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RESEARCH ARTICLE

Effects of families' socioeconomic and education level on auditory skills of cochlear implant users: an Iranian population study

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Abstract

Background and Aim: Hearing loss can have disabling effects on all aspects of children's life and demographic factors of families can have significant effects on children's auditory development. The main aim of the study was determining the effects of socioeconomic and education level on auditory behaviors of hearing-impaired children.

Methods: The study was cross sectional descriptive-analytic study and was conducted on 207 parents of children under age of four years with native Persian speaking parents with literacy skill. Their hearing impairment was identified before the first month of age. Early occurrence of hearing loss was considered to exclude any effects of early exposure to normal auditory stimuli on the outcome measurements. The children had at least 3-month experience with the cochlear implant (CI) after best fitting and adaptation to their device at the time of the study. Samples were selected by convenience sampling method from available subjects. For determining socioeconomic level, Ghodratnama socioeconomic status (SES) questionnaire was used. Infants and Toddlers Meaningful Auditory Integration Scale (IT-MAIS) was selected for the auditory behaviors study.

Results: Socioeconomic and educational level of the family showed no significant effects on auditory behaviors. The age of receiving auditory assistive device had weak but statistically significant effect on the outcome.

Conclusion: It seems that socioeconomic status and educational level of the family did not contribute to the auditory behaviors of children with cochlear implant. The generalizations of these results need further studies.

Keywords: Cochlear implant; pediatric; auditory behaviors; socioeconomic status

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Introduction

Hearing loss can have disabling effects on all

aspects of children's life [1]. Evaluation and estimation of functional effects of hearing impairment is difficult especially in children below 3 years of age [2]. In addition, after prescribing hearing assistive devices and starting auditory rehabilitation, it is necessary to evaluate the communication outcome to ensure that the device and the training program are efficient and it is essential to control factors limiting rehabilitation success [3-5].

It seems that the demographic background of the child and his family (e.g. ethnicity, race, educational status and socioeconomic status) plays important part on auditory progress of hearing-impaired children regardless of the type of auditory assistive device [6-8]. For example previous studies have suggested that the level of parental involvement, their knowledge, support provided by clinicians and socioeconomic status are essential factors affecting the psychosocial and academic development of the child and contribute to his or her ultimate quality of life [8-11]. The parents try to meet the needs of their children and prepare an appropriate environment for their growth and development and parents of hearing-impaired children often require more information and support to meet their children's needs. This support must be provided according to the education and cultural status of the family to be effective and there is no one accepted way [11]. In fact factors such as the distance from service centers, ethnicity, educational status, the availability of financial supports, and commitment from the parents are all important in final outcome. However, most studies have reported that socioeconomic and education level of the family can affect the age of hearing loss identification and receiving auditory assistive devices. Secondary to these factors auditory outcome is affected [9,12-14]. This raise this question that if the age of hearing loss identification, receiving hearing assistive device and auditory rehabilitation is similar, is there any additional effects of family education and socioeconomic status (SES) on the children's auditory behaviors.

The main aim of the study was the evaluation of auditory behaviors in hearing-impaired children with cochlear implant (CI) and determining the effects of socioeconomic and education level on their auditory outcome. This study tries to limit confounding variables to isolate the effects of socioeconomic and education level on auditory behaviors of children with CI. This results do not intend to isolate CI effects on auditory development and skills of children, but it tended to indicate the effects of socioeconomic and education level of families and the whole trend of auditory development from hearing aid prescription, auditory rehabilitation before CI and after CI.

Methods

The study was a cross-sectional descriptive analytic study from 2015-2017 and 2018-2019 and was conducted on 252 parents of children with CI at Baqiyatallah Cochlear Implant Center, Baqiyatallah auditory rehabilitation center and AVA rehabilitation center. The sampling method was convenient method and from available cases with pre-defined inclusion criteria. Only 207 cases showed full co-operation with valid responses to the questionnaire and their data were analyzed. Inclusion criteria included following items: native Persian speaking parents with literacy skill who had children under age of 4 years old with profound hearing loss that happened before the first month of age without any accompanying mental or physical disabilities based on medical documents from CI center. Medical documents were completed by the second and last author of the article. In addition all children had their hearing aid before age of one year old and had their CI before 2 years of age. Also children had at least 3-month experience with the CI after best fitting and adaptation to their device at the time of the study. A written informed consent was obtained from participants. The study was approved by the ethics committee of Tehran University of Medical Sciences with the registration Code of IR.TUMS.FNM.REC.1397.164.

Infant and toddler meaningful auditory integration scale (IT-MAIS) was used for evaluation of auditory behaviors of children. This scale is a modification of the Meaningful Auditory Integration Scale (MAIS) (Robbins et al. 1991). IT-MAIS was selected for the study because it is the most frequently used in different parts of the

world to help determine cochlear implant candidacy and monitoring listening development after cochlear implant surgery in children with hearing loss [15]. It is translated and validated in many languages including Arabic, Italian, Chinese, German, Polish, and British English [16,17]. It is completed during an interview and parents/caregiver are encouraged to provide as many examples of the child's auditory behaviors in real-world situations as possible (duration of the interview was from 30 minutes to 1 hour). IT-MAIS is useful for the quantitative valuation of auditory behaviors in different situations and consists of 10 main probes that assess three areas: vocalization behavior; alertness to sounds; and deriving meaning from sound. Question 1 and 2 are related to vocalization changes following device usage; questions 3−6 are related to child alertness to environmental sounds; question 7−10 are related to auditory recognition. For scoring, 0 (lowest = never) to 4 (highest = always) points can be designated to each probe. The time percentage spent by the child on auditory abilities is investigated and scored. The overall score Cronbach α (internal consistency) for original scale 0.83 and for Farsi version was 0.93. Test-retest reliability of original version was 0.92 and for Farsi version was 0.96 [2]. The interview was performed by an audiologist (first author). The interview could help to avoid any simple yes/no answer from parents. Parents could ask their questionnaires in case of any ambiguity of the questions, they were encouraged to provide as many examples as possible and the interviewer could check the accuracy of the responses. Parents could contact the corresponding author of the article for more information any time during the research.

Demographic information of parents and children, as well as hearing impairment information, were obtained from interview and medical documents. For determining socioeconomic level, Ghodratnama socioeconomic status (SES) questionnaire was used which is a valid and reliable tool in Farsi. Ghodratnama questionnaire that included 4 main components (family income, economic level, house situation and education) and 6 demographic (sex, age, marital status, education level, whether has a job or not, what is the job). Each main question has a 5-point Likert scale options (1 = very low and 5 = very high). It was confirmed that the formal and content validity of the questionnaire by 12 experts, and the reliability of the questionnaire was 0.83 using Cronbach α [18].

Data analysis was performed by using SPSS 17. For analyzing the relationship between different demographic information with each other and the effects of SES and educational level on IT-MAIS score, Pearson Chi square and ANOVA tests were used. The significance level was considered 0.05.

Results

Data analysis was performed on 207 parents (170 mothers) of children (mean age of 3.28 ± 0.45 years old) with CI (81 girls). The mean duration of CI usage (after best fitting and adaptation to the device) was 7.2 ± 3.5 months. The mean age of mothers and fathers was 33.27 (±5.40) and 37.65 (±5.63) years old respectively. Number of siblings were from 0 to 5 (with mean of 1.92 ± 1.69; median 2). The etiology of hearing the loss is summarized in the Fig. 1.

114 (55.1%) families were living in urban areas with mean distance of 3.08 ± 2.56 Km and 93 families were from rural areas (44.9%) mean distance of 58.76 ± 66.76 Km. They were from different cities and rural places of Iran. 77 (37.2%) parents had consanguinity. In urban families 21 (18.42%) out of 114 and in rural families 56 (60.21%) out of 93 had consanguinity. Pearson Chi-square test showed that there was a significant relationship between place of living and consanguinity ($p < 0.001$).

91 (42.85%) families reported that they had hearing loss history in their next of kin (32.5% of urban families and 57% of rural families). Pearson Chi-square test showed a significant relationship between place of living and family history of hearing loss ($p < 0.001$). Pearson Chi-square test also showed that there was a significant relationship between consanguinity and family s of hearing loss ($p = 0.02$).

170 (82.1%) respondents were mothers and 37 (17.9%) fathers. Mothers and fathers' education

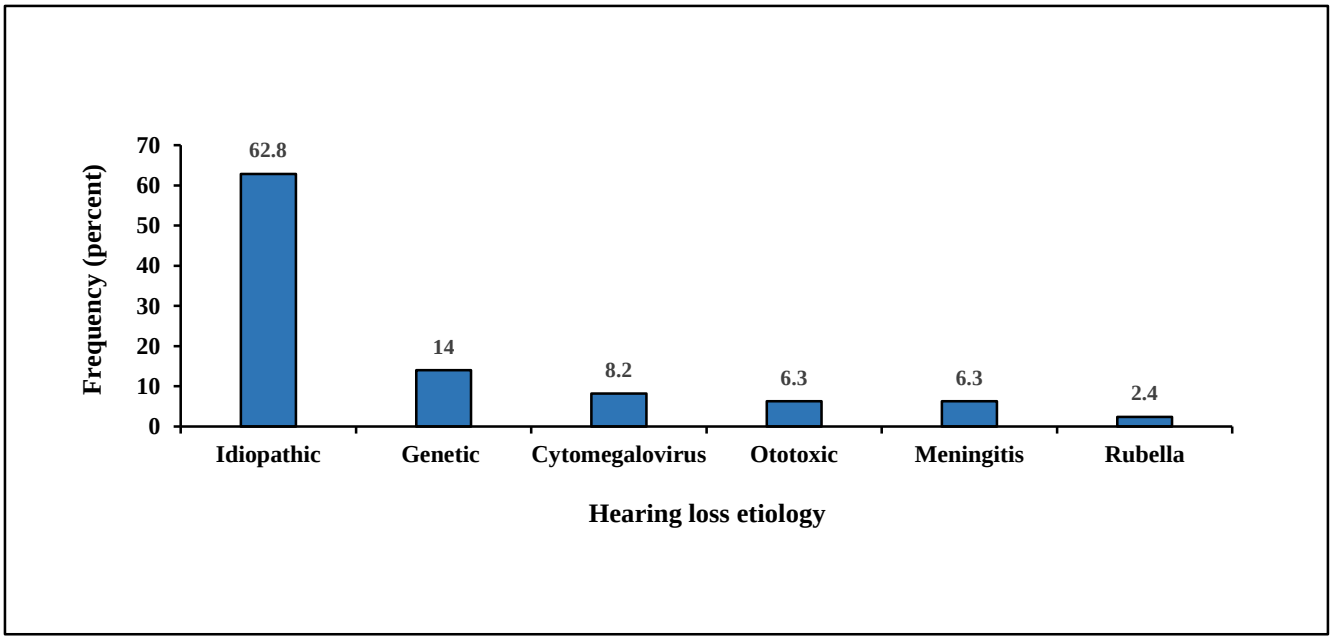

Fig. 1. Etiology of hearing loss in children with cochlear implant.

status is summarized in Fig. 2. Pearson Chi-square test also showed that there was a significant relationship between the place of living and parents' education level ($p < 0.001$). ANOVA test failed to show any significant effects of parents' education level on the IT-MAIS scores ($p = 0.34$ for mothers and $p = 0.41$ for fathers). 194 mothers (93.7%) were housewives or worked at house and the remaining 13 (6.3%) had a job with mean working hours of 52.53 ± 10.61 per week. All fathers had a job: 101 (48.8%) were self-employed, 69 (33.3%) were office employees and 37 (17.9%) were workers and their mean working hours was 57.47 ± 14.43. All children had a two-parent family.

For evaluation of SES of the family, Ghodratnama SES questionnaire was used. 76 (36.7%) families had low, 123 (59.4%) had medium and 8 (3.9%) had a high socioeconomic level. The mean score of IT-MAIS total score was 81.42% ± 5.81% (range from 62.50% to 92.50%). ANOVA test showed no significant effects of family SES on the IT-MAIS score ($p = 0.26$).

All cases had unilateral CI. In 155 cases (74.9%), the right ear was the implanted ear and in 52 children (25.1%), the left one had CI. T-test showed that there were no significant effects on the CI side on the IT-MAIS scores ($p = 0.59$).

Age of hearing loss incidence and identification was before 1 month of life in all cases. The age range of receiving hearing aid was 4 to 11 months old (mean of 7.92 ± 1.56 months old). The age range of receiving CI was 12 to 22 months (mean 17.81 ± 2.16 months). All cases started auditory training (auditory verbal therapy in all cases) immediately after receiving hearing aids. Pearson correlation test showed that there was a weak but statistically significant correlation between the age of receiving hearing aid and IT-MAIS scores ($r = -021$; $p < 0.001$). However, there was not a significant correlation between the age of receiving CI and IT-MAIS scores ($r = 0.03$; $p = 0.65$).

Discussion

Reports about the prevalence of severe to profound hearing loss in children are variable but it seems that the prevalence is about 0.1−0.2% in the US [6]. However, the prevalence might be different and potentially higher in developing countries such as Iran [19]. Many factors can contribute in this variation. In a study by

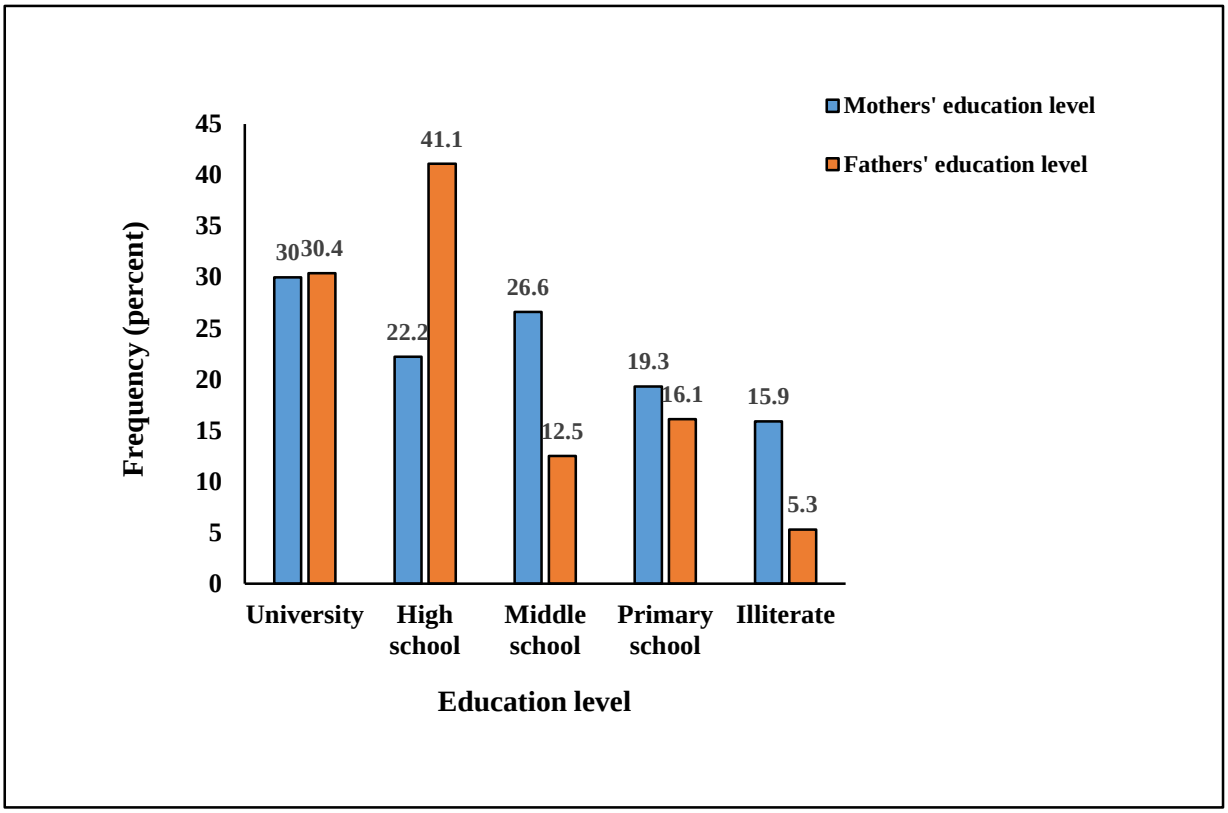

Fig. 2. Education level of parents of children with cochlear implant.

Yousefi et al. the most prevalent risk factor for hearing loss in Iranian children was a hereditary factor. They showed that 65% of the parents of 310 children with hearing loss had a consanguineous marriage which is higher than the reported mean of consanguineous marriages in Iranian normal population (38.6%). Hereditary hearing loss, in general, has a higher incidence in the Middle East which might be attributable to a higher incidence of consanguineous marriages [20-23]. In the present study, 77 (37.2%) parents had consanguinity (urban families = 18.42%; rural families = 60.21%). Pearson Chi-square test showed that there was a significant relationship between place of living and consanguinity. Pearson Chi-square test also showed that there was a significant relationship between consanguinity and family history of hearing loss. High prevalence of hereditary hearing loss and its' correlation with consanguinity has been reported in Iran, Saudi Arabia and Qatar [20,22,24-26].

In the present study, all cases had hearing loss before first month of age and the age range of receiving hearing aid was 4 to 11 months old (mean of 7.92 ± 1.56 months old) and the age range of receiving CI was 12 to 22 months (mean 17.81 ± 2.16 months). At the time of the study mean age of children was 3.28 ± 0.45 years old. The study showed that there was a weak but significant relationship between the age of receiving hearing aid and children's auditory performance on IT-MAIS-F score. There was not any significant relationship between age of cochlear implantation and IT-MAIS-F score. The reason might be due to this fact that participants had relatively early age of receiving hearing aid and auditory rehabilitation. Several studies have shown that the age of receiving amplification is a very vital factor in determining children' auditory, speech, and language outcome. In fact, children who receive their amplification in the early months of life can perform near their normal-hearing peers or they show better outcome after CI [27-30]. For achieving this goal professional

need parents' commitment and participation. This can be achievable through appropriate consultation which is adapted for each individual. In consultation process the ethnicity, education level and SES of the family are determining factors and can affect auditory outcome in children [6].

Several studies have reported that SES of the family can potentially affect the auditory performance of hearing-impaired children [14,31]. It has been suggested that SES affects the age and accessibility of hearing assistive devices and auditory rehabilitation. Hearing aid, auditory rehabilitation and implantation are costly. In fact, it seems that families with lower SES show delay in seeking auditory assistive device and rehabilitation facilities and this could be the most important factor in determining the auditory performance of hearing-impaired children [8,11]. Parents must be aware of all consequences of late auditory intervention and be supported financially and psychologically to start intervention in time. In the present study, there was not any significant effect of SES on the auditory performance of hearing-impaired children. Eyalati et al. stated that in Iran, general knowledge about hearing loss is poor among parents of hearing-impaired children and also among professionals working with these families. They showed that these families need more additional and appropriate information and there is poor general awareness and weak consultation. This leads to late acceptance of hearing loss and its' consequences. They also showed that parents who had a higher level of education needed less information than those with less education. Parents with higher level of SES had more information about different domains related to hearing loss and it seemed that SES appears to be an important factor affecting buying hearing aid, its' maintenance, persistent participation in auditory rehabilitation classes [11]. Yucel et al. studied sixty-five parents of children and showed that the delays in obtaining a hearing aid device secondary to economic problems and low level of awareness to hearing loss are the major factors that may affect early intervention [32]. Jeddi et al studied 96 children with profound SNHL with cochlear implant. They showed there was a significant delay between the diagnosis of hearing loss and aural rehabilitation in hearing-impaired children. Parents' education level and economic status had a significant effect on the age of cochlear implantation [8]. Chang et al reported that additional disabilities, severity of hearing loss, gender, and maternal education are important factors for determining auditory outcome of children. They showed that higher maternal education was associated with better outcomes for children at 3 years of age possibly due to the quality and quantity of communicative input provided in the home environment [33]. The present study showed different result from aforementioned studies. There reason might be due to different inclusion criteria. The present study only investigated children who had hearing loss before age of one month old and early auditory assistive device prescription and rehabilitation. The results of the present study is in agreement with Chang et al. and Wu et al. Chang et al. studied 133 pediatric patients and showed that with fair medical care and insurance, there is no significant effect of SES on auditory outcome of children after cochlear implantation [33]. Wu et al. found that there were no relation between parental level of education and degree of parental involvement in auditory verbal therapy. They reported that when insurance covers the cost of auditory assistive device, this factor does not affect performance as much as it was thought in the past [34]. In the present study parent's educational level had no significant effects on children's performance. It appears that with providing similar facilities with low cost to all families regardless of their SES or education level and with suitable informational consultation according to their SES or education level, we can limit the contribution of these factors to great extent.

The generalization of the present study results need further research with sampling from different cochlear implant centers.

Conclusion

It seems that socioeconomic status and educational level of the family might not contribute strongly to auditory behaviors of hearing-

impaired children as long as there is early prescription of auditory assistive device and auditory rehabilitation. The generalizations of these results need further studies. This study did not intend to investigate effects of cochlear implantation on auditory development and auditory skills of children, but it considered a whole picture from hearing aid prescription, auditory rehabilitation before CI and after CI and tried to extract the effects of SES and educational level of families on children's auditory progress.

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Conflict of interest

All authors declare that they have no conflict of interest.

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