Trends in Educational Placement and Cost-Benefit Considerations in Children With Cochlear Implants

Howard W. Francis, MD; Mary E. Koch, MA; J. Robert Wyatt, MD, MBA; John K. Niparko, MD

Objectives: To study the effect of cochlear implantation on the use of educational resources by profoundly hearing-impaired children and to determine trends in educational cost vs benefit.

Design: Retrospective study and cost-benefit analysis.

Setting: Outpatient pediatric cochlear implant program in an academic institution (The Listening Center at Johns Hopkins University School of Medicine, Baltimore, Md), in collaboration with public schools in Maryland and surrounding states.

Patients or Other Participants: School-aged children with profound prelingual hearing impairment without other clearly defined disabilities. Thirty-five children with multiple-channel cochlear prostheses and a comparison group of 10 children without implants from “total communication” programs in the Maryland public school system.

Interventions: Multiple-channel cochlear implantation and at least 1 year of a systematic auditory skill development program at the Listening Center, compared with standard educational management of children with conventional amplification.

Main Outcome Measures: Classroom placement and number of hours of special educational support used.

Results: A correlation was observed between the length of cochlear implant experience and the rate of full-time placement in mainstream classrooms ($r = 0.10; P = .04$). There was also a negative correlation between the length of implant experience and the number of hours of special educational support used by fully mainstreamed children (Pearson product moment correlation = −0.10; $P = .03$). Children with greater than 2 years of implant experience were mainstreamed at twice the rate or more of age-matched children with profound hearing loss who did not have implants. They were also placed less frequently in self-contained classrooms and used fewer hours of special education support. A cost-benefit analysis based on conservative estimates of educational expenses from kindergarten to 12th grade shows a cost savings of cochlear implantation and appropriate auditory (re)habilitation that ranges from $30,000 to $200,000.

Conclusions: Cochlear implantation accompanied by aural (re)habilitation increases access to acoustic information of spoken language, leading to higher rates of mainstream placement in schools and lower dependence on special education support services. The cost savings that results from a decrease in the use of support services indicates an educational cost benefit of cochlear implant (re)habilitation for many children.


Educational achievement by hearing-impaired children is enhanced by the use of verbal communication.\(^1\,^2\) Mainstream classrooms offer standard verbal and academic training that forms the foundation for future academic development and vocation. Deaf young adults not in mainstream elementary and postsecondary schools are less likely to pursue secondary education and are more likely to be underemployed or unemployed.\(^3\,^4\) Severely to profoundly hearing-impaired children are disadvantaged in mainstream classrooms by reduced access to verbal communication and delays in English-language competence. Special educational services—eg, interpreters, speech pathologists, and teaching assistants—can attempt to remediate language delays and enhance access to communication and the academic material in mainstream classrooms. The demand for special education services has increased by the passage of laws (Public Law 94-142, The Education for all Handicapped Children Act)\(^5\) that compel educational systems to make available to students with disabilities, at no cost, a public education that ap-
SUBJECTS AND METHODS

School-aged children with prelingual profound hearing loss and no other clearly defined disabilities were selected for inclusion in this study. The implanted cohort consisted of 35 children enrolled in special education programs or mainstream classrooms between kindergarten and 12th grade in regular public schools in the mid-Atlantic region. They underwent cochlear implantation before December 1996 at ages between 2 and 15 years (mean ± SD, 5 years 2 months ± 3 years), followed by a 2-year program of weekly auditory (re)habilitation. Twenty-eight children underwent outpatient cochlear implantation at the Johns Hopkins Hospital, and 7 received implants elsewhere, all undergoing aural (re)habilitation by therapists of The Listening Center at Johns Hopkins University School of Medicine. A representative nonrandomized sample of 10 children with comparable levels of hearing loss who did not have cochlear implants was selected from a "total communication" program in the Maryland public school system. Longitudinal data for the comparison group were obtained retrospectively for grades corresponding to ages 5, 8, and 11 years. Data on educational placement and the use of special educational support services were obtained through school consultations, interviews with parents, and a review of individualized educational plans. Educational placement at the time of implantation was determined retrospectively, and postimplantation data were obtained for the 1996-1997 academic year.

An educational resource matrix (ERM) (Figure 1) was used to track changes in classroom placement and the use of special educational services by children in both groups.20 The ERM was designed to quantify the use of educational resources by hearing-impaired children as a tool for assessing the educational cost-benefit of various forms of auditory, speech, and language interventions. Educational placement is represented on the ordinate of the ERM as ordinal variables from mainstream placement within a neighborhood school to residential placement at a state school for the deaf. Support services indicated on the abscissa refer to hours of daily intervention that were provided in addition to classroom instruction for academic remediation and enhancing verbal communication. Skilled personnel providing this instruction include speech or language pathologists, educational audiologists, special educators, teachers of the hearing impaired, interpreters (sign language, "cued speech," or oral), occupational therapists, and instructional assistants. The use of these services is based on a 6.5-hour school day and is averaged for a 5-day week.

Annual costs associated with educational placement (Figure 1) were based on the 1995 Maryland Department of Education budget. The hourly cost of support services was estimated at $23 per hour based on average salaries of the professionals and paraprofessionals listed above in Maryland. The cost associated with cochlear implantation, including preoperative evaluation, hardware, operative fees, and 2 years of postoperative (re)habilitation, was estimated to be $43,000 based on 1997 cost data from The Listening Center. A 2-year period of postoperative (re)habilitation is required at The Listening Center for all prelingually deafened children following cochlear implantation. A total projected cost of cochlear implantation and educational intervention from kindergarten through 12th grade was discounted at 5% per annum to account for the time value of money. Costs were based on the educational resource use by children who received implants and compared with those of the group not receiving implants to estimate the educational cost-benefit of cochlear implantation.

RESULTS

Of 35 children in the cochlear-implanted group, 21 attend schools in Maryland, and 14 reside in Pennsylvania, Virginia, New York, and New Jersey. Before

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implantation, 27 of the group with implants were school-aged, of whom 5 were day students at the Maryland School for the Deaf and 22 were placed in regular public schools. Of children enrolled in regular neighborhood schools, 20 were placed full-time in special education classrooms for the hearing impaired, and 2 were fully mainstreamed with substantial support services in schools where special education classes were not available. Various communication methods were represented in this group, including total communication, oral communication, and cued speech, of which total communication was predominant. Before implantation, 13 additional children received parent-infant support services.

The cohort of students without implants had similar educational placement and support service use to those of the study group before the latter group’s surgery. When the children were stratified by age at implantation, there was a close approximation in ERM distribution between those receiving implants (before surgery) and those not receiving implants in the 4- to 6-year-old and the 7- to 9-year-old age groups (Figure 2). The small number of children receiving implants after age 9 years hampered meaningful comparison of this older age group.

A positive correlation was observed between the length of implantation and the incidence of placement in mainstream classrooms ($r = 0.10; P = .04$) (Figure 3). The distribution of educational placement during the first 2 years of cochlear implant experience remained approximately the same as before implantation, but the rate of mainstream placement was higher for children with more implant experience. In the group of 17 children with less than 2 years (mean, 12.4 months) of implant experience, 2 children (12%) were assigned full time to a mainstream classroom compared with 3 (30%) in the group of 10 students in their third and fourth years (mean, 33.4 months) of implant experience and 6 (75%) in the group of 8 students with greater than 4 years (mean, 74.6 months) of cochlear implant use (Figure 3 and Table 1). The incidence of full-time placement in special education classrooms decreased from 20 (70%) in 27 students before implantation and 13 (76%) in 17 students with less than 2 years of implant experience, to 2 (20%) in 10 students in their third and fourth years of implant experience and 1 (13%) in 8 students with more than 4 years of cochlear implant use (Figure 3 and Table 1).

An age-matched comparison of groups of hearing-impaired children with and without cochlear implants revealed higher rates of mainstream placement in the group with implants, especially among children with

**Figure 1.** The educational resource matrix indicating educational placement (ordinate) vs rehabilitative support (abscissa) and associated costs based on the 1995 budget of the Maryland Department of Education.

**Figure 2.** The distribution of educational placement and number of hours of rehabilitation services used is similar for the comparison group and the study group before cochlear implant surgery: A, age-matched comparison of 4- to 6-year-old children ($n = 8$) before cochlear implant placement; B, school placement of 5-year-old children ($n = 10$) without implants; C, age-matched comparison of 7- to 9-year-old children ($n = 6$) before cochlear implant placement; and D, school placement of 8-year-old children without implants ($n = 10$).
greater than 2 years of implant experience. As shown in Table 2, the transition from full-time placement in special education classrooms to mainstream classrooms occurred at younger ages in the group with implants. There was a significantly lower rate of placement of the 4- to 6-year-old age group with more than 2 years of implant experience in special education classrooms compared with age-matched children in the comparison group ($z = 2.91$, 95% confidence interval, −1.30 to −0.36; $P = .004$). Although the rates of full-time mainstream placement of children with more than 2 years of implant experience were greater than those of children without implants for all age groups (Table 1), these differences were not significant. Sample sizes of 20 to 30 subjects per age group would be needed to acquire the necessary statistical power to show significance at the 95% confidence level.

The average number of support service hours used by fully mainstreamed students was inversely proportional to the duration of cochlear implant experience (Table 1). The negative correlation between the number of special education service hours and the length of cochlear implant experience was statistically significant up to 4 years after implantation (Pearson product moment correlation $= −0.10; P = .03$). When the group with more than 4 years of experience was included, however, the statistical significance of this relationship was lost ($r = −0.91; P = .09$). This trend appeared to be independent of age and grade level.

Compared with four 11-year-old mainstreamed children in the comparison group without implants, 3 children with implants in the 10- to 12-year-old group with more than 2 years of implant experience used about one-fourth the number of hours (Table 3). This difference was not significant ($P = .09$, 95% confidence interval, −7.57 to 0.70), requiring a sample size of 11 to achieve the necessary statistical power.

We observed an increase in the mean number of support service hours used by a subgroup of children with implants who were partially placed in both self-contained and mainstream classrooms (Table 1). This apparent transition from self-contained placement to partial mainstream placement was most prevalent in the group of 10 children with 2 to 4 years of implant experience of whom 1 (10%) was placed in mainstream classrooms less than 50% of the time and 4 (40%) were placed part-time in mainstream classrooms more than 50% of the time (Figure 3). The number of hours of special education services used by partially mainstreamed students with more than 2 years of implant experience was significantly greater than that used by students with implants who were placed full time in special education classrooms (mean, 2.96 vs 0.5 hours per day; $P < .001$, Mann-Whitney test) and students with implants who were placed full time in mainstream classrooms (mean, 2.96 vs 1.11 hours per day; $P = .03$, Mann-Whitney test).

### Table 2. Special Educational Support Hours Used by Children With Cochlear Implants by Educational Placement and Length of Implant Experience*

<table>
<thead>
<tr>
<th>Cochlear Implant Experience, y</th>
<th>100% Mainstream, h</th>
<th>≥50% Mainstream, h</th>
<th>&lt;50% Mainstream, h</th>
<th>100% Special Education, h</th>
<th>State School for Deaf–Day Student, h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before surgery</td>
<td>4.88 ± 0.88 (n = 2)</td>
<td>. . .</td>
<td>. . .</td>
<td>1.03 ± 0.36 (n = 20)</td>
<td>0.14 ± 0.09 (n = 5)</td>
</tr>
<tr>
<td>&lt;2</td>
<td>3.13 ± 2.63 (n = 2)</td>
<td>3.00 ± 1.00 (n = 2)</td>
<td>. . .</td>
<td>0.5 ± 0 (n = 13)</td>
<td>. . .</td>
</tr>
<tr>
<td>2-4</td>
<td>1.33 ± 0.67 (n = 3)</td>
<td>2.83 ± 0.85 (n = 4)</td>
<td>5.75 (n = 1)‡</td>
<td>0.5 ± 0 (n = 2)</td>
<td>. . .</td>
</tr>
<tr>
<td>≥4</td>
<td>1.00 ± 0.32 (n = 6)</td>
<td>. . .</td>
<td>2.00 (n = 1)‡</td>
<td>0.5 ± 0 (n = 1)‡</td>
<td>. . .</td>
</tr>
</tbody>
</table>

*Data are given as mean ± SE (number of children) unless otherwise indicated. Ellipses indicate not applicable. †Support hours used by a single subject.

### Table 1. Rates of Full-time Placement in Special Education and Mainstream Classrooms by Children With >2 Years’ Implant Experience and Hearing-Impaired Children Without Implants*

<table>
<thead>
<tr>
<th>Age Group, y</th>
<th>With Implant</th>
<th>Special Education</th>
<th>Mainstream</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-6</td>
<td>Yes (n = 6)</td>
<td>1 (17)†</td>
<td>1 (17)</td>
</tr>
<tr>
<td>5</td>
<td>No (n = 10)</td>
<td>10 (100)</td>
<td>0</td>
</tr>
<tr>
<td>7-9</td>
<td>Yes (n = 5)</td>
<td>3 (60)</td>
<td>2 (40)</td>
</tr>
<tr>
<td>8</td>
<td>No (n = 10)</td>
<td>9 (90)</td>
<td>1 (10)</td>
</tr>
<tr>
<td>10-12</td>
<td>Yes (n = 4)</td>
<td>0</td>
<td>3 (75)</td>
</tr>
<tr>
<td>11</td>
<td>No (n = 10)</td>
<td>4 (40)</td>
<td>4 (40)</td>
</tr>
</tbody>
</table>

*Data are given as number (percentage).
†P < .05.

**COST-BENEFIT ANALYSIS**

The cost-benefit analysis of cochlear implantation was done for children with profound levels of prelingual hearing loss who received implants at 3 and 5 years of age. The net present cost of cochlear implantation and of edu-
cation from kindergarten to 12th grade was calculated for 4 different educational scenarios that reflect trends in the use of educational resources observed in the present study (Figure 4). Cochlear implantation and postoperative (re)habilitation costs in scenarios 1C and 1D in Figure 4 were discounted by 2 years relative to scenarios 1A and 1B because implantation occurs at age 5 years in the former and at age 3 years in the latter. Because of the lack of data on the use of educational resources by children with implants in high school, we assumed that patterns of placement and the use of support services remained static from middle into high school.

Initial classroom placement and the use of support services in scenario 1A (Figure 4) were observed in 4 of 6 children aged 4 to 6 years with more than 2 years of implant experience. Subsequent full-time placement in a mainstream classroom was also the case for 6 (75%) of 8 children in the study cohort with more than 4 years of implant experience (Figure 3 and Table 1). The more restricted initial placement of the hypothetical child in scenario 1B was true for only 1 (17%) of 6 children aged 4 to 6 years in this age group with greater than 2 years of implant experience. As in scenario 1A, subsequent full-time placement in a mainstream classroom was consistent with the results of the present study. The decline in the number of support services used from 2 h/d to 1 h/d reflects trends in the average number of support hours used by mainstreamed children with implants in the 7- to 9-year-old age group as the duration of their implant experience exceeds 4 years. In scenarios 1C and 1D of Figure 4, hypothetical children received implants at age 5 years, the average age of implantation of children in the study cohort. The patterns of educational placement and the use of support services closely reflect those seen in the present study.

The educational costs from kindergarten to 12th grade of children with profound hearing impairment by years after implantation were calculated for 4 different educational scenarios that reflect trends in the use of educational resources observed in the present study (Figure 4). Cochlear implantation and postoperative (re)habilitation costs in scenarios 1C and 1D in Figure 4 were discounted by 2 years relative to scenarios 1A and 1B because implantation occurs at age 5 years in the former and at age 3 years in the latter. Because of the lack of data on the use of educational resources by children with implants in high school, we assumed that patterns of placement and the use of support services remained static from middle into high school.

Initial classroom placement and the use of support services in scenario 1A (Figure 4) were observed in 4 of 6 children aged 4 to 6 years with more than 2 years of implant experience. Subsequent full-time placement in a mainstream classroom was also the case for 6 (75%) of 8 children in the study cohort with more than 4 years of implant experience (Figure 3 and Table 1). The more restricted initial placement of the hypothetical child in scenario 1B was true for only 1 (17%) of 6 children aged 4 to 6 years in this age group with greater than 2 years of implant experience. As in scenario 1A, subsequent full-time placement in a mainstream classroom was consistent with the results of the present study. The decline in the number of support services used from 2 h/d to 1 h/d reflects trends in the average number of support hours used by mainstreamed children with implants in the 7- to 9-year-old age group as the duration of their implant experience exceeds 4 years. In scenarios 1C and 1D of Figure 4, hypothetical children received implants at age 5 years, the average age of implantation of children in the study cohort. The patterns of educational placement and the use of support services closely reflect those seen in the present study.

The educational costs from kindergarten to 12th grade of children with profound levels of hearing impairment without implants were evaluated for 2 scenarios in Figure 4. Scenario 2A reflects the predominant path of migration to mainstream placement by children in the comparison group, and scenario 2B shows the total costs from kindergarten through 12th grade associated with attendance as a day student and a residential student in a state school for the deaf.

The cost savings associated with cochlear implantation at age 3 years and kindergarten to 12th grade education in scenarios 1A and 1B range from $30,000 to $200,000 compared with educational costs of the children without implants in scenarios 2A and 2B. A similar cost savings associated with cochlear implantation at age 5 years is shown in scenario 1C, in which progression to full-time mainstream placement is more delayed: $27,000 to $192,000.

**COMMENT**

Trends toward increased educational independence offer preliminary evidence that a cochlear implant enhances access to mainstream education. Educational independence in a mainstream classroom ensues for most children as they acquire experience with their cochlear implant, aided by aural (re)habilitation. A decline in the use of special education support services suggests that access to communication in a mainstream classroom improves, presumably as the gap between chronological and language ages narrows.21

Of 10 children in their third and fourth years of implant experience and (re)habilitation, 8 (80%) of 10 children were in transition from full-time placement in a self-contained classroom to either full-time or part-time placement in a mainstream classroom, a trend that has been observed by others.6,22 The comparison group demonstrated a pattern of delayed mainstreaming, with fewer than half of the students gaining full-time mainstream placement at age 11 years, compared with 3 of 4 children of comparable age in the group with implants. The correlation between the length of cochlear implant experience and the incidence of mainstream placement was significant (P<.05), implying that cochlear implanta-
tion aided by aural (re)habilitation enhances the growth in language skills that presumably underlies the increased rate of mainstream placement. Growth in speech perception and production is delayed during the first 2 years of experience with the cochlear implant.\textsuperscript{11,23} which for school-aged children is reflected in static classroom placement and a sustained use of support services during this time. Thereafter, the rate of mainstream placement accelerates, with full-time mainstream placement occurring in 6 (75\%) of 8 children with more than 4 years of implant experience (Figure 3 and Table 1).

The diminished use of special education support services in mainstream classrooms as the duration of implant experience increases reflects the substantial evolution of language skills and educational independence by these children even after full-time mainstream placement was achieved. This trend was particularly robust in the first 4 years of implant experience (Pearson product moment correlation = −0.10; \( P = .03 \)) and became less so thereafter (Pearson product moment correlation = −0.91; \( P = .09 \)). A smaller reduction in the use of support services after 4 years of implant experience was most likely the result of a floor effect rather than a slowing of language acquisition or educational independence.

Preliminary evidence indicates, therefore, that cochlear implantation accompanied by aural rehabilitation equips most children with an increasing ability to participate in and benefit from the mainstream classroom. The diminished use of support services appeared to be consistent through middle school, suggesting a sustained effect on language development that equips adolescents to address the academic challenges of higher grades. The language and educational advantages provided by cochlear implantation are also supported by a 2- to 4-fold greater use of support services by children without implants who were placed in mainstream classrooms in middle school (Table 3).

A complex array of factors likely influences the path of educational migration by a child with a cochlear implant. For example, a higher need for support services before mainstream placement, as observed in 5 partially mainstreamed children of 10 children in their third and fourth years of implant experience, may reflect a more significant discrepancy between chronological and language ages. Such discrepancies may result from learning disabilities and cognitive delays, the nature and effectiveness of preimplantation intervention, and a relatively late age of implantation. In addition to the specific abilities and challenges of individual children, the availability of educational placement options and resources, as well as school placement policies and parental preference, may affect patterns of transition.

Although migration within the ERM is likely to reflect changes in the educational and verbal independence of a child, other factors are likely to be influential. Public Law 94-142\textsuperscript{2} advocates for the “least restrictive environment” for children with special needs. The interpretation and implementation of this law are subject to the policies, preferences, and budgets of school districts, leading to a variety of placement policies. When schooling options include the full range of educational and support services, a child can be placed according to changing educational needs in pursuing less restrictive educational experiences. If options are limited, as they are in many areas of the United States, placement may remain static or constrained to certain patterns of movement, despite advancing skills. Parents also have the right to assert reasonable preferences in placement, communication methods, and services for their child. Therefore, a child’s placement and rate of progression to educational independence may be subject to parental choice and assertion rather than standard district placement policy or academic or communication competence. This study did not attempt to examine how decisions on placement and the use of special education services were made and whether or not they were appropriate. The correlation of ERM data with measures of language development and academic performance is needed to assess the appropriateness of educational placement and the effects of cochlear implant (re)habilitation on scholastic achievement and potential.

Although we were unable to assess the effects of age at implantation on trends in educational independence, we hypothesize that children who receive implants before age 3 years will have the language skills on which literacy can be built more quickly, permitting early mainstream placement and a diminished need for educational support services. This premise is based on the observation that better speech perception scores result from implantation at an early age\textsuperscript{24} when the discrepancy between chronological and age is still small. Summerfield et al\textsuperscript{25} observed an age effect in which children who received implants before age 5 years had a greater chance of mainstream placement than children receiving implants after age 5 years. A longitudinal prospective study of a larger sample is needed to determine the effect of age at implantation on educational independence.

As the longitudinal study of the use of educational resources by children with cochlear implants continues, properly matched and randomized comparison groups will be necessary so that the effects of cochlear implantation and aural (re)habilitation on educational independence can be separated from the influence of socioeconomic status, cognitive function, age of diagnosis of deafness and language intervention, and the mode of communication.

The cost-benefit analysis suggests that a decrease in special education costs is one of the early societal benefits of cochlear implantation in young children. A trend toward increased educational independence by children who have received cochlear implants results in a favorable cost-benefit ratio of this intervention during elementary and middle school years. When all treatment and (re)habilitation costs are considered, there is a cost savings of $100 000 to $200 000 from kindergarten to 12th grade associated with the education of a child with cochlear implants compared with a student attending a state school for the deaf, and of approximately $30 000 compared with a child without implant(s) in a total communication program in a public school. These figures are based on extremely conservative estimates of costs of educating profoundly hearing-impaired children in Maryland public schools. For example, these estimates do not include the costs of transportation to regional or distant...
schools that provide the needed special education support services, and they do not take into account the costs of hearing aids and other communicative adjuncts.

Prior reports have suggested that an increase in mainstream placement raises the cost-effectiveness of cochlear implantation. Special education support services, however, account for a large portion of the educational costs of hearing-impaired children and constitute an important factor in the assessment of the cost-benefit ratio. A 2- to 4-fold decrease in the use of support services by mainstreamed children with implants when compared with mainstreamed children without implants (Table 3) carries favorable cost-benefit implications for cochlear implantation in children. We hypothesize that this trend reflects emerging English-language fluency and literacy and, therefore, bodes well for increased educational and vocational options and achievement in most children. The favorable trends in employment and postsecondary education associated with early mainstream placement of children with profound hearing loss are also consistent with optimistic expectations that increased educational independence as a result of cochlear implantation will have long-term benefits.

The assessment of the overall cost-effectiveness of cochlear implantation in children requires an estimation of the availability and use of appropriate special educational and rehabilitation services; the degree to which speech and language benefits produce improved speech perception and production, reading comprehension, and other functional capabilities that affect social, educational, and vocational options; and the effects of the device on general measures of quality of life.

Changes in the use of educational resources occur relatively early and can be quantified with the help of an ERM. The assessment of language development and its effects on quality of life require longitudinal study. Although the cost-utility ratio of cochlear implantation in adults has been shown to be favorable, this conclusion cannot be automatically applied to children. An estimation of cost vs utility that incorporates quality of life is challenging because the most frequently used measure—the quality-adjusted life-year—relies on a comparison of preintervention and postintervention experiences reported by the subject. For now, cost-benefit analysis is the most feasible component in the preliminary assessment of the cost-effectiveness of cochlear implant (re)habilitation in children.

Although the long-term effects of this intervention on individual children are inconclusive, there are significant short-term effects on the use of educational resources that reduce the demand for support services by profoundly hearing-impaired children and diminish expenditures by school systems throughout the United States. Because 90% of special education takes place in regular public schools, communities and, particularly, their school systems may be beneficiaries of the educational cost savings associated with cochlear implantation and (re)habilitation. As policies, attitudes, and technology change, so will patterns of use of educational resources by children with implants, requiring continued monitoring of these trends as children who have previously undergone implantation come of age and new recipients accrue.


Incorrect Data. In the Original Article by Francis et al titled “Trends in Educational Placement and Cost-Benefit Considerations in Children With Cochlear Implants,” published in the May 1999 issue of the ARCHIVES (1999;125:499-503), statistical values were incorrectly reported. On page 499, line 3 of the “Results” subsection of the abstract, and on page 501, line 3 of the first full paragraph in the right column, the $r$ value should have read 0.939 and the $P$ value, .008. Also, on page 499, line 7 of the “Results” subsection of the abstract; page 502, line 8 of the first full paragraph in the left column; and page 504, line 8 of the first full paragraph in left column, the Pearson product moment correlation should have read −0.999. The journal regrets the errors.