tyrimas atliktas 2013–2018 metais Vilniaus universiteto ligo-

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ninės Santaros klinikose. Klausos raida buvo įvertinta naudojant atvirojo tipo kalbos suvokimo testus, kurie atlikti tylioje aplinkoje (n=81). Informacija apie skirtingas veiksnių grupes surinkti remiantis Notingemo kochlearinės implantacijos profilio klausimynu. Tyrimo metu buvo nagrinėtos trys pagrindinės veiksnių grupės: demografiniai, šeimos ir lavinimo veiksniai. Gauti rezultatai nagrinėti sveikatos nelygybės teorinių priegū kontekste, pasitelkiant P. Bourdieu teorines įžvalgas. Skirtingi veiksniai buvo operacionalizuoti kaip skirtingos kapitalo formos. Tyrimo rezultatai pabrėžė šeimos socialinio ir kultūrinio kapitalo svarbą vaikų su kochleariniais implantais kalbos suvokimo raidai.

Pagrindiniai žodžiai: kochleariniai implantai, sveikatos nelygybė, Lietuva, kalbos suvokimas.

Introduction

Relevance of the Study

The results of cochlear implantation are widely studied both in medical and educational literature. Results of previous research show that cochlear implantation gives the opportunity to hear, positively affects speech and language development, improves educational achievements, employment possibilities, and quality of life. It is proven that cochlear implantation decreases expenses for the deaf children education and increases deaf people work productivity (Bond et al. 2009). The results of study conducted in USA show that about half of children with cochlear implants exhibited standard scores of spoken language within the average range for hearing age-mates (Geers et al. 2009).

The number of cochlear implant users is rising in developed countries. Lithuania is not an exception. The number of cochlear implantation surgeries almost tripled during last decade (Mataitytė-Diržienė et al. 2018). In total, 463 implantations have been performed in Lithuania from 1998 to 2017. Implantations were conducted in two main hospitals: Vilnius University Hospital Santaros Klinikos and the Hospital of Lithuanian University of Health Sciences Kauno Klinikos; 234 implantations were conducted in Kaunas, and 229 – in Vilnius. Last available data show that 61 implantations were conducted in the year 2017, or 2.164 per 100 000 inhabitants. Overall 377 persons were implanted in Lithuania until the end of 2017 (Mataitytė-Diržienė et al. 2018). Due to the growing number of cochlear implant users, the demand of studies dedicated to analysing the outcomes of cochlear implantation is rising. According to the European Cochlear Implant User Association, there were 150 000 cochlear implant users in Europe (EURO CIU 2017).

Novelty of the Study

Majority of all implantations (79.48%) were conducted to children under 18 years old in Lithuania. Still there is a lack of studies dedicated to evaluating long-term outcomes of children's cochlear implantation. Only early postoperative results of cochlear implantation were evaluated in Lithuania (Byčková et al. 2012). Long-term results, such as speech perception, speech and language development, integration into general education system have not yet been studied in the Lithuanian population. Demographic, family, and educational factors that might affect the results of cochlear implantation were not studied as well. This is the first

study dedicated to analysing the differences of long term outcomes of children's cochlear implantation in Lithuania.

Individual results in cochlear implantation outcomes differ a lot. A huge variability in speech perception and language development results was observed (Geers et al. 2011; Tobey et al. 2013). Previous work has shown the importance of demographic and educational factors for development of speech perception and language development. Studies emphasized the demographic factors, importance of family involvement into therapy process, family's economic status, family size, use of oral language, and parent educational level (Geers et al. 2003; 2011; Holt et al. 2013). Therefore, deaf children from different social background benefits differently from early intervention (Holt et al. 2013).

Goal and Objectives of the Study

The goal of our study is to examine the relationship between the speech perception development level and demographic, family, and educational factors of implanted children and their families. Demographic factors were sex, age, and place of residence. Family factors were family size, parents' education and understanding of the cochlear implantation process, frequency of family visits to the cochlear implantation centre. Educational factors were parents' engagement in the learning process, communication mode, accessibility of speech and language therapy, intensity of speech and language therapy, educational placement settings, type of school and kindergarten attended. More information about list of factors and their variables could be found in the appendix no 1. The objectives of this study were: (1) to discuss the application of P. Bourdieu's theories application in health inequality researches; (2) to identify demographic, family and educational profile of families rising children with cochlear implants by performing a parents survey; (3) to evaluate the speech perception results of deaf children after cochlear implantation; (4) to determine prognostic factors for the outcomes of children's cochlear implantation by using statistical analysis; (5) to discuss the outcomes of children's cochlear implantation in the context of P. Bourdieu's theory.

Theoretical background

Social inequalities in health continue to be one of the key problems in public health and social policy documents both in national and international levels (European Commission 2013a; 2013b, LR SAM 2013). Social inequalities in health are described by WHO as "avoidable health inequalities that arise because of the circumstances in which people grow, live, work, and age, and the systems put in place to deal with illness. The conditions in which people live and die are, in turn, shaped by political, social, and economic forces" (CSDH 2008, 3). Previous studies conducted in Lithuania (Byčková et al. 2012; Mikstiene et al. 2016) did not examine the social aspects of cochlear implantation outcomes. In this study we analyse the outcomes of children's cochlear implantation in the context of social inequalities in health. Previous researches have shown (Holt et al. 2013) that the benefit which deaf children

gets from cochlear implantation varies between in upper and lower socioeconomic groups. We adopted P. Bourdieu's theory to interpret different demographic and educational factors as specific forms of *capital*. The notion of capital is used to describe and analyse the relations between the various positions in a social space (or field) (Samuelsen 2004). Capital is understood as a fundamental power, and P. Bourdieu (1986) argues that there are three types of capital: *economic* (financial resources, real estate), *cultural* (education, cultural norms), and *social* (social relationships). The capital which is the most valuable and the most powerful in a particular *field* becomes the *symbolic* capital of that *field*. Each of these forms of capital can be considered as a resource that might be useful for acquiring or maintaining good health (Pinxten, Lievens 2014).

P. Bourdieu's concept of *capitals* is becoming more common in researches dedicated to study social inequalities in health. There are some theoretical works based on P. Bourdieu's theoretical concepts in health of sociology (Carpiano 2006; Korp 2010; Cockerham 2013; Veenstra, Burnett 2014; Abel, Frohlich 2012; etc.) but only few empirical applications (Veenstra 2007; McGovern, Nazroo 2015; Pinxten, Lievens 2017). Medical sociologist W. C. Cockerham (2013) suggested incorporating P. Bourdieu's concepts in the *health lifestyle* theory. Different forms of *capital* are used in the health field to reach the better position in hierarchical structure. The higher position the individual (or *agent* in Bourdieu's terms) occupies the better health outcomes she or he reaches. P. Korp (2008) interprets practice of a *healthy lifestyle* as "habitual practices of groups which dominate the social fields where healthy living is an important issue." R. M. Carpiano (2003) developed theoretical model of neighbourhood social capital processes on individual health. T. Abel and K. L. Frohlich (2012) suggested A. Sen's capability approach as a link between P. Bourdieu's *capital* theory and action to reduce social inequalities in health. They have argued that the habitus concept does not provide a "theoretically supported move from sociological explanation to public health action" (Abel, Frohlich 2012, 236). Despite the critique of the relevance of P. Bourdieu's concepts to analysing social aspects of health inequality, there are some applications of this theory in empirical researches. W. Pinxten and J. Lievens (2017) adopted P. Bourdieu's concept of *capitals* to study social inequalities in perceptions of mental and physical health. P. McGovern and J. Nazroo (2015) applied P. Bourdieu's concept of social class to analyse patterns and causes of health inequalities in later life. To the author's knowledge, this is the first empirical study dedicated to health inequalities of deaf children and based on P. Bourdieu's concepts.

Data, methods and study design

Study Design

This interdisciplinary cross-sectional study was performed during 2013–2018 in Vilnius University, Faculty of Medicine, at the Clinic of the Ear, Nose, Throat and Eye Diseases, as well as in the Vilnius University Hospital Santaros Klinikos at the Children's Hospital at the Children's Otorhinolaryngology and Ophthalmology Department. The ethical principles of the Declaration of Helsinki for medical research involving human subjects were fulfilled.

This research was conducted with the permission from the Lithuanian Bioethics Committee (No. 158200-15-786-298, 05/05/2015) and only after the parents of participants signed the informed consent form.

Sampling

The sample of the study included children who underwent unilateral or bilateral cochlear implantations in Vilnius University Hospital Santaros Klinikos. Patients were informed about the study and suggested to participate during a scheduled visit to an otorhinolaryngologist-audiologist or via a phone call, using contact data found in medical documentation. Overall 130 children with cochlear implants were found, 81 of them met the inclusion criteria: aged 5–18 years (1); implanted at least 2 years ago (2); implanted not later than prior to 6 months (3); hearing loss diagnosed before their 3rd birthday (4); and had no severe additional disabilities (5). Data of all 81 participants were used to assess demographic, family, and educational characteristics.

Data Collection and Analysis

Parent's questionnaires about demographic, family, and educational characteristics were filled in during the visit to an otorhinolaryngologist-audiologist. Medical documentation reviewed from the in-patient and out-patient medical records, the electronic medical records of Vilnius University Hospital Santaros Klinikos and medical records from other healthcare institutions. Open-set speech audiometry was performed in an audiometric booth according to standard procedure to assess speech perception levels. Every child was presented with a list of 25 disyllabic phonetically balanced words at 65 dB sound pressure level in quite in a 1 m distance from the child. The child was instructed to repeat the words that he or she had heard. The speech perception score was calculated based on the number of correct words in percentages. Later, the results were classified according to speech perception levels into two groups of good (score $\geq 60\%$) and poor speech perception (score $< 60\%$) levels. The differentiation of speech perception level by demographic, family and educational factors was analysed using methods of statistical analysis: descriptive statistics and regression analysis. Demographic factors group included sex, age at the study, and place of residence. Family factors group included family composition, family size, father's education, mother's education, parents' understanding of the cochlear implantation process, and family visits to the cochlear implantation centre. Educational factors included parents' engagement in the learning process, accessibility of speech and language therapy, intensity of speech and language therapy, educational placement settings, kindergarten, school / program. A detailed list of factors and their variables is in the appendix no 1.

Different forms of capitals were operationalized using questions about patients demographic, family, and educational factors. We have assumed that parents' education and their understating of cochlear implantation process reflected family's cultural capital. Place of residence, access and intensity of speech and language therapy were indirectly related to family's economic status. Family factors, such as family composition and family size, were related to social capital.

Results

Descriptive Statistics

Descriptive statistics results showed that the speech perception level differed significantly by place of residence ($p=0.034$). The majority (60%) of children in the good speech perception group lived in five largest cities, whereas 47.6% of children from the poor speech perception group resided in small cities and the rural areas. The residential area was the only significant factor from demographic factor group. The speech perception level did not differ significantly by sex ($p=0.837$). The two groups did not differ on the number of bilateral cochlear implantations ($p=0.19$).

The descriptive statistics results of speech perception levels by family factors indicate an unfavourable situation in families with lower education. The education level of the fathers and mothers was lower in the poor speech perception groups ($p<0.001$ and $p<0.001$, respectively). Furthermore, parents of children from poor speech perception group tended to misunderstand the cochlear implantation process more often ($p<0.001$), and their families visited the cochlear implantation centre less frequently after surgery ($p<0.001$). However, the speech perception level did not differ significantly by family size ($p=0.0738$) and family composition ($p=0.061$).

The speech perception level differed significantly by all educational factors included into analysis. The results of descriptive statistics analysis showed that parents of children from poor speech perception group participated in the child's learning process less ($p<0.001$). Children from poor speech perception group attended specialized kindergartens and schools more often ($p<0.001$ and $p<0.001$, respectively). In addition, they used total communication more often ($p<0.001$). Total communication utilizes all modalities of communication (spoken, signed, and written) as well as lip-reading, and gestures in the education of deaf children (Mueller 2013). The groups differed significantly based on the accessibility of speech and language therapy: children from the poor speech perception group were less exposed to speech and language therapy ($p<0.001$), and it was significantly less intensive ($p=0.029$).

Regression Analysis

Table 1 provides outcomes from the univariate logistic regression analysis. The univariate analysis included all demographic, family, and educational variables that differed significantly between the good and poor speech perception groups. Univariate logistic regression demonstrated that speech perception was influenced by the place of residence (OR: 1.506). All factors from family factor group showed statistically significant association with speech perception level. The father's education (OR: 6.944), the mother's education (OR: 6.416), the parents' understanding of the cochlear implantation process (OR: 42.745), and the frequency of family visits to the cochlear implantation centre (OR: 24.444) were predictors of children's speech perception level. The parents' engagement in a child's learning (OR: 44.230), the accessibility of speech and language therapy (OR: 7.076), intensity of speech and language therapy (OR: 1.639) and type of the preschool institution (OR: 5.067) were educational variables that were associated with speech perception results.

Table 1. Univariate logistic regression analysis for detecting factors associated with speech perception and language development levels

Variable	Odds ratio		P-Value
	Value	95% CI	
Demographic factors			
Place of residence	1.506	1.044–2.173	0.029
Family factors			
Father’s education	6.944	2.403–20.066	<0.001
Mother’s education	6.416	2.170–18.968	0.001
Parents’ understanding of the cochlear implantation process	42.745	5.765–316.933	<0.001
Rehabilitation and educational factors			
Family visits to the cochlear implantation cent	24.444	6.234–95.855	<0.001
Parents’ engagement in the learning process	44.23	6.069–322.372	<0.001
Accessibility of speech and language therapy	7.076	2.837–17.652	<0.001
Intensity of speech and language therapy	1.639	1.030–2.609	0.037
Pre-school educational institution	5.067	1.812–14.171	0.002

Discussion and Conclusion

Discussion

The results of our study not only confirm the persisting hypothesis of the disadvantages in health associated with level of education (Mirowsky, Ross 2005), but also indicate the transfer of that disadvantage to our own children. We observed that living in the family where the parents have a low level of education increased the risk for children with cochlear implant to end up in the poor speech perception group. According to the theory, the advantages or disadvantages in health associated with our level of education accumulate throughout life and affect our physical health (Mirowsky, Ross 2005). Both descriptive statistics analysis and logistic regression analysis results showed the importance of family’s cultural capital to the speech development of implanted children.

The results of our study show that speech perception development results differed significantly by residential area. This factor does not reflect economic capital directly. However, people living in rural areas and small towns usually earn less compared to those living in urban areas and large cities (Statistics Lithuania 2019). So this factor may be related to economic capital. Other studies also confirm that living in a rural area may negatively affect health indicators (Jasilionis et al. 2015). Living in a rural area also may be related to limited access to speech and language therapy and an insufficient number of visit to a cochlear implantation centre.

P. Bourdieu described social capital as a network of actual or potential resources that can be legitimized by family, group, or class membership (Bourdieu, 1986). Such a network allows to access the necessary resources, information, and knowledge (Gretzinger et al. 2010;

Walther 2013). Results of our analysis show a strong relationship between parents' engagement in the learning process and the speech perception development level of children with cochlear implants. Therefore, children from such families have access to necessary information and knowledge at home.

Strengths and Limitations

One of the main advantages of this study is its representativeness. The study sample covered 40% of children implanted in Lithuania until the middle of 2017. These data allowed revealing tendencies of speech perception development by demographic, family, and educational factors in a whole population in Lithuania. The first limitation of this study is the limited operationalization of the measures we used. There were no factors directly related to economic capital, which may be crucial to access necessary postoperative services. However, parents' education or place of residence may be related to economic capital. The second limitation is related to a limited number of factors which may be related to speech perception development. In future researches, it would be important to include more factors related to cochlear implantation surgery, patient's anatomy, character, and intellect.

Conclusions

Our study demonstrates how focusing on different types of capital is useful for extending our understanding on the social causes of speech and language development in children with cochlear implants. The results of our study highlight the importance of family's cultural capital as a crucial element for the successful social integration of deaf children. Special attention should be paid to parents' engagement in the learning process of children with cochlear implants in families from a lower socioeconomic status.

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Appendix 1. Children in good and poor speech perception groups by demographic, family, and educational factors.

Variable	Speech perception group		P-Value
	Good (N=60) N (%) or M (±SD)	Poor (N=21) N (%) or M (±SD)	
Demographic factors			
Sex			0.837
Male	30 (50)	14 (66.7)	
Female	30 (50)	7 (33.3)	
Place of residence			
Cities pop. >100.000	36 (60)	7 (33.3)	0.034
Cities pop. 20,000-99,000	6 (10)	1 (4.8)	
Cities pop. 10,000-19,000	1 (1.7)	3 (14.3)	
Cities pop. <10,000 and rural areas	17 (21)	10 (47.6)	
Age at study			
Age at the time of the study, years	8.32 (±2.56)	9,67 (±2.9)	0.057

Family factors			
Family composition:			0.061
Nuclear family	52 (86.7)	15 (71.4)	
Single-parent	7 (11.7)	6 (28.6)	
Caregivers	1 (1.7)	0 (0)	
Family size:			0.738
One child	23 (38.3)	10 (47.6)	
Two children	29 (48.3)	7 (33.3)	
3 or more children	8 (13.3)	4 (19.0)	
Father's education			<0.001
Higher	32 (55.2)	1 (4.8)	
Secondary	23 (39.7)	15 (71.4)	
Lower than secondary	3 (5.2)	5 (23.8)	
Mother's education			<0.001
Higher	39 (66.1)	5 (23.8)	
Secondary	20 (33.9)	14 (66.7)	
Lower than secondary	0 (0)	2 (9.5)	
Parents' understanding of the cochlear implantation process			<0.001
Sufficient	37 (61.7)	1 (4.8)	
Insufficient	23 (38.3)	8 (38.1)	
Did not understand	0 (0)	12 (57.1)	
Family visits to the CI center:			<0.001
Sufficient	34 (56.7)	1 (4.8)	
Insufficient	24 (40.0)	4 (19.0)	
Did not visit	2 (3.3)	16 (76.2)	
Educational factors			
Parents' engagement in the learning process			<0.001
Active	42 (70.0)	1 (4.8)	
Passive	18 (30.0)	8 (38.1)	
Did not participate	0 (0)	12 (57.1)	
Communication mode:			<0.001
Spoken language	59 (98.3)	4 (19.0)	
Total communication	1 (1.7)	14 (66.7)	
Sign language	0 (0)	3 (14.3)	
Accessibility of speech and language therapy:			<0.001
Good	46 (76.7)	4 (19.0)	
Moderate	12 (20)	10 (47.6)	
Bad	2 (3.3)	7 (33.3)	

Intensity of speech and language therapy:			<0.029
Did not attend	0 (0)	7 (33.3)	
Once per week	12 (20)	3 (14.3)	
2 times per week	32 (53.3)	6 (28.6)	
3 times per week	7 (11.7)	3 (14.3)	
5 times per week	9 (15)	2 (9.5)	
Educational placement settings:			<0.001
General education	56 (93.3)	5 (23.8)	
Special education	4 (6.7)	16 (76.2)	
Home-schooling	0	0 (0)	
Does not attend yet	0	0 (0)	
Kindergarten:			0.001
General	41 (68.3)	6 (28.6)	
Special education	19 (31.7)	13 (61.9)	
Did not attend	0 (0)	2 (9.5)	
Does not attend yet	0 (0)	0 (0)	
School/program (N=57):			<0.001
General school/mainstream program	31 (79.5)	1 (5.6)	
General school/adapted program	7 (17.9)	5 (27.8)	
Special education school	1 (2.6)	12 (66.7)	
Home-schooling	0 (0)	0 (0)	