Validation of a Parent Outcome Questionnaire From Pediatric Cochlear Implantation

Terezinha Nunes
Ursula Pretzlik
Selin Ilicak
Oxford Brookes University

This paper analyzes the reliability and validity of a questionnaire designed by Archbold, Lutman, Gregory, O'Neil, and Nikolpoulos (2002) for the assessment of pediatric cochlear implantation. Parents of 61 youngsters (age range 5 to 16 years), who had the implant for at least 3 years, responded to the questionnaire and to an interview. The alpha reliability of the 11 questionnaire scales varied between .41 and .74. Content validity was assessed by comparison with parents' responses to an interview. In general, there was agreement between parents' concerns and views expressed in the interview and as assessed by the questionnaire. However, extra issues were identified in the interview, which suggest the need for increasing the breadth of the questionnaire. Criterion validity was assessed by identifying contrasting cases, with very low or very high scores in each scale, and analyzing the descriptions obtained in the interviews. For nine scales this analysis provided support for the validity of the questionnaire; two scales did not produce positive results. Correlations with interview scores were calculated for only four scales: two were positive and significant whereas two were not significant. A factor analysis of the questionnaire scales identified four components, interpreted as the child's functioning in social situations, attitudes to the process of implantation, support required in the long term, and effective use of the implant. Suggestions for further research and descriptive comments provided by parents are included.

The aim of this investigation was to carry out an independent assessment of a parent outcome questionnaire from pediatric cochlear implantation designed by Archbold, Gregory, Lutman, O'Neil, and

Nikolpoulos (2002). Their instrument is presently titled "Parent outcome profile from pediatric cochlear implantation" but was originally named "Parents' views and experiences with pediatric cochlear implant questionnaire." It will be referred to here as the PVECIQ. In their previous work, the authors obtained data to show that the questionnaire is robust and repeatable. The questionnaire was given twice, with a 1-month interval, to a random sample of parents from a list of children who had received implants in one implant center. The children were all either born deaf of had been deafened before the age of 3 and had been using the implant for at least 2 years. Twenty parents were approached; 100% responses were obtained on both occasions, after reminder letters were sent out. The authors reported the test-retest correlation by item. Of the 103 test-retest correlations, only 8 were not significant; the majority (68) was above .60. Archbold et al. also considered the value of the standard deviation of the difference between the first and the second responses. The range of possible differences when the second response was subtracted from the first was -4 to $+4$. For all the items, the mode for the difference between the responses on the two occasions was equal to zero and the absolute value of the mean was less than one; the majority of the items (73) had standard deviations with values under 0.5. This indicates that the most likely answer on retest was the same answer given previously; for the 73 items with standard deviations under 0.5, the same answer is likely to be observed in 95% of the cases.

Correspondence should be sent to Terezinha Nunes, Department of Psychology, Oxford Brookes University, Gipsy Lane, OX3 0BP, United Kingdom (e-mail: tnunes@brookes.ac.uk).

Thus Archbold et al. showed that the PVECIQ is robust and the evaluation of the PVECIQ carried out here will not consider test-retest reliability. It will use other aspects of psychometric theory to analyze the internal consistency of the scales that compose the questionnaire, and the content, criterion, and construct validity of the questionnaire.

Background

Pediatric cochlear implantation involves a considerable investment, both financial and in terms of parental commitment. It is therefore essential that valid instruments should be available for the assessment of the benefits associated with this hearing device. The instruments should also support further developments in the process of implantation and follow-up, leading to greater benefit for the children and overall satisfaction for the child and the family.

Why Assess Parents' Views of Cochlear Implant Outcomes?

Outcomes of cochlear implants can be assessed in many different ways. It is obviously desirable to assess the children through audiometric techniques (see, for example, Balkany, Cohen, & Gantz, 1999) but these measures do not tell the whole story of effects of implantation. Children may learn to use the sensations provided by their implants in different ways, so audiometric measures do not tell us directly about the child's use of the implant in everyday life; this is why they are often complemented by measures of language development and educational achievement (e.g., Spencer, 2002). These objective and standardized measures of language development, though valid in their own right, must be complemented by a personal view of the stressors, efforts, and benefits related to the implant. It is possible, for example, that measurable benefits can only be accomplished through considerable effort and that some parents view the stressors as too intense to justify the benefits. A cost-benefit analysis of implants is not a matter of financial investment only but also a matter of personal investment. In the case of cochlear implants, this personal investment will often involve the parents as main actors.

It would be possible to obtain the children's own perspective but there are methodological difficulties with this approach. Some children may be too young when implanted and thus unable to provide any information; different methods may be required to obtain younger and older children's perspectives, making it difficult to compare results across age levels. Waiting for the young children to reach an age when they can provide information would require the use of retrospective accounts, which would be less reliable.

Archbold et al.'s approach to obtain parents' views offers a valuable insight into cochlear implant outcomes for several reasons. First, parents are often the ones who make the decision for a cochlear implant for their child. When making such an important decision, parents often feel that it would help them to know more about the views of those parents who already have experience with cochlear implants. A questionnaire that summarizes parents' views would be a good way of obtaining an overview of the process and outcomes. Thus this method is desirable in its own right. Second, parents whose children received implants can offer comments of great value to implant teams and policy makers. They not only provide reliable information on the child's functioning but also an evaluative perspective on the process of implantation, the additional interventions needed, and the benefits and limitations experienced. Third, a questionnaire regarding parents' views has the advantage of providing a single method that can be used across children's age levels and still relies on the perspective of actors profoundly interested in the process and outcomes of implants. Finally, parents can comment on outcomes across a variety of situations (school, everyday life, the family): it is likely that parents can provide the most comprehensive description of the outcomes of pediatric cochlear implants that can be obtained from a single source. It must be recognized, though, that any perspective of outcomes is limited and should not be used as the single source of information.

Some earlier studies have used parent interviews to assess outcomes from pediatric cochlear implants. Christiansen and Leigh (2002), for example, offered a comprehensive view of outcomes and ethical issues involved in pediatric cochlear implants, using a variety of sources and methods. Interviews offer rich insights

into parents' perspectives but they are an expensive method, requiring a great deal of time for data collection and analysis. Surveys have also been used and have provided valuable information about outcomes of cochlear implants for children from parents' perspective (e.g., Gallaudet Research Institute, 1999) but these have not included methodological analyses regarding the validity of the instrument. Because surveys are often based on frequency of responses, they cannot be analyzed using psychometric theory.

Independent Assessment of the PVCIQ

Psychometric theory will be used in this paper to assess the PVECIQ. There are different ways of considering the validity of a measure. Cronbach (1990) suggests that these can be organized around three basic forms of scrutiny.

The first one he terms *content validity*. At the simplest level, analysis of content validity considers whether relevant questions have been asked. In the case of the PVECIQ, one needs to consider whether the parents are being asked questions that will lead to an adequate and comprehensive description of their views and experiences. Two steps were taken in this assessment of the questionnaire's content validity. First, the investigators in this project independently analyzed the questionnaire items and carried out a new classification of items for the purposes of analysis. Second, semi-structured interviews were used to try to identify issues perceived as significant by the parents but not covered in the questionnaire (or vice versa, issues included in the questionnaire which did not seem to concern the parents).

A second form of scrutiny into the validity of a measure is termed *criterion validity*. Criterion validity essentially checks one assessment against another that can provide the same type of information. In the analysis of a measure of benefits of cochlear implants, three types of criterion validity can be considered important. First, the results of the questionnaire can be compared with the results of another measure of the parents' views and experiences of their children's implants. In this project, a semi-structured interview was used to validate the questionnaire's scores. This type of scrutiny is also known as concurrent validity

(Kline, 1995). Second, the parents' views can be assessed against measures of the child's adaptation provided by other observers, such as a teacher or a trained assessor. This validation would indicate whether the parents' views can be considered objective or whether they are biased by the parents' life perspective. However, it must be pointed out that any measure of a child's adaptation will be obtained from a particular perspective and different actors may perceive and value different aspects of a child's functioning in distinct ways. The parents' perspective is so important for the child's life that it was not considered appropriate to attempt to validate it against the perspective of others, such as the children's teachers. A third way of approaching criterion validity in the assessment of benefits of cochlear implants is to include comparisons of deaf children who have cochlear implants with deaf children who use traditional hearing aids. It is important to ascertain whether high levels of satisfaction expressed by parents of children with cochlear implants are actually higher than those expressed by parents of deaf children who use traditional hearing devices. The level of benefit perceived by the parents can be validated through the comparison between deaf children with implants and those who use other hearing devices. This comparison was included in the present investigation but for reasons of space it will not be reported in this paper; for details, see Nunes and Pretzlik (2003).

A third type of assessment of a measure considers its *construct validity*. Construct validity goes behind the content of a measure to investigate the connections between its different parts with the object of the assessment. Construct validity is intimately related to the broader view that an investigator has of the phenomenon. For example, when analyzing the benefits of cochlear implants, it is necessary to consider much more than the results of hearing tests. Construct validity considers the question: "what are possible benefits of cochlear implants?" In this project, it was assumed that the benefits may differ in nature and thus a questionnaire should cover a range of issues that are relatively independent of each other. In order to analyze whether the questionnaire covers a variety of issues, a factor analysis was carried out to identify the factors assessed by the PVECIQ.

Method

Participants

Letters were sent to 100 parents whose children had received implants at the Nottingham Implant Center and to 60 parents whose children had received implants at the Southampton Center. The parents were chosen randomly from a list of children who met the following criteria: (a) they had received the implant at least 3 years previously; and (b) they were in the age range 5 to 16 years. The letter to parents explained the aims of the study and what their participation involved. The letter also made it clear that the study was independent from the centers and that the centers would not even know who had or had not agreed to participate. Reminder letters were sent to all the parents approached initially through the Nottingham Center, explaining that the Center personnel did not know who had already responded and encouraging parents to reply, if they had not done so. No reminder letters were sent to the parents approached through the Southampton Center as the target number of participants had already been achieved. All the parents who agreed to participate were interviewed. The low response rate (38%) is a cause for concern, though not unusual in clinical studies.

Parents (either both or one parent) of 61 children who had received a cochlear implant participated in this study. Of the children who had received the implant, 42 participated in the Nottingham and 19 in the Southampton programs. Two children came from the same family; the mother responded to separate questionnaires and interviews for each child. Because only one child had a deaf mother (who was the parent interviewed), it will not be possible to consider this instrument as validated for use with deaf parents.

Assessments

The parents completed three assessments: the PVECIQ (see Appendix 1, where the questionnaire items are presented along with the scoring codes); a semi-structured interview covering the main topics in the questionnaire, which also contained open questions

to allow for the emergence of new themes (see Appendix 1 for the interview schedule); and the questionnaire "What is my child like?" For reasons of space, the latter instrument is not described in this paper.

There are two forms of presentation of the PVECIQ, one for boys and one for girls; only one is included here as the difference is only in the use of gender. The questionnaire covers ten themes, identified by Archbold et al. as significant on the basis of their interviews with parents: communication, general functioning, self-reliance, well-being and happiness, social relationships, process of implantation, education, effects of implantation, decision to implant, and supporting the child. In order to avoid a halo effect in the responses to items referring to the same theme, the items were placed in random order for presentation to the parents; this is not the order used by Archbold et al., who follow conventional psychometric theory (Nunnally, 1978) and present the items grouped by theme.

The schedule for the semi-structured interview used in this project is included in Appendix 1. The interview began with an introduction to the aims of the research and questions that would give the interviewer an understanding of the child's and parents' perception of the meaning of deafness for the child and the family (e.g., cause of deafness, child's age at diagnosis, parents' reaction to diagnosis). This was considered necessary to allow the conversation to flow more smoothly. The themes included in the questionnaire were all covered by the interview schedule. Under each theme, the interviewer had a series of questions to pose if the issues had not been spontaneously addressed by the parents. The interviewers were two researchers[1] trained by the authors and entirely independent from the cochlear implant centers. They were trained (in a pilot study) to ensure that they covered all the themes while allowing the conversation to flow naturally. At the end of the interview, the parents were asked what were their best and their worst moments. These questions, which were part of the longer form of the PVECIQ used initially by Archbold et al., were sufficiently open to obtain information about issues central to the parents' views that might not have been elicited by the previous questions.

Procedure

Parents were approached through the centers where their children had received the implant through a letter introducing the study. Parents received a letter from the center along with a separate letter from the research team, which described the aims and design of the study and the level of commitment that the parents would be agreeing to; it was made clear that the centers would not know who had agreed to participate in the study and that the child's treatment in the center would not be influenced by participation.

After about 3 months, a new letter was sent out to all the parents approached initially through the Nottingham center, as the implant team did not know which parents had answered the first invitation. This second letter explained the importance of representing all the different views in the study and offered apologies to those who had already responded. Responses were processed by the researchers, who contacted the parents by phone and scheduled a date for the interviews.

Interviews were conducted in the respondents' homes except for five cases, where a telephone interview was used. In four cases, the respondent lived in Scotland and in one case the respondent had to cancel the visit at the last minute but left a note on the door asking the researcher to contact her by phone; she then suggested that she could be interviewed by telephone due to difficulties in re-scheduling the appointment.

Parents provided written responses to the questionnaires; the interviews were tape recorded and transcribed for analysis. The questionnaire was administered to half of the parents before and to the other half of the parents after the interview. For telephone respondents, the questionnaire was posted after the interview and returned by post.

Analyzing Content Validity

There were two steps in the process of analyzing the content validity of the PVECIQ: the first was a new analysis by the authors of this paper and the second involved considering the themes identified in the interviews with parents.

Our analysis involved considering both the classification of the items by *theme* and by *form.* The items had been grouped by the authors of the questionnaire into ten themes. We printed the items in random order and re-classified them. This approach essentially assesses whether the items had been placed in categories that seemed sensible when considered by other researchers. It draws on the notion of face validity but it was used here to go beyond this simple concept. The two classifications—the original and the revised one, produced by us—were treated as hypotheses in further psychometric analysis. Only after the results of the psychometric analysis were available was one classification chosen over the other for the subsequent analyses.

Some items were excluded from the psychometric analysis at this point because the themes they investigated were not considered relevant to parents' views and experience with cochlear implantation. Examples of items excluded from further analysis at this point were those classified as indications of interest in support services or assessment of the quality of the support offered by the educational authority. These items are of interest to parents and implant centers but were not considered relevant for an analysis of parents' views of outcomes of pediatric cochlear implants.

The second input we had on the analysis of content validity was to carry out a classification of items according to their form. Items in psychological measurement can have different forms—for example, they can lead to categories, rank order, rating scales, and so forth (Guilford, 1954). Different types of mathematical and statistical operations can be applied to the different types of items. Among the items included in the PVECIQ, two types were identified. Items of the first type were those that could be used to construct a scale: these were items that conveyed either negative or positive assessments of the same issue and could be added to compose a score. For example, when a parent agrees with the assertion "Communication is difficult even with people she knows well," this can be seen as expressing a negative view of the child's communication. Items assessing attitudes with respect to the same issue can be added to compose a score: for example, all the items referring to attitudes towards the child's

communication ability can be added to provide a score for the combined ratings produced by the parent. All the items in the same scale are coded in a consistent manner so that the higher the score, the more positive the attitude. For example, if a parent strongly *disagrees* with the statement "Communication is difficult even with people she knows well" the score for the item is 5; if the parent strongly *agrees* with it, the score for the item is 1. In contrast, if a parent strongly *disagrees* with the statement "Her use of spoken language has developed greatly" the score is 1 and if the parent strongly *agrees* the score is 5. Items that belong together in this way can be used to form a composite rank and can be analyzed by means of statistical techniques that include correlation and factor analysis (Stevens, 1946; Guilford, 1978; Siegel & Castellan, 1988). Because it is reasonable to assume that each item involves a certain amount of error and that the best measure of the scale is obtained by the combination of all the items, it is possible to apply psychometric theory to the analysis of such combined ratings. Thus these items were analyzed for their internal consistency (i.e., alpha reliability) and the combined scale scores were used in correlational and factor analyses.

A second type of item was identified which could not be used to compose an attitude scale. These items were essentially categories to which parents assigned themselves and the mathematical and statistical manipulations that can be applied to them are frequencies and associated statistics (Guilford, 1954; Stevens, 1946; Siegel & Castellan, 1988); they cannot be used in analysis of reliability nor in correlational and factor analyses. For example, items assessing parents' reasons for opting for the cochlear implant for their children were assessed by statement such as "I chose implantation for my child so she would have a chance to become part of the hearing world" and "It was important to me that my child could hear sounds from traffic for safety reasons." These two reasons might or might not be held by the same parent, as one may have more than one reason for choosing a course of action. However, the number of reasons is not necessarily a measure of a parent's motivation to choose a cochlear implant for the child; one strongly held view may provide more motivation than three weakly held ones. Items that do not form a scale can

only be used more descriptively, in frequency analyses. They could not be included in the quantitative analyses carried out in this paper because they are not consistent with the assumptions made in psychometric theory.

The second step in the assessment of the PVECIQ's content validity considered the themes identified in the questionnaire in comparison with those emerging in the interviews. The parents' responses were coded (with the support of NVivo – NUD*IST Vivo Software for Qualitative Research) into content categories based on the ten themes of the PVECIQ. Responses that mapped on to the PVECIQ's themes were coded under the label used in the PVECIQ. The analysis of these responses is helpful in determining the meaning of the PVECIQ scales for the parents: For example, when parents express a very positive view of the child's communication, what does this correspond to in their everyday lives? Contrasting cases of parents with very high or very low scores in the scale will be presented in the section on criterion validity. Responses that did not fit with the questionnaire's themes were given a new descriptive code; these responses were analyzed to investigate the question of breadth of coverage of the PVECIQ.

Analyzing Criterion Validity

Two methods were used in order to assess the PVECIQ's results vis-à-vis those from the interviews. First, a comparison of contrasting cases was carried out. Contrasting cases were identified by obtaining the total score for the scale. Respondents whose scores were either very high or very low were identified for each scale. Their interviews were then searched for comments relevant to the scale. It is expected that responses in the interviews will vary considerably between parents with a high and with a low score in the questionnaire. This method was developed by the authors on the basis of theories of construction of scales in psychological measurement. Guilford (1954) recommends that scale items should be constructed by developing cues for anchoring the different points on a scale so that observers using the scale can attach the same meaning to the different points. It is particularly important that the extremes of a scale should be labeled adequately to support appropriate

observation. This is more easily done when the scale measures a well-defined trait. In the case of fuzzy concepts, test construction often has to start with less precise ratings; it is through research that both the dimensions of the phenomenon and its different descriptors are identified (Nunnally, 1978). Parents' views and experiences with the impact of cochlear implants on their child's life is still a fuzzy concept: Researchers are still seeking the dimensions necessary to describe this experience and the meaning of different views. By comparing parents' descriptions of very positive and very negative effects on the child's social life, for example, it should be possible to identify the dimensions of children's social life that are affected by cochlear implants. The description of both extremes provides rich information for the future design of analytic instruments both through the identification of dimensions and the anchoring points in these. At the same time, if parents who obtained a very high score do not differ in the interview from those who obtained a very low one—in other words, if no anchoring points can be found by comparing the extreme cases—then there is no evidence to validate the scale in the PVECIQ.

The second method was a correlational analysis. It consisted of grouping all the information relevant to each scale in each interview and attributing a score between 1 and 5 (with 1 the least positive and 5 the most positive) to the attitude represented in the interview. Whereas it is recognized that this method is based on judgments made by the researchers, it is also known that such judgments can be shown to have inter-subjective agreement: Positive and significant correlations can be obtained between the judgments made by two independent researchers. Because this method is very time consuming, it was decided that it would be applied only to scales that had reached at least an alpha level of .5 in the PVECIQ and that referred to the child's adaptation *after* the implant. According to Nunnally (1978), when the alpha level is too low (.4 or lower), it is unreasonable to expect that other estimates of reliability such as the correlation with an alternative form would provide strong results. The same can be said of correlations with the scoring of the interview.

Items belonging to the same themes in the PVECIQ sometimes included distinct aspects related to the same issue: For example, the assessment of the child's ability to communicate includes questions about communication in and outside the family and also differentiates between the child's intelligibility and the child's ability to understand others. Thus the interviews were analyzed to produce different scores for the assessment of the child's ability to communicate, which were then combined in one score for the interview rating. The correlation between the scores for the composite ratings from the interview and the score in the PVECIQ scale can then be considered in the analysis of criterion validity.

The initial analysis also showed that it was not feasible to assess the interviews with respect to parental attitudes to education. The variation in the children's age, and thus the themes discussed by the parents when commenting on their children's education, was too large to yield a scale applicable to the different age levels. For example, the type of adjustment required from children at the start of primary school, when parents viewed their main task as learning to read, was very different from that expected at the end of primary school, when parents expected higher levels of reading to have been achieved. Similarly, expectations at the start of secondary school were different from those at the end; youngsters take national exams at age 16 in England and at this age level parents' comments were focused on the chances of their child obtaining results good enough for admission to academic rather than vocational schools. Splitting the participants by age groups would result in groups too small for correlational methods to be employed. It was thus decided not to apply this method to the validation of PVECIQ scale on education.

After the initial analyses were completed (including the reliability analysis presented later on in the results section), it became clear that only four PVECIQ scales met the criteria for inclusion in the validation by correlation with interview ratings: the *Child's communication ability, Well-being and happiness*, the *Parent's anxiety about the decision to implant*, and the *Child's use of the implant*.

In the judgment of the interview data, five-point scales were used whenever possible. Conklin (1923; in Guilford, 1954) carried out an analysis of 23,000 rating scales and concluded that the number of steps

that is best handled by untrained observers is five, though with trained observers seven-point scales were seen as optimal. His analysis was based on the empirical observation that the average inter-rater correlations are between .55 and .60 for scales with these numbers of steps; with larger number of steps, little improvement in the inter-correlations is gained for the extra work required. Because we were working with interview ratings that had not been used previously, it was seen as prudent to consider that we were untrained observers. As recommended by Guilford (1978), anchoring points were developed for these judgments, as described below.

1. *The child's communication ability* comprised three aspects: ability to communicate at a distance, ability to communicate with non-family members, and ability to communicate within the family.

The ability to communicate at a distance was judged as 1 if there was no reaction to sounds like the doorbell or the telephone; 2 if there was some reaction to these sounds but no ability to communicate; 3 if the child responded to being called from a different room and was able to understand a short message on the telephone; 4 if the child could have a conversation on the telephone but was limited in this ability; 5 if the child was described as able to chat on the telephone and pass on messages without difficulty.

The ability to communicate with non-family members was assessed through three different judgments:

the child's ability to understand others (from 1, indicating that the child could not understand non-family members, to 5, indicating that the child could understand anyone);

the child's intelligibility for others as judged by the parent (from 1, indicating that non-family members could not understand the child, to 5, indicating that everyone understands the child);

the child's willingness to engage in conversation with others (from 1, indicating that the child is not willing to engage in conversation with strangers, to 5, indicating that the child speaks to unfamiliar others such as waiters or sales clerks).

The child's ability to communicate within the family was judged as 1 if nobody in the family really under-

stands the child's oral language; 3 if the child always needs to communicate orally through one family member, who understands the child well; and 5 if everyone in the family can understand the child's oral language.

The five ratings described above produced a combined score for the child's ability to communicate.

2. *The child's well-being and happiness* was assessed through three ratings:

with respect to mood, from 1, indicating that the child is always moody, through 3, indicating that the child is moody occasionally, to 5, indicating that the child is not at all a moody child;

with respect to frustration, from 1, indicating that the child is very often frustrated, through 3, indicating that the child is frustrated occasionally, to 5, indicating that the child does not get frustrated easily;

with respect to challenging behavior, 1 was assigned to indicate that the child had challenging behavior very often, 3 to indicate that the child sometimes showed challenging behavior, and 5 to indicate that the child never shows any challenging behavior.

These three ratings produced a score for the child's well-being and happiness from the interview data.

3. *Parents' current level of anxiety about their decision to implant* was rated as 1 when the parents indicated that they still felt very anxious about their decision, 3 when they indicated they still felt some anxiety about the decision, and 5 when they reported that they felt no anxiety and were certain that they had made the right decision.

4. *The child's use of the implant* was the only judgment that used a three-point scale: 1 indicated that the child was not using the implant at the time; 2 indicated that the child used the implant regularly but took it off sometimes; 3 indicated that the child used the implant all the time. Although it is recognized that a three-point scale might be too coarse (Guilford, 1978), the information available in the interviews would not allow for finer discriminations.

All interview ratings were done blindly with respect to PVECIQ scores. In order to obtain information on

the reliability of the assessments, all three authors independently scored the interviews for the ratings on communication; two authors produced independent ratings for the other scales. A code for missing data was entered when the parents did not offer sufficient information for rating. Disagreements were noted and resolved by two researchers or, if necessary, the third researcher helped make the final decision.

Analyzing Construct Validity

The assessment of construct validity was carried out through a factor analysis of the scales. The information provided by the factor analysis is useful to identify the number of independent dimensions in the questionnaire, the amount of variance explained by the different factors, and the relations between the scales. However, the results of the factor analysis must be interpreted with caution because the number of items in most scales and the number of participants is small.

Results

Content Validity

Scales and reliability.   Our independent classification of the items into scales showed small discrepancies with respect to the themes used in the PVECIQ. Table 1 summarizes the original classification of items and the new classification used in the study and provides information on the reliability of the scales as assessed by alpha levels. As can be seen in Table 1, the new groupings into scales have produced either the same or higher levels of reliability.

Alpha levels are considered good if they are at least .7. By such a stringent criterion, only one of the scales would be acceptable. However, as Cronbach (1990) pointed out, high internal consistency is only desirable when the phenomenon is not multifaceted. Developing a highly consistent scale when many factors must be considered simultaneously militates against the validity of the measure. A similar argument is put forth by Nunnally (1978), who suggests that

> at least a moderate level of internal consistency among the items within a test would be expected;

Table 1   List of items in the original scales (left) and the redefined scales (right) with their alpha reliability levels

Communication	*Communication now*
Items 1, 4, 18, 27, 73	Items 1, 18, 27, 73
Reliability:.51	Reliability:.62
General Functioning	*Child's use of implant*
Items 6, 7, 35, 52, 54	Items 6, 7, 35, 52, 54, 71
Reliability:.45	Reliability:.59
Self-reliance	*Self-reliance now*
Items 12, 32, 33, 48	Items 12, 32, 48
Reliability:.30	Reliability:.49
Well-being and happiness	*Well-being and happiness*
Items 16, 61, 63, 66, 72	Items 16, 61, 63, 66, 72
Reliability:.61	Reliability:.61
Social relationships	*Social relationships*
Items 5, 30, 40, 42, 46, 59, 67, 74	Items 5, 40, 42, 46, 59, 67, 74
Reliability:.40	Reliability:.41
Education	*Education*
Items 9, 23, 31, 34, 36, 37, 49, 71	Items 9, 23, 37, 51
Reliability:.51	Reliability:.74
Process of implantation	*Attitudes to process of implantation*
Items 10, 13, 21, 22, 24, 25, 38, 39, 41, 43, 44, 45, 47, 50, 53, 65	Items 10, 22, 39, 56, 65
Reliability:.20	Reliability: 41
Effects of implantation	*Immediate adaptation*
Items 2, 8, 11, 51, 55, 56	Items 2, 11, 26
Reliability:.42	Reliability:.43
Decision to implant	*Anxieties about the decision to implant*
Items 14, 17, 26, 28, 29, 57, 58, 60, 62, 70	Items 14, 17, 28, 29, 58
Reliability:.39	Reliability:.51
Supporting the child	*Parental support to the child*
Items 3, 15, 19, 20, 64, 68, 69	Items 3, 15, 19, 20, 64, 69
Reliability:.41	Reliability:.44
	Child's functioning before implant
	Items 4, 33, 30
	Reliability:.57

i.e., the items should tend to measure something in common. . . . This is not an infallible guide, however, because with some subject matter it is reasonable to include materials that tap somewhat different abilities. For example, abilities for numerical computation are not entirely the same as

those for grasping some of the essential ideas about quantification, but a good argument could be made for mixing these two types of content to measure overall progress in arithmetic. (p. 93)

Thus the moderate levels of reliability observed after the reclassification of the items should not be viewed negatively. They can be attributed to the multifaceted nature of the attitudes under consideration and to the relatively small number of items. For example, the items that assess the attitudes to the process of implant consider the variety of stressors that can impinge on a family when their child needs medical treatment in hospital: difficulties in finding the time, in finding someone to look after the rest of the family, in meeting the costs of travel, and so forth. Although it is reasonable to add the effects of these various stressors to form a scale, there is no reason to expect the different stressors to be correlated. Parents may find the financial demands minimal but still have difficulty in finding someone to look after the family when they accompany the child to the implant center. The low levels ($<.40$) observed for two scales in the original classification would be a cause for concern but the reclassification of items has led to improvements. This analysis leads to the conclusion that the new groupings should be used in the subsequent analyses of criterion and construct validity in order to obtain the best information about the PVECIQ.

The classification of the questionnaire in the 11 different scales included in Table 1 covers 53 items, leaving 21 items outside the scales. These items vary in nature and should be used descriptively. Table 2 presents these items, grouped when possible, with comments. This form of descriptive analysis was considered the most appropriate for items that do not form a scale. Because assumptions from psychometric theory are not met by these items, their validity will not be investigated.

Breadth of coverage: new themes identified.   An analysis of the items included in Table 2 suggests the need to increase the number of items related to some of the themes covered in the questionnaires. An analysis of the content of the interviews indicates the need to include other themes, considering that some of the responses to which parents attributed great importance

are not represented in the questionnaire. The new themes that were identified through interviews are listed below.

Communication at a distance.   The PVECIQ communication scale contains items related to the children's ability to communicate orally and in face-to-face situations, and to the quality of the child's speech. In the interviews, many parents emphasized the importance for them of the child's gained ability to communicate at a distance. One example was of calling the child from the floor below rather than having to go upstairs to call the child but the vast majority emphasized the importance of their child's ability to use the telephone. Parents felt rewarded that their children could chat on the telephone with friends and speak with the extended family, increasing their contact with grandparents. They also felt that it was a relief for them to be able to contact their children by telephone when they are away from home. These advantages were mentioned spontaneously, often as response to the question "what are your best moments?"

Reading ability.   It was surprising to find that many children were reported to enjoy reading, often as a response to the question about the child's favorite activities. The reading ability of deaf children is known to be limited (see, for example, Traxler, 2000) and a limiting factor in their communication. For this reason, it is important to document more clearly the impact of cochlear implantation on the children's reading ability. It is stressed, though, that a questionnaire for parents cannot go beyond the enjoyment and practical uses of reading and writing. An adequate evaluation of implantation on children's reading development would have to be carried out through children's assessments. Better knowledge of children's reading ability and uses of reading would contribute to the description of the effects of implantation on children's quality of life and educational perspectives.

Adaptation in the family.   The PVECIQ focuses on the deaf child's adaptation in family; there is only one item referring to siblings. A frequent theme in the interviews was that siblings have suffered in a variety of ways from having a deaf sibling and the process of implantation. Grandparents were referred to on some

Table 2 Items not included in the scales

Concern about the Physical Functioning of the Implant
Item 8: I worry that the implant will break down.
Item 53: The most important factor in choosing an implant device is its reliability.

These two items reflect a concern with the functioning of the implant. They are significantly correlated but the correlation is low ($r = -.33$; $p = .009$). Parents did express this form of concern during the interview very frequently; it would be advisable to include further items in the scale to assess this issue. Their concern ranged from how long the implant may last, whether re-implantation might be necessary, whether some electrodes might fail, or parts of the device might break off and be lost. They worried about the stress of a new operation and the child's sense of isolation if the device were to fail.

Attitudes Toward Oral and Sign Language
Item 13: The program at the Implant Center should emphasize speaking and listening.
Item 24: Signing support is helpful for a considerable time after implantation.
Item 49: Parents should have a choice in the use of sign language at school.
Item 68: I find it easier to communicate with him by speaking than by signing.

These items describe views on the importance of oral and sign language. Item 13 does not correlate with the other three items. Item 24 is significantly correlated with 49 ($r = .43$; $p = .001$) and with 68 ($r =. 26$; $p = .04$). Items 49 and 68 do not correlated significantly with each other. Item 68 correlates with all the items in the scale that describes level of parental support. A team that wishes to analyze carefully the process of introducing the use of the implant with children who were already signing should take into account the parents' views on sign. Some parents expressed the view that their children should be allowed to continue signing after implant.

Reliance on and Attitudes to Support Services
Item 25: I wish to participate in meetings with other families having an implanted child.
Item 31: The local school and support services adequately meet all our needs concerning the use of his implant at school.
Item 34: We feel the need for advice from the Implant Center concerning his future.
Item 50: It was useful to meet another family with an implanted child before deciding on an implant.

Although it would be possible to construct a scale assessing parents' attitudes to support services, these items do not form a scale. Items 25, 34, and 50 refer to different aspects of parents' experiences and provide information descriptive of parents' needs and what they find useful. Item 31 included the assessment of the school and support services in the same question and this may have distorted parents' reactions. In the interview, some parents strongly criticized the support received from local Learning Authorities, describing months of battles to obtain proper support for their children, yet felt happy with what the school was offering the child at the time.

Reasons for Choosing a Cochlear Implant
Item 57: I expected him to learn to talk once he had his implant.
Item 60: It was important to me that my child could hear sounds from traffic for safety reasons.
Item 62: I believe now that my child will have reasonable prospects for employment.
Item 70: I chose implantation for my child so he would have a chance to become part of the hearing world.

Parents may have different reasons to opt for implantation for their children. Parental descriptions of their reasons include others not contemplated in these items: the complete lack of success of other hearing devices for their child; the quick disappearance of language and of communication with the parents after the child was deafened; the desire to have "their" child back after the child was deafened; the conviction that implantation was the best option for their child; meeting a child who had been implanted and the parents; advice from a trusted medical professional; hearing about the implant when it was reported on television. In order to obtain a complete description of the reasons given by parents, it would be necessary to include other possibilities in the questionnaire and perhaps include an open question for parents to fill in their reasons.

Social Desirability Items
Item 21: Only experienced teams should carry out cochlear implantation.
Item 36: We are reliant on the Implant Center for technical advice about his implant.
Item 41: It is essential that he is encouraged to wear the processor all the time.
Item 43: A positive attitude is a great help towards successful use of the implant.
Item 44: Regular tuning and checking of the implant system are essential.
Item 45: At least one visit per year by Implant Center staff to home/school is essential.
Item 47: Before proceeding with implantation, parents should obtain as much information and advice as possible

All parents agreed or strongly agreed with items 41, 43, 44, and 47. Only two parents did not respond in the same way to items 21 and 36 and one parent to item 45. When the items are considered from the perspective of content validity, it is difficult

Table 2 Continued

to imagine that parents would disagree with them as they express socially desirable views. Items that elicit such little variation in response are not useful for making distinctions amongst participants. They convey little information about the participants. However, researchers may have other reasons to include such items: for example, to ensure that the respondents are reading the items and reacting to them or to document a high level of agreement among parents with respect to certain issues.

Two Odd Items

Item 38: Other children in the family resented the time and attention taken up by the implant.

Item 55: I am confident that long-term electrical stimulation will not be a problem.

Although item 38 does describe a concern of parents when they have other children, it could not be included in a scale because there were no other items of this type. As pediatric psychology now tends to increasingly consider the child in the social context, it may be important to obtain a description of factors that contribute to a positive family participation in deaf children's rehabilitation programs.

About half of the sample agreed or strongly agreed with item 55. However, this was not a concern expressed spontaneously by parents during the interviews when they were questioned about their worries regarding the implant.

---

occasions as having unrealistic expectations of the effects of implantation and finding it difficult to cope with the child's deafness. In other families, in contrast, siblings and grandparents were seen as an asset due to their support to the child and the parents. It is of interest to implant teams and policy makers to consider how the family can participate in the rehabilitation process and be guided into developing realistic expectations that do not cause frustration. Parents were unanimous in reporting that they were prepared by the implant teams not to develop unrealistic expectations but they were unable to transmit this attitude to their families on their own.

These comments suggest that sibling and the extended family might have to be considered in greater detail.

Physical appearance and public lack of information. A concern expressed by some parents was with the physical appearance of the device. This is a domain where progress is being made as less obtrusive devices are being developed. Parents also expressed concern with public lack of information: Mainstream schools often had not had a pupil with a cochlear implant before and the general public seems to have little knowledge of it. One parent thought that lack of information was the reason for her child being bullied in school.

Friendships in mainstream schools. A remarkable and possible result of implantation is on the children's

social network in school. Many parents referred to their child as "popular" and "having many hearing friends." Past research (e.g., Nunes, Pretzlik, & Olsson, 2001) has shown that deaf children in mainstream schools are at risk for being isolated. Parents spoke with pleasure of their children's friendships and viewed this as adding to the children's happiness. In view of the current emphasis on integration policy worldwide, it would be advisable to include items specifically about friendship in an assessment of the impact of cochlear implantation on children's lives. It is advisable to distinguish between relationships in the family and friendships if this effect of the implant is to be assessed.

Identity. This is a sensitive issue in research about deafness and a topic that parents often brought up in the interviews. Cochlear implants sometimes seem to lead to a rejection of deafness by the child, who may refuse to sign or look at the interpreter in the classroom. Some parents clearly regretted this effect. For other parents whose children were deafened by illness and who had no previous experience with deafness, the implant created a sense of normalization in their lives, as they no longer saw their children as deaf.

Some children appeared to continue seeing themselves as deaf, an attitude that was generally not regretted by the parents. Irrespective of whether the children defined themselves as deaf or not, this was a central issue to many parents. Although sensitive, it seems so central in the children's and their families' lives that it is necessary to seek greater understanding

of the question of identity. It is also important to be able to provide clear information to parents in this respect as many parents feared that their child would stand between two worlds, the hearing and the deaf, without finding a place where they really belonged.

Summarizing the findings on content validity. The assessment of the content validity of the PVECIQ indicated the possibility of refinements in some of the measurement scales, leading to a general improvement in their reliability. The refinements should consider the classification of items that belong together and the number of items in each scale as alpha reliability is often low with few items. The analysis of interviews confirmed the significance of the themes included in the PVECIQ and provided indication of further themes that should be included in order to reach a better breadth of coverage.

Criterion Validity

Validation against the interview: an analysis of contrasting cases. The first analysis of criterion validity examined the convergence between results obtained in the questionnaire and those obtained in the interviews. In order to carry out a comparison between results in the questionnaire and the interviews, respondents with very high or very low scores in each of the scales were selected. The interviews' classifications by themes were then analyzed to assess whether the contrasting cases did in fact correspond to extreme points in the scale—that is, very positive and very negative views. For each of the cases, a brief summary is presented here.

Communication. The contrasting cases for this scale did differ markedly according to parental description. P108, who had a very low score in communication, was described as understanding sign better than English, finding it difficult to participate in group conversation and to communicate with new people, finding it frustrating to be unable to communicate, and lacking confidence to communicate with strangers; he only started to string words together in sentences two years after the implant and still gets "the sequence of words muddled up." In contrast, P202, who received a high score, was described as pretty good at understanding,

continuously impressing the extended family with her language development, finding it easy to communicate with adults and children, participating well in group discussions, and being confident to express her opinions and to talk to strangers.

Child's use of the implant. P114, who received a very low score on use of the implant, was described as showing response to sound, which he did not do before, and being aware that the telephone or doorbell are ringing but unable to use the telephone. He listens to music but only watches TV with subtitles. This contrasts strongly with the description of P205, who had a very high score on use of the implant. He is described as having become the happiest boy when he received the implant, wearing it all the time, not needing subtitles on television, and being able to use the telephone to give messages. Thus it can be concluded that the scale does work in discriminating contrasting cases.

Self-reliance. P108, low on self-reliance, was described as not very confident with new situations, a bit wary, and not having made any improvement in self-confidence after the implant. P123, who had a very high score on self-reliance, was described as enjoying a good social life, having lots of interests, being good at occupying herself, being confident in talking to waiters in restaurants, and wanting to do things for herself. The scale therefore seems to identify contrasting cases well.

Well-being and happiness. P108, who received a low score on this scale, was described as easily frustrated and moody. P119, with a high score on this scale, was described by his parents as having become a little withdrawn when he lost his hearing but having "the spark brought back into him" after the implant. Thus the scale does identify contrasting cases.

Social relationships. Scores in this PVECIQ scale showed relatively little variation so the contrasting cases are not as distinct as those chosen for other scales. P206, who had a low score in the social relationships scale, was described as not terribly confident with others, only having friends from the deaf unit, giving cause for concern with respect to friendships. P205,

with a high score in social relationships, was described as having lots of friends, having a life of his own with his friends, being confident and feeling that everyone likes him, and making friends easily. Thus in spite of little variation in scores, the scale can identify contrasting cases.

Education.   P108, who had a low score in education, was described as having a reading delay of about 6 years, having "muddled up writing," and having difficulty understanding what he reads; he is expected to find education difficult in the future. P115, who had a high score on education, was described as making progress all the time and narrowing the gap between his educational and chronological age quite quickly. The scale therefore discriminates contrasting cases.

Attitudes to process of implantation.   P118, who scored low in attitudes to process of implantation, describes the time of implantation as one of huge worries, not knowing whether they were doing the right thing, having financial problems and feeling concerns about the scar from the operation. The parents still express concern as the implant does not seem to be working properly and they think it will be disastrous if the implant fails completely. P140, with a very high score in attitudes to process of implantation, described their only fear during the process as the ones that you have regarding any operation. The team at the implant center was described as "absolutely wonderful," showing concerns beyond what was expected. The information process before the decision to proceed with the implant was considered extensive, with many meetings including the opportunity to meet parents of children who had received a cochlear implant. The parents were well aware that they were not opting for a miracle cure and that much hard work would be necessary for success, perhaps even more than before, and indicated that they felt it was important to have a positive attitude to whatever would be gained. It can be concluded that the scale discriminates contrasting cases well.

Immediate adaptation to the implant.   P129, with a low score in immediate adaptation, indicated that the child had no difficulty in accepting the implant from the start but had shown very little progress over a long period of time. There seemed to be little response to the hearing tests and a doubt about whether the implant was working. The parents expressed skepticism regarding the ability of the liaison person in the team to convey to them information about the reliability of the implant at the time and frustration about the continued deterioration of their child's language. Extra pressures were also being put on the parents through conflicting advice by different professionals regarding the use of oral and signed language and the possible effectiveness of the implant. Considering that the child did not seem to show difficulties in adapting to the implant itself, and that the parents seem to describe more a failure to benefit from the implant, we identified a second case with a low score in immediate adaptation to the implant. P212, with a low score in immediate adaptation, also describes no immediate difficulty in the use of the implant itself but little progress over a long period of time. This suggests that the low scores in this scale should be interpreted as difficulties related not to the process of implantation but to the child's progress in the effective use of the implant.

P111, who had a very high score in immediate adaptation to the implant, was described as feeling very sick for about two weeks after the operation and perhaps wondering what he had let himself in for, but very quickly changing to being extremely pleased when he realized that he could hear his own trainers squeaking as he walked on a wooden bridge. This confirms the interpretation of the meaning of this scale as a matter not of physical difficulties in the use of the implant but rather of progress observed after the implant.

Anxieties about the decision to implant.   P108, with a very low score on anxieties about the decisions to implant—which indicates a high level of anxiety—expressed as the main concern the fear that the child would be considered unsuited for implantation because of "too much hearing." Other concerns were the child's physical appearance after the operation and what he would think about it when he grew up. P140, with a very positive attitude to the decision to implant, indicates that the child has never been embarrassed about being deaf, never tries to hide the implant and wears her hair pulled back. The contrasting cases seem

to indicate that parents' anxieties about the decision to implant are mostly related to what their children will feel about their identity in the future: In this example, the low-anxiety parents appear to think that the child will still be deaf and proud to be deaf after implantation whereas the high-anxiety parents appear to expect the child to be more like a hearing child and to need to hide the marks of the implant. It is noteworthy that both spontaneously referred to physical appearance: P108's parents expressed concern about it and P140's parents indicated that this is not a problem for their daughter. Although there is a clear difference between the contrasting cases, it could be helpful to reconsider the focus of this scale. Some of the new themes identified in the analysis of the interviews (e.g., the issue of identity) could be used for this purpose.

Supporting the child. This scale was expected to reflect the level of stress put on the family as a result of supporting the child in the rehabilitation process. A low score would indicate a high level of stress—in other words, a negative attitude—and a high score would reflect little stress resulting from the amount of support needed by the child. Inspection of the extreme cases suggests that this PVECIQ scale may need reconsideration because low and high scoring parents did not seem to differ in their interviews. P123, with a low score, indicated that she did not think the amount of support really changed after the implant, only the kind of support, but feels she was lucky as she was not working at the time of implant and could offer the child plenty of support. Thus this does not indicate the negative attitude expected from the questionnaire score. P208, who scored high in this scale, similarly reports that the amount of support did not change with the implant but rather the type of support. Neither parent reports high level of stress as a function of having to offer the child support. It can be concluded that the scores in this scale and the results of the interview do not converge.

To summarize, the scrutiny of criterion validity by means of the analysis of contrasting cases suggests that the scales detect differences between extreme cases well. With the exception of two scales—*Parental support to the child* and *Anxieties about decision to implant*—there were clear differences between the views of parents with low and high scores as assessed through the interviews. The analysis of the contrasting cases could be used in the future to support the development of new items and help clarify the meaning of the different scales from the parents' viewpoint.

Validation against the interview: a correlational analysis. In order to test whether the questionnaire and the interview produced converging information, the Spearman's correlation coefficient was used.

With respect to the assessment of the child's *communication ability*, the separate ratings obtained from the interview were added to produce a combined score. The inter-rater correlations for the communication interview combined scores were .96 for raters A and B, .86 for raters A and C, and .82 for raters B and C. These were all significant at the .001 level. A final rating agreed between the judges for each component was used to obtain the combined interview rating for the scale and to calculate the correlation between the interview and the PVECIQ scale. The correlation between the combined interview scores and the PVECIQ scale *Communication now* was .57 ($p < .01$).

Three interview ratings were added to produce a combined score on the child's *Well-being and happiness*. Missing data codes were entered for 21 children in one of the three scores; combined scores were obtained for 39 children. These scales were analyzed by two independent raters; the inter-rater correlation between the total interview scores on well-being and happiness was .86 ($p < .001$). The correlation between the scores obtained from the interview ratings and the PVECIQ scale was .43 ($p < .01$).

Two researchers independently rated the excerpts of the interviews on the *Anxiety about the decision to implant*. The inter-rater correlation (based on 57 cases due to missing data) on these scores was .93 ($p < .001$). A low and non-significant correlation was obtained between the interview scores and this PVECIQ scale ($r = .09$).

Two researchers independently rated the interviews on the *Child's reliance on the implant*. This was a coarse measure as only three points on a scale were used. There was loss of information when it was not possible to apply the classification; only 38 cases were used in this analysis. The inter-rater correlation was 1.0. Both the coarseness of the interview ratings and the loss of information are problematic. However, finer

Table 3 Correlation matrix: Coefficients and significance levels (* for .05 and ** for .01)

Item clusters	1	2	3	4	5	6	7	8	9	10
1 Communication now	–									
2 Child's use of the implant	.40 **	–								
3 Self-reliance now	.43 **	.47 **	–							
4 Well-being & happiness	.34 **	.20 ns	.26 *	–						
5 Social relationships	.42 **	.52 **	.51 **	.40 **	–					
6 Education	.63 **	.41 **	.54 **	.35 **	.43 **	–				
7 Attitudes to process of implant	.11 ns	.18 ns	.26 *	.04 ns	.08 ns	.01 ns	–			
8 Immediate adaptation	.48 **	.23 ns	.12 ns	.01 ns	.15 ns	.27 *	.12 ns	–		
9 Anxieties about decision to implant	.16 ns	.24 ns	.08 ns	.03 ns	.22 ns	.17 ns	.15 ns	.03 ns	–	
10 Parental support to the child	.24 ns	.19 ns	.16 ns	.01 ns	−.04 ns	.28 *	.09 ns	.32 **	.19 ns	–
11 Functioning before implant	−.05 ns	−.20 ns	−.06 ns	.01 ns	−.07 ns	.02 ns	.28 *	−.04 ns	.1 ns	.06 ns

scales could not be devised because parents used such different indicators of how much their children relied on the implant that no indicators could be used throughout. The correlation between the PVECIQ scale on the Child's reliance on the implant and the interview rating was low ($r = .13$) and not significant.

In summary, positive results were obtained for the criterion validity of the PVECIQ scales regarding the *child's ability to communicate* and the child's *Well-being and happiness*. The correlation between the scores in the combined ratings from the interviews and the PVECIQ *Communication* scale was in the range of average inter-rater reliability (Guilford, 1978); the correlation between the combined interview ratings and the PVECIQ *Well-being and happiness* scale is lower but can still be considered acceptable. These results are encouraging because they indicate that it is possible to obtain valid data from a questionnaire, which is a much simpler method both in terms of data collection and analysis than a detailed interview.

The failure to obtain similarly positive results for the scales related to parental anxiety about the decision to implant and the child's use of the implant may be explained either by deficiencies in the PVECIQ or

deficiencies in the interview scoring or by the fact that different aspects of the same phenomenon were being investigated through the two methods. These results indicate the need for further research, which could help identify whether there are different dimensions underlying these domains of parental experience with cochlear implants. The low values obtained here do not provide evidence for the criterion validity of the latter scales.

Construct Validity

Scrutiny of the relations between the PVECIQ scales helps clarify what is behind the items. Are the domains defined by the questionnaire independent of each other, are they related but still distinct, or are they so closely related that they should be considered together?

Table 3 shows the intercorrelations between the scales as defined in our analysis of content validity. As can be seen in the table, some of the scales are correlated with each other. The scales of (1) *Communication*, (2) *Child's use of the implant*, (3) *Self-reliance*, (5) *Social relationships* and (6) *Education* are moderately and significantly correlated. It is expected that these

Table 4 Factor loadings for the different scales before rotation

Scales	Component 1	Component 2	Component 3	Component 4
Communication now	.73			
Child's use of implant	.69			
Self-reliance now	.77			
Well-being & happiness				.57
Social relationships	.77			
Education	.79			
Attitudes to process of implantation		.66		
Immediate adaptation			.62	
Anxieties about decision to implant		.42		
Parental support to the child			.72	
Functioning before implant		.61		

relations emerge because the better the child is able to use the implant, the better he or she would be able to communicate and the easier it should be for him or her to relate to others and to learn in school. Thus it is possible that the child's use of the implant influences how the communication process develops after implantation, which in turn is related to the child's self-reliance, social relationships, and education.

The scales (8) *Immediate adaptation* and (10) *Parental support to the child* are related to each other but only loosely so, appearing to form a different group of items. This result suggests that parents concentrate more on the child's support needs immediately after the implant and that they perceive the immediate adaptation as relatively distinct from the long term effects.

The scale (11) *Child characteristics before the implant* appears as a scale almost on its own, and is only significantly related to (7) Attitudes towards implant. These results suggest that the child's characteristics before the implant have little impact on the effects of implantation apart from influencing the parents' attitude to the implant.

Table 4 shows the results of the factor analysis. The purpose of factor analyses is to discern and to quantify the dimensions that underlie a specific measure. The greater the loading on a factor, the more important is that factor in accounting for the correlations between that component and others in the questionnaire (Kinnear & Gray, 1999). These results have to be interpreted with caution, as the number of items in each scale is small. Table 5 shows the results of the

factor analysis after orthogonal rotation. Because similar results were obtained with orthogonal and non-orthogonal rotation, only the orthogonal rotation results are included here.

The factor analysis supports Archbold et al.'s conception that it is necessary to consider different underlying factors in order to understand the impact of cochlear implant on a child's functioning. The factor analysis suggests that four different factors describe the relations between the different scales. Because factors are often easier to interpret after rotation, the comments on the underlying factors are based on Table 5, which presents the results after rotation.

It is remarkable that very high factor loadings are observed for the majority of the scales. The scales *Communication, Well-being and happiness, Social relationships* and *Education* have their highest loading on factor 1. This factor may be conceived as representing the impact of the implant on the children's functioning in social settings. Although different concepts can still be recognized that make these scales distinct, it is possible that the relations across the factors is mediated by the child's ability to communicate. The better the child communicates, the better his or her adaptation in social relations, the better the child understands what is happening in school, and the happier the child will feel.

From the initial correlations, it was expected that *Self-reliance* might also load strongly on this factor. However, *Self-reliance* loads most strongly on the second factor, along with *Attitudes to process of implantation* and *Anxieties about the decision to implant*.

Table 5 Factor loadings for the different scales after orthogonal rotation

Cluster	Component 1	Component 2	Component 3	Component 4
Communication now	.77			
Child's use of implant				.65
Self-reliance now		.65		
Well-being & happiness	.79			
Social relationships	.64			
Education	.71			
Attitudes to process of implantation		.73		
Immediate adaptation			.77	
Anxieties about decision to implant		.53		
Parental support to the child			.79	
Functioning before implant				−.82

All the relations are positive, suggesting that the more independent the child is after the implant, the more positive the parents feel about the process and the less anxious they are about having made the decision to proceed with implantation for their child.

The third factor confirms the indications obtained in the interviews and the correlations: Parents seem to distinguish between their child's initial adaptation to the implant and longer-term consequences, as the scale about immediate adaptation does not load on the same factor as the other aspects of the child's adaptation. The child's immediate adaptation loads on the same factor as the parents' support to the child. It is likely that parents take the view that their initial efforts immediately after the implant were crucial for the child's immediate adaptation. However, it should be noted that the criterion validity for the scale Parental support did not produce strong results.

The fourth component explains large amounts of variance in the scales *Use of the implant* and *Functioning before the implant*. Here the relation is inverse: The more negatively the child's functioning before the implant is perceived, the more positively the use of the implant is judged to be. This result is of interest because it indicates that gains are judged against the background of the child's difficulties before the implant.

In order to ascertain whether the results of the factor analysis were simply the product of a generally positive or negative parental attitude, scores were corrected by calculating each parent's average score across all the scales and subtracting this average from the observed score in each scale (after adjusting for differences in number of items by transforming the raw scores into proportions). These corrected scores were then subjected to a factor analysis. It is expected that if the scores simply reflect a generally positive or negative attitude towards everything on the parents' part, the factor analysis of corrected scores will produce meaningless results. This was, however, not the case. Although the factors obtained were not identical to those obtained in the analysis with the uncorrected scores, there was considerable similarity in the results, which were still meaningful. The results are not detailed here, as this is simply a test for the existence of a response bias and the test showed that there is no reason to attribute the results of the previous analysis to a generally positive or negative attitude by the parents.

In summary, the factor analysis produced interpretable results, indicating that a single factor does not describe parents' views and experiences of cochlear implants. It is stressed again that these results are tentative and that replication of the obtained factor structure is necessary. The results are useful in that it is now possible to form hypotheses about the underlying dimensions of the parental experience with greater confidence than that provided by intuition. Before this study, researchers had to rely on their intuitions as far as the dimensions were concerned. These results can also provide significant information for the design of predictive studies. Little is known presently about what

predicts a positive result from cochlear implantation. Hypotheses about significant predictors can be developed more easily if the dimensions that describe post-implant adaptation are better understood.

Conclusions

This evaluation of the PVECIQ designed by Archbold et al. (2002) revealed that 11 scales with moderate levels of reliability can be identified. The fact that the levels of reliability as assessed by internal consistency are moderate is not cause for concern because the phenomena under investigation are arguably multifaceted; thus variation within a scale is expected. It is often possible to improve the alpha reliability of scales by increasing the number of items in the scale, even for complex phenomena. Thus a recommendation for further research is to increase the number of items in each scale.

The analysis of the PVECIQ content validity through a comparison with themes raised by parents in the interviews suggested that the themes included in the questionnaire are generally raised by parents when they are asked about their views and experiences in interviews that use a more open format. A few PVECIQ themes that did not emerge as a concern for parents—such as worrying about effects of long-term electrical stimulation of the nervous system—may nevertheless be included in the questionnaire for other reasons. Other themes were spontaneously raised by the parents and merit further consideration in the PVECIQ (e.g., the physical appearance of the device, public knowledge about implants, the child's identity as hearing or deaf).

The scrutiny of criterion validity by means of the analysis of interviews of contrasting cases suggests that the scales detect differences between extreme cases well. With the exception of two scales—parental support to the child and anxieties about the decision to implant—there were clear differences between the views of parents with low and high scores as assessed through the interviews. Researchers interested in further specification of the meaning the scales have for the parents can learn much from contrasting cases, which function as anchoring points at the extremes of the scale.

Criterion validity was also analyzed through the correlations with scores for the combined interview ratings for four PVECIQ scales. This quantitative analysis adds to the analysis of contrasting cases because all cases are taken into account. The analysis produced positive results for the PVECIQ scales assessing the *Child's communication ability* and *Well-being and happiness.* These are crucial aspects of the child's quality of life; the validation of these questionnaire scales is therefore of significance because it shows that valid information can be obtained through efficient means of data collection and analysis. There was no support for the criterion validity of the PVECIQ scales *Child's reliance on the implant* and *Parents' anxieties about the decision to implant.*

Finally, construct validity was scrutinized through two factor analyses, one where the factors underlying the 11 scales were identified and a second one run as a test of response bias. Four clearly interpretable factors were identified after orthogonal rotation, supporting the idea that parents' views and experiences with cochlear implants cannot be described by unidimensional instruments. It is stressed that the factor structure observed here needs replication in view of the small number of participants in this study. The second analysis, which controlled for general positive or negative attitude as a response bias, produced an interpretable solution, thereby providing positive evidence in support of the PVECIQ because the factor structure cannot be explained by a response bias.

It is concluded that the PVECIQ can be used to describe how pediatric cochlear implants affect the children's lives according to their parents' perceptions. It can fulfill its aim of making it possible to obtain data relatively quickly and in quantifiable ways in order to keep implant centers and policy makers well informed. Some scales produced stronger results than others. Where the results were more modest, caution is required in the use of the PVECIQ as an instrument of assessment of outcomes of cochlear implants. In brief, this paper offers a contribution to the incremental validity (Kline, 1995) of the PVECIQ, suggests some refinements in the scoring system leading to 11 scales, identifies further themes worthy of assessment, and provides evidence that can be used to improve its criterion and construct validity.

Acknowledgment

Appendix 1

Items and Scoring Codes for the PVECOIQ

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1) C1 Communication is difficult even with people she knows well.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
2) I5 Immediately after implantation her/his ability to communicate was poorer.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
3) U5 The help I give her/him has become more productive now he/she has her implant.	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
4) C4 Before implantation she/he obtained no benefit at all from her hearing aids.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
5) S6 S/he does not have a close relationship with her grandparents.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
6) G1 S/he is totally reliant on her implant all the time.	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
7) G3 S/he knows when I want her attention because s/he she can hear me call.	5 ☐	4 ☐	3 ☐	2 ☐	1 ☐
8) I1 I worry that the implant will break down.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
9) E2 S/he is unable to cope with mainstream school.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
10) P1 It has been a problem getting someone to look after the family when we go to the Implant Center.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
11) I6 Progress during the first few months seemed very slow.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
12) R3 I can seldom leave her/him to do something on her own.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
13) P14 The program at the Implant Center should emphasize speaking and listening.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
14) D9 I worry that s/he will blame me for my decision for him/her to have an implant.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
15) U1 S/he has needed more help from me since she received her/his implant.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
16) H4 S/he still shows signs of frustration in her behavior.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
17) D7 I am concerned that my child will be rejected by the deaf community because of the implant	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
18) C2 The quality of her/his speech give me gives me cause for concern.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

Appendix 1 Continued

	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree	
19) U6 A lot of help at first means a child needs less help later.	5	☐	4	☐	3	☐	2	☐	1	☐
20) U7 I get more time to myself because of her/his increased independence.	5	☐	4	☐	3	☐	2	☐	1	☐
21) P7 Only experienced teams should carry out cochlear implantation.	1	☐	2	☐	3	☐	4	☐	5	☐
22) P5 The costs of travel to the Implant Center are a problem.	1	☐	2	☐	3	☐	4	☐	5	☐
23) E1 S/he is keeping up well with children of her/his own age.	5	☐	4	☐	3	☐	2	☐	1	☐
24) P15 Sign support is helpful for a considerable time after implantation.	5	☐	4	☐	3	☐	2	☐	1	☐
25) P12 I wish to participate in meetings with other families having an implanted child.	1	☐	2	☐	3	☐	4	☐	5	☐
26) D5 Progress after implantation has exceeded my expectation.	5	☐	4	☐	3	☐	2	☐	1	☐
27) C5 We can now chat even when s/he cannot see my face.	5	☐	4	☐	3	☐	2	☐	1	☐
28) D1 Making the decision to proceed with the implantation was the most difficult part for me.	1	☐	2	☐	3	☐	4	☐	5	☐
29) D2 It was a difficult time waiting for the results of the assessments before implantation.	1	☐	2	☐	3	☐	4	☐	5	☐
30) S1 S/he was socially isolated before getting her implant.	1	☐	2	☐	3	☐	4	☐	5	☐
31) E4 The local school and support services adequately meet.	5	☐	4	☐	3	☐	2	☐	1	☐
32) R1 A significant change has been improvement in his/her confidence.	5	☐	4	☐	3	☐	2	☐	1	☐
33) R2 S/he was very dependent on us before the implant.	1	☐	2	☐	3	☐	4	☐	5	☐
34) E6 We feel the need for advice from the Implant Center concerning her future.	1	☐	2	☐	3	☐	4	☐	5	☐
35) G5 S/he can now amuse herself listening to music or watching TV or playing games.	5	☐	4	☐	3	☐	2	☐	1	☐
36) E7 We are reliant on the Implant Center for technical advice about her implant.	1	☐	2	☐	3	☐	4	☐	5	☐
37) E8 I am concerned about her/his future school placement.	1	☐	2	☐	3	☐	4	☐	5	☐
38) P2 Other children in the family resented the time and attention taken up by the implant.	1	☐	2	☐	3	☐	4	☐	5	☐
39) P4 The process of implantation was no more intrusive than expected.	5	☐	4	☐	3	☐	2	☐	1	☐
40) S4 S/he does not make friends easily outside the family.	1	☐	2	☐	3	☐	4	☐	5	☐
41) P6 It is essential that she is encouraged to wear the processor all the time.	1	☐	2	☐	3	☐	4	☐	5	☐

Appendix 1   Continued

	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree	
42) **S3** S/he is sociable within the family.	5	☐	4	☐	3	☐	2	☐	1	☐
43) **P8** A positive attitude is a great help towards successful use of the implant.	5	☐	4	☐	3	☐	2	☐	1	☐
44) **P9** Regular tuning and checking of the implant system are essential.	5	☐	4	☐	3	☐	2	☐	1	☐
45) **P11** At least one visit per year by Implant Center staff is essential.	5	☐	4	☐	3	☐	2	☐	1	☐
46) **S5** S/he shares in family situations more than before implantation.	5	☐	4	☐	3	☐	2	☐	1	☐
47) **P13** Before proceeding with implantation, parents should obtain as much information and advice as possible.	5	☐	4	☐	3	☐	2	☐	1	☐
48) **R4** S/he is as independent as most other children of her age.	5	☐	4	☐	3	☐	2	☐	1	☐
49) **E5** Parents should have a choice in the use of sign language.	5	☐	4	☐	3	☐	2	☐	1	☐
50) **P16** It was useful to meet other families with an implanted child before deciding on an implant.	5	☐	4	☐	3	☐	2	☐	1	☐
51) **I3** I am happy about her progress at school.	5	☐	4	☐	3	☐	2	☐	1	☐
52) **G2** I can now let her play outside as she is aware of the sound of traffic.	5	☐	4	☐	3	☐	2	☐	1	☐
53) **P10** The most important factor in choosing an implant device is its reliability.	5	☐	4	☐	3	☐	2	☐	1	☐
54) **G4** S/he is still unable to cope in new situations.	1	☐	2	☐	3	☐	4	☐	5	☐
55) **I4** I am confident that long-term electrical stimulation will not be a problem.	5	☐	4	☐	3	☐	2	☐	1	☐
56) **I2** The whole process of implantation is still stressful.	1	☐	2	☐	3	☐	4	☐	5	☐
57) **D4** I expected her/him to talk once s/he had her implant.	1	☐	2	☐	3	☐	4	☐	5	☐
58) **D6** I worry that ultimately s/he may be neither part of the deaf nor the hearing world.	1	☐	2	☐	3	☐	4	☐	5	☐
59) **S8** Her/his relationship with brothers and sisters has improved.	5	☐	4	☐	3	☐	2	☐	1	☐
60) **D8** It was important to me that my child could hear sounds from traffic for safety reasons.	1	☐	2	☐	3	☐	4	☐	5	☐
61) **H3** His/her behavior has improved since s/he had her implant.	5	☐	4	☐	3	☐	2	☐	1	☐
62) **D10** I believe now that my child will have reasonable prospects for employment.	5	☐	4	☐	3	☐	2	☐	1	☐
63) **H5** S/he has become argumentative since getting his/her implant	1	☐	2	☐	3	☐	4	☐	5	☐

Appendix 1   Continued

	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree	
64) U2 A parent of a child with an implant needs to be patient as benefits may take time to show.	1	☐	2	☐	3	☐	4	☐	5	☐
65) P3 It has been hard to take time off work for the appointments at the Implant Center.	1	☐	2	☐	3	☐	4	☐	5	☐
66) H2 S/he is less frustrated than before s/he had the implant.	5	☐	4	☐	3	☐	2	☐	1	☐
67) S7 S/he takes part in family relationships on an equal footing with other members.	5	☐	4	☐	3	☐	2	☐	1	☐
68) U3 I find it easier to communicate with her/him by speaking than by signing.	1	☐	2	☐	3	☐	4	☐	5	☐
69) U4 I give the same amount of help as before the implant.	1	☐	2	☐	3	☐	4	☐	5	☐
70) D3 I chose implantation for my child so s/he would have a chance to become part of the hearing world.	1	☐	2	☐	3	☐	4	☐	5	☐
71) E3 S/he is totally reliant on her implant at school.	5	☐	4	☐	3	☐	2	☐	1	☐
72) H1 S/he continues to be a happy child and good fun to be with.	5	☐	4	☐	3	☐	2	☐	1	☐
73) C3 His/her use of spoken language has developed.	5	☐	4	☐	3	☐	2	☐	1	☐
74) S2 Now s/he is talkative and engages others in conversation.	5	☐	4	☐	3	☐	2	☐	1	☐

Interview Schedule

Introduction

Thank you very much for agreeing to talk to me today. We are doing this interview as part of a larger study funded by the RNID to look at parents' view of the benefits and shortcomings of the cochlear implant, the family, and the child's adjustment, looking in particular at communication issues, education, and relationships with family and friends in the context of the child's cochlear implant.

Please remember this is an independent assessment of the implant and not connected to the Implant Center.

Hearing Loss

What first lead you to believe your child had a hearing loss? When you received the diagnosis what was your initial reaction? How has it changed over time? Without the cochlear implant what level of hearing does your child have? With the implant what level of hearing does your child have? In your family is there anybody else that has been diagnosed with a hearing loss?

Describing the Cochlear Implant

What sort of cochlear implant does he use? How long has he had it? How did he adapt to it when he was first given this device? How did you feel about it? How did it affect his functioning at the beginning? Did it change over time? How? Did he have other aids before? Did he benefit from them? Was there something that made you decide to try something else?

Implantation

Decision to Implant.   In the beginning what made you and your family to consider a cochlear implant for

your child? During the process of assessment did you have any particular concerns? Was the decision easier or harder to make than you had anticipated? Was there anything in particular that made your decision process harder or easier, e.g. lack of or frightening information, talking to other parents whose children had gone through implantation successfully? What were your expectations after the implantation? Do you think that you had reasonable expectations? Was your child involved in the decision of implantation? How did you explain the cochlear implant to your child? In the long-term do you have any particular concerns?

Process of Implantation.   In general what did you feel about the process of implantation? Was it harder or easier than you had anticipated? In going through with the implantation was there anything in particular that put pressure on your child, on you and on your family as a whole? What about choosing an implant device, what influenced you there? What would you say is the most important feature of the chosen implant? Thinking about the role of the Implant Center at this stage, what did you see as their main role?

Effects of Implantation.   Looking back to immediately after the implantation what do you remember concerning behavior, communication, worries, hopes? Did you for example worry that the implant could have negative effects on your child? Could you tell me a bit about what happened at "switch on"? After the implantation did your child progress as quickly as you had anticipated? Thinking about the rehabilitation that your child is/has received, what has it been like? Do you feel it demands too much of you as a parent? The rehabilitation that your child has received do you think it has been too much, too little? What do you see the role of rehabilitation as in the future for your child? Have you got any concerns about the possible long-term problems with your child and the cochlear implant – technical, educational and personal? Today what do you feel about the process of implantation?

Supporting the Child

Thinking about supporting your child after the implantation, do you feel that the child needs less support from you or more? Have there been any changes in the type of support you give your child now after the cochlear implant/implantation? Have there been any changes for you since the implantation? More free time, less free time? When you see your child doing something is there ever a time that you think he would not have been able to do that if he did not have a cochlear implant?

Think about your Child and how he is now Compared to before the New Implant.

Communication Dimensions

Modes of Communication.   What is his main mode of communication today? How has it changed since before the cochlear implant? In your view does he feel more comfortable with his chosen communication method today than before the implant, not at all, somewhat, or very?

Intelligibility of Speech.   In many families with a deaf child there is one person in the family who understands what the child says better than the others and interprets when necessary. Is this the case with your child? Do you notice changes in the ease with which other people understanding him? Has anyone in particular mentioned this change to you? What about people that he doesn't know, do they find it easy to understand him? Do you think that he still needs to make a lot of progress here?

Enjoying Group Conversation.   Does he enjoy participating in conversation with more than one person? Does he mainly listen or does he chat himself? Think about situations in groups with adults that he knows? With groups with children that he knows? With groups with new people that he doesn't know? Do you think he still needs to make a lot of progress here? Has this changed since the implant in your view?

Hearing Others.   What about him understanding others? Does he find it easier to understand one person in the family? What about strangers, can he understand people he is not familiar with? Has this changed since the implant in your view?

Vocabulary.   What about his knowledge of words? Did you notice any changes in how easily he learns new words? Does he find it easier to learn long words? Does he sometimes feel frustrated because he doesn't know

the word for something? How often does this happen, quite often, sometimes, or hardly ever?

Grammar.   What about the way he forms sentences? Does he sometimes say sentences where the words are not in the right order? How often does this happen, quite often, sometimes, or hardly ever? Have you noticed changes in how he forms his sentences? Have they improved? For example does he find it difficult to understand the difference between words such as strong – strength or writer – wrote?

Understanding Stories, Orders.   What about him understanding stories? That is told to him? That he reads himself? Can he retell a story (say something he has heard from a storybook)? Can he retell the story in the order it happened? Has his ability to retell a story changed since the implant?

General Functioning

Coping in General.   What about in general how does he cope? How much does he rely on the cochlear implant? In new situations? With new people? Has that changed since the cochlear implant?

Passing Messages On.   Can/Does he answer the telephone at home? Does he like answering the telephone? Does he feel comfortable passing messages on? Does he take it upon himself to pass messages on? Has this changed since the cochlear implant?

Entertainment.   What about his spare time (after school, weekends) what does he like doing? Does he enjoy playing games? With other children? On his own? Have his interests and things that he likes doing changed since the implant? What about watching TV and listening to the radio? Does he find it easier to follow for example TV programs and games?

Help Needed from Parents.   In what situations does he need help from his parents? Do you see him as more dependent or more independent since the implant?

Self-reliance

Confidence–Thinking about His/Her Confidence.   Does he now do more things by himself – e.g. like walks to the corner shop and buys sweets, playing happily on his own, initiate relationships with peers (ask for examples)?

Does he express his opinion and wishes more – e.g. what he doesn't want and want to do, answers back (ask for examples)? How does he react when you take him to a new place (e.g. a new friend's house, a new park, on holiday, new out-of-school activities)? In general has his confidence changed in your opinion since the cochlear implant? Can you give an example of where you see the biggest change?

Emotional Life.   Would you describe him as basically happy or is he more of a moody child? Do you think his behavior is more challenging than that of other children? If yes, in what ways? Has it changed over time? Do you see any connection between this change and the use of the cochlear implant?

Social Relationships

Meeting New People.   How does he react when he meets new children? Would you describe him as shy or does he join new peers easily? Do you think this has changed over time? More specifically, since the implant have you noticed any changes? When he goes to a party or when siblings' friends come to you, does he join in games? If no, do you think he would like to but finds it difficult or do you think he prefers to be by himself (or with adults, with you)? Do you think he makes friends easily? Does he tend to stick to his friendships or does he seem to have more peers than friends – that is, relates to different peers well but doesn't seem to have favorite friends?

Relationships in the Family.   Is he more sociable now than before the cochlear implant? How would you describe his relationships with the family? With you, the parents? With his siblings? With his extended family (grandparents, aunts, uncles and cousins)? Has his relationships changed in anyway since the implant? Have there been any specific negative or positive effects on his relationships with his family in your opinion as a result of the implant?

Education

Provision.   What type of school does he go to? Mainstream unit or special school? What method of communication does he mainly use in school? Is it different from home? Has his educational placement

changed as a result of implantation? Do you think that he'll change type of school in the future? If so what do you attribute such change to? In your opinion does the school understand the needs of a child with a cochlear implant? How do you see the role of the Implant Center at the school? Has the support given by the Implant Center been useful for your child and the school? In what way? Technical advice, specialist advice, reassurance?

Reading.

What can he read independently–I'm going to give you a list and tell me whether he can read these things on his own.

Familiar signs – Macdonald's, Coke, Underground, EXIT

Sentences – does he read comics, adverts in magazines – short things with pictures

Homework assignments – does he get on with his homework or does he need help from an adult or older sibling?

Text – what sort of books? Could you give some examples

Do you notice whether he takes more interest in written material such as reading signposts or notices in shop windows? Do you feel that there has been a change in his reading as a result of the implant?

Math.

Everyday uses: does he recognize money, can he use money independently to buy his lunch or sweets – small things. Is he good with time keeping – knows how to tell the time, reads both analogue and digital watches, days of the week, months in the year.

Do you find it difficult to explain about things in the past or the future?

Remembering number bondsb – like $5 + 3$ or multiplication tables – how good is the child at this, has this changed?

Have you noticed whether he likes puzzles or to solve problems? Play games that involve thinking? What games?

Other Subjects.   Whether child likes other subjects, which, how does this interest become expressed. Are you happy with his school progress? What has he made good progress on? What do you think is the main difficulty for him? In the long run, what do you think will happen in his education?

Overall

Thinking about the whole process of implantation, from starting taking the decision to today, what would you see as the worst moment?

Thinking about the whole process of implantation, from starting taking the decision to today, what would you see as the best moment?

Core Attitude to Cochlear Implant

If a friend considered the same type of cochlear implant for her/his child, what advice would you give?

Notes

1. One researcher has a Masters' degree in Child Development and the second is a teacher with vast experience in working with parents; both have ample research experience.

References

Archbold, S., Lutman, M., Gregory, S., O'Neil, C., & Nikolpoulos, T. P. (2002). Parents and their deaf child: Three years after cochlear implantation. *Deafness and Education International, 4,* 12–40.

Balkany, T. J., Cohen, N. L., & Gantz, B. J. (1999). Surgical technique for the Clarion Cochlear Implant: Clinical results with the Clarion multi-strategy cochlear implant. *Annals of Otology, Rhinology and Laryngology, 108* (suppl. 177), 27–30.

Christiansen, J. B., & Leigh, I. W. (2002). *Cochlear implants in children. Ethics and choices.* Washington, DC, Gallaudet University Press.

Conklin, E. S. (1923). The scale of values method for studies in genetic psychology. *University of Oregon Publications, 2,* 1.

Cronbach, L. J. (1990). *Essentials of psychological testing* (5th ed.). New York: Harper Collins.

Gallaudet Research Institute. (1999). *Regional and national summary report of data from the 1998–99 annual survey of deaf and hard of hearing children and youth.* Washington, DC, Gallaudet University.

Guilford, J. P. (1954). *Psychometric methods.* New York: McGraw-Hill.

Guilford, J. P. (1978). *Fundamental Statistics in Psychology and Education* (6th ed.). New York: McGraw-Hill.

Kinnear, P. R., & Gray, C. D. (1999). *SPSS for Windows Made Simple.* Hove, UK: Psychology Press.

Kline, P. (1995). *Handbook of psychological testing* (2nd ed.). London: Routledge.

Nunes, T., & Pretzlik, U. (2003). *An independent assessment and evaluation of a profile form parents of children with a cochlear implant.* Oxford, UK: Oxford Brookes University Press.

Nunes, T., Pretzlik, U., & Olsson, J. (2001). Deaf children's social relationships in mainstream schools. *Deafness and Education International, 3,* 123–136.

Nunnally, J. C. (1978). *Psychometric theory.* New York: McGraw-Hill.

Siegel, S., & Castellan, N. J., Jr. (1988). *Nonparametric statistics for the behavioral sciences* (2nd ed.). New York: McGraw Hill.

Spencer, P. E. (2002). Language development of children with cochlear implants. In J. B. Christiansen & I. W. Leigh. (Eds.), *Cochlear implants in children. Ethics and choices* (pp. 223–249). Washington, DC: Gallaudet University Press.

Stevens, S. S. (1946). On the theory of scales of measurement. *Science, 103,* 670–680.

Traxler, C. B. (2000). The Stanford Achievement Test, 9th Edition: National norming and performance standards for deaf and hard-of-hearing students. *Journal of Deaf Studies and Deaf Education, 5,* 337–348.