THE KNOWLEDGE AND ATTITUDE OF PEDIATRICIANS REGARDING THE DIAGNOSIS AND INTERVENTION OF INFANTS AND CHILDREN WITH A SENSORINEURAL HEARING LOSS

By

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In conducting this research project there were a few people who helped me in conducting the research. I wish to thank them for all their support and love throughout the years.

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SUMMARY

TITLE	**The knowledge and attitude of pediatricians regarding the diagnosis and intervention of infants and children with a sensorineural hearing loss**
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The pediatric audiology landscape changed dramatically with the advances in screening and diagnostic procedures, amplification possibilities and early identification outcomes. Pediatricians play a key role in this rapidly developing field. The aim of this study was to investigate Pediatricians' knowledge and attitudes regarding the diagnosis and intervention of infants and children with a sensorineural hearing loss. A questionnaire was compiled to obtain the relevant empirical data. This was distributed to 257 pediatricians in the Gauteng Province. Of the 257 questionnaires only 47 could be utilised. According to the results obtained from the pediatricians it appears that the respondents possess adequate knowledge regarding the diagnosis and intervention of infants and children with sensorineural hearing loss. This is despite having received limited or no information and training on this subject. As is discussed in Chapter 4 it became evident that knowledge gaps were found to exist. The pediatrician is an important team member of the hearing intervention team. Their involvement is crucial and their referral can be the important stepping-stone for early identification and intervention. A lack of skills and proficient knowledge is a major constraint during the implementation of efficient primary health care services in developing countries. Throughout the

results of this study, it is found that pediatricians have a need for additional information and training in the intervention process of infants and children with sensorineural hearing loss, therefore showing a positive attitude towards continuous education. This is based on the results found throughout the study, in terms of a void in certain areas surrounding effective intervention of hearing loss. The aim of the study was to highlight areas of uncertainty that the respondents might experience and to provide educational programmes in order to equip them with the relevant knowledge with regards to sensorineural hearing loss. The findings of this study would hopefully encourage future research and a more in-depth study regarding this topic.

List of keywords: Amplification, Attitude, Continuous education, Developing countries, Diagnostic procedures, Educational programmes, Hearing intervention team Intervention, Knowledge, Primary health care, Screening procedures, Sensorineural hearing loss

OPSOMMING

TITEL	**Die kennis en houding van pediaters rakende die diagnose en intervensie van neonate en kinders met 'n sensories-neurale gehoorverlies**
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Pediatriese oudiologie het dramaties verander in terme siftings- en diagnostiese prosedures, gehoorapparaat (versterkings) moontlikhede en vroeë identifikasie van kinders. Pediaters vertolk 'n sleutel rol in die vinnig ontwikkelende veld. Die doel van die studie was om ondersoek in te stel na pediaters se kennis en houding rakende die diagnose en intervensie van babas en kinders met 'n sensories-neurale gehoorverlies. Daar is gebruik gemaak van 'n vraelys om al die relevante en verlangde inligting te verkry. Die vraelyste is uitgestuur na 257 pediaters regoor Gauteng Provinsie. Van die 257 vraelyste kon slegs 47 suksesvol aangewend word vir die studie. Volgens die resultate blyk dit dat die respondente oor genoegsame kennis beskik van die diagnose en intervensie van babas en kinders met 'n sensories-neurale gehoorverlies. Dit is ten spyte van beperkte of geen opleiding rakende die onderwerp. Soos volledig in Hoofstuk 4 bespreek word, het kennisleemtes egter wel in sekere van die vrae na vore gekom. Die pediater is 'n belangrike lid van die gehoor-intervensie span. Hul betrokkenheid is krities en hul verwysing na relevante persone is die begin punt vir vroeë identifikasie en intervensie. Beperkte kennis en vaardighede is een van die grootste beperkinge tydens die implementering van effektiewe primêre gesondheids dienste in ontwikkelende lande. Die implikasie hiervan dui uit die studie dat regtydige

vewysing en behandeling van die pasiënt met sensories-neurale gehoorverlies negatief beïnvloed kan word. Die resultate dui egter ook aan dat die respondente 'n behoefte het vir addisionele inligting en opleiding in die intervensie proses van neonate en kinders met 'n sensories-neurale gehoorverlies. Verder dui die studie op 'n positiewe houding aangaande deurlopende opleiding. Die doel van die studie was om areas van onsekerheid by die respondente uit te lig en om daarvolgens opleidings programme daar te stel om hulle sodoende met die relevante kennis te bemagtig. Die bevindinge van die navorsings studie moet toekomstige navorsing rakende die onderwerp aanmoedig.

Lys van sleutelwoorde: Deurlopende opleiding, Diagnostiese prosedures, Gehoor-intervensie span, Houding, Intervensie, Kennis, Ontwikkelende lande, Opleidingsprogramme, Primêre gesondheids dienste, Sensories-neurale gehoorverlies, Siftings prosedures, Versterkings moontlikhede,

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CHAPTER 1: INTRODUCTION AND PROBLEM STATEMENT

1.1 INTRODUCTION

"*Children are the touchstone of a healthy and sustainable society. How a culture or society treats its youngest members has a significant influence on how it will grow, prosper and be viewed by others*" (Shonkoff & Meisels, 2000:10).

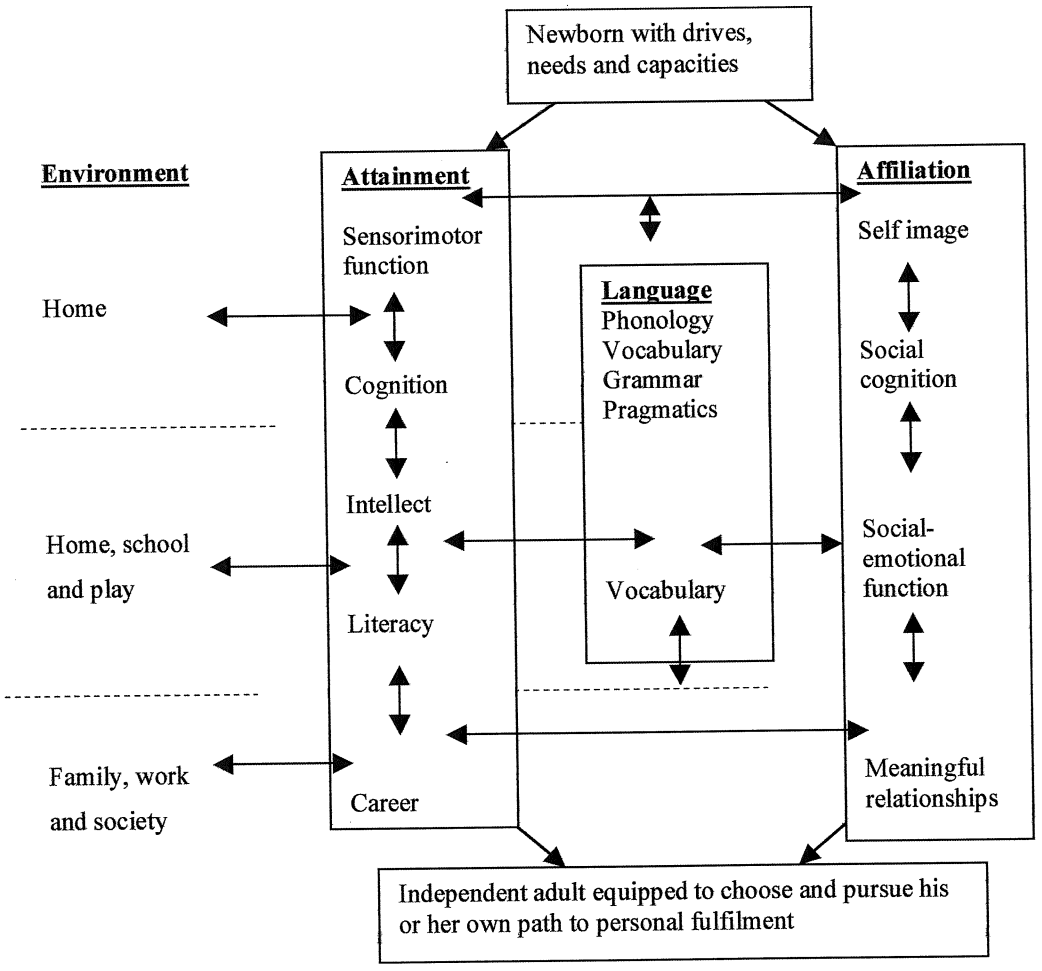
Normal hearing is the entrance to the world of sound for infants and children – a process that is necessary for normal speech and language development (Campbell, 1998). Deafness or loss of hearing is simply defined as an inability to hear (Encarta Encyclopedia, 1998). The condition affects all age groups, it may be temporary or permanent, partial or complete and its consequences range from minor to severe. Deafness is classified into two types – conductive deafness or sensorineural deafness – depending on the part of the hearing mechanism that fails to function adequately (Martin & Clark, 2000).

Deafness from birth causes severe sensory deprivation that can seriously affect a person's intellectual capacity or ability to learn (Alpiner & McCarthy, 1993). The critical period for neurological plasticity is up to age seven (McGrath, 1998). Failure of acoustic sensory input during this period results in failure of formation of synaptic connections and possibly an irremediable situation for the child. Hearing loss that is treated late or not treated at all holds negative effects for the developing child/infant (McGrath, 1998). This includes problems among others with optimal cognitive development, communication competency, literacy- and academic skills (McGrath, 1998).

The requirement for spoken language development in infancy is normal hearing (Boothroyd, 1998). Unless provided early with special training, children with profound hearing loss are incapable of learning to speak. Their chances of optimal socio-emotional, cognitive and sensori-motor development are also severely restricted (Boothroyd, 1998).

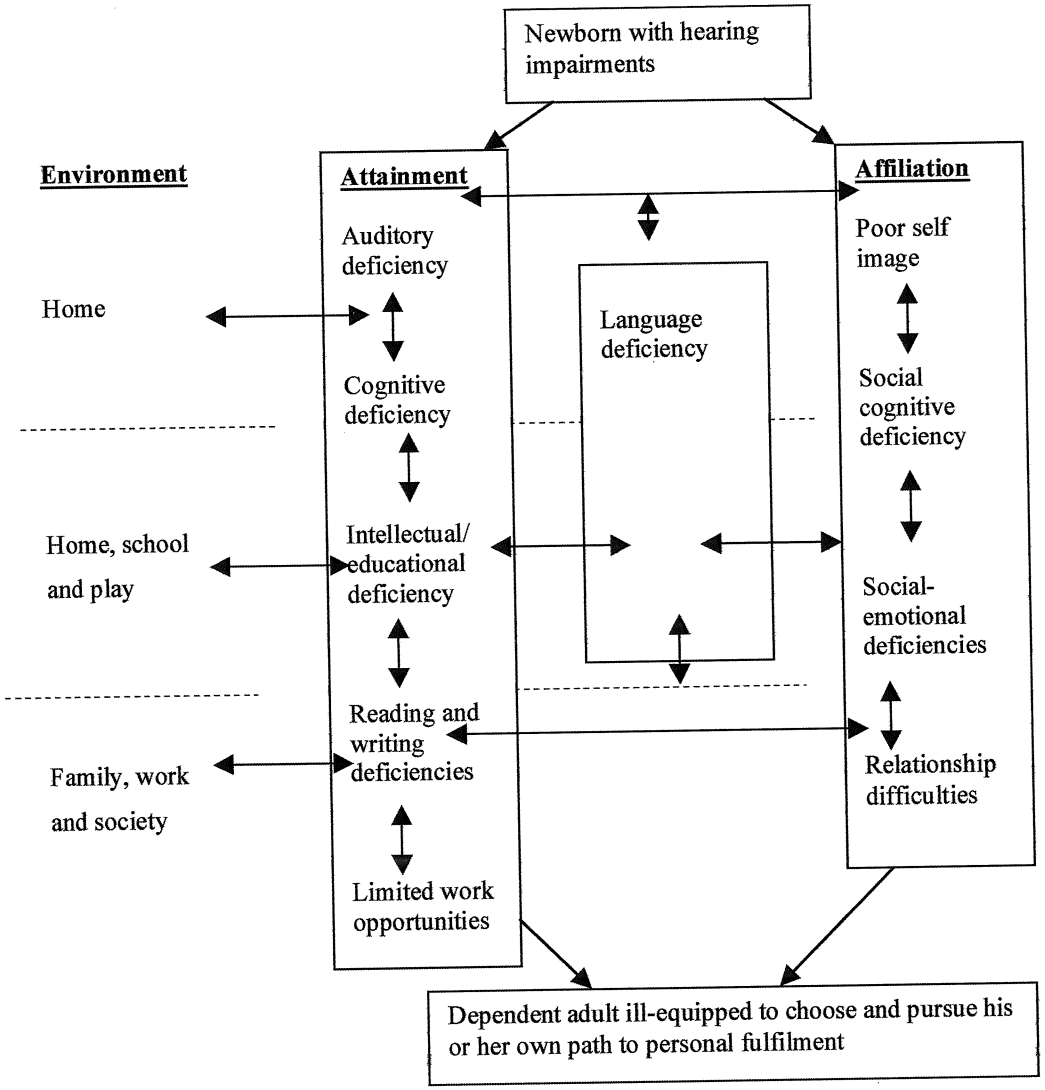
There is a limited time span during a child's development for optimal speech acquisition. The critical time is during the first 2 years of life (Boothroyd, 1998). Hearing is important for the acquisition of vocabulary that leads to the expression of words and meaning of life. Vocabulary is the basis for learning and intellectual development. Therefore, early diagnosis of hearing loss is important. Figure 1.1 is a schematic representation of the factors and processes involved in human development, especially the key role that normal language development plays. Figure 1.2 represents the negative consequences of unmanaged hearing loss on an infant or child.

Figure 1.1:The role of hearing in normal development



Source: Boothroyd (1998) p.3

Figure 1.2: The effects of hearing impairment on development



Source: Boothroyd (1998) p.4

* In Figure 1.1 the bi-directional arrows indicate mutual enhancement or positive feedback while in Figure 1.2 it indicates mutual interference or negative feedback.

Research done by Yoshinaga-Itano (2001), Campbell (1998), Diefendorf (1997) and Alum (1996) proves hearing loss to be one of the most common birth defects. The prevalence of infants and children with loss of hearing revealed to be 1½ to 6 of all live births (Alum, 1996). According to a South African health website, deafness is considered to be the second largest disability in South Africa. In South Africa the prevalence figures according to www.health24.co.za (2004) classification of hearing impairment are as follows:

- 2\1000 – moderately severe to profound hearing loss
- 5\1000 – moderate to moderately severe hearing loss
- 150\1000 – middle ear infections.

McGrath (1998:1) states as follows: "*Hearing impairment is no longer a low incidence disability.*"

In this chapter, the problem and the need for interdisciplinary teamwork between the audiologist and the pediatrician, who are involved with the infant/child with hearing loss, is discussed. The arguments will be based on literature supporting the clinical value of early diagnosis and intervention of sensorineural hearing loss, as well as on the importance of teamwork between above-mentioned professionals working with infants/children with sensorineural hearing loss.

1.2 PROBLEM STATEMENT, RATIONALE AND OBJECTIVE OF THE STUDY

The aim of this section is to highlight the problem that occurs in the early diagnosis and intervention of infants/children with hearing loss, to develop a rationale and to set the objectives for this study.

The problem that occurs during the early diagnosis and intervention of infants and children with hearing loss is caused by the need for holistic and integrated teamwork of professionals. This statement has its origin in the need for extended knowledge that stems

from the concepts that surround hearing loss and rapidly developing technology that is available for intervention. The context refers to the clinical setting where an infant/child is in need of the positive attitude and proficient knowledge needed for appropriate intervention by pediatricians, who deal with sensorineural hearing loss.

The rationale for this study is to investigate the reason for late diagnosis and intervention and the need for pediatricians to contribute to a more effective intervention strategy for infants/children diagnosed with sensorineural hearing loss. The objectives of this study, as mentioned, are to analyse relevant literature in order to establish a theoretical baseline for the study and to analyse the overlapping patterns in previous studies that may support the underlying aims of this study.

1.2.1 Problem statement

This section will outline the problems that may be experienced by pediatricians in the diagnosis and intervention of infants/children with sensorineural hearing loss, especially in the South African context.

1.2.1.1 Establishing the relationship between hearing loss and early screening/diagnosis and intervention

The importance and value of early identification of hearing loss through hearing screening of infants and children is being emphasized worldwide and is well reported in the literature (Geal-Dor, Levi, Elidan & Arad, 2002). The earlier identification of hearing loss in infants and children may lead to an increase in the provision of early intervention and educational services. Amplification, special methods of providing language input and counseling of parents are aspects of early intervention programmes for hearing-impaired infants and children that have the potential for optimizing the child's language development (Northern & Downs, 2002; Alpiner & McCarthy, 1993). With the identification and diagnosis of hearing loss at birth and appropriate intervention within six months after birth, the prognosis for intellectual, emotional, language and speech development in the hearing impaired child is improved. Yoshinaga-Itano's (2001) study

proved that infants with hearing loss (and normal cognitive development) who were identified before the age of 6 months, and received immediate intervention, showed normal speech and language development. Identification of hearing loss, followed by relevant intervention, has proved to be the most effective strategy for the normal development of speech and language.

Previously the usual diagnosis of severe to profound hearing impairment was at the age of at least between 18-30 months (or even later in cases of milder hearing impairment) and where no screening programmes existed (Harrison & Roush, 1996). The ultimate goal currently is to allow as little time as possible to elapse between the onset of a hearing disorder, and its detection and subsequent management (Yoshinaga-Itano, 2001). Effective programmes for early identification and management are highly dependent on a well-coordinated interdisciplinary strategy involving pediatricians, audiologists and other medical specialists (Hall, 2000). A study in Ireland confirmed the importance of early screening: an increase of 39.9% was achieved in the identification of infants, between ages 3 to 6 months, with a congenital hearing loss (Nekahm, Weichbold, Welz-Meuller, Hirst-Stadlmann, 2001).

1.2.1.2 An integrated approach towards teamwork

Pediatric audiology, in particular, is a growth area of practice and will continue to be into the new century (Boswell, 2001). The success, efficiency and effectiveness of early hearing detection and intervention (EHDI) programmes require the support and expertise throughout the health care system and especially that of pediatricians (Finitzo & Crumley, 1999). Information is the key to developing a shared commitment for the EHDI programmes.

According to Wactel and Compart (1996) the pediatrician's primary task is to identify infants and children with a-typical development and to make the relevant referrals for further evaluations or services (Tharpe & Bess, 1999). Research indicates that the average pediatrician will encounter approximately a dozen children with a severe hearing impairment in the course of a practice lifetime (Tomaski & Grundfast, 1999). By

understanding the concepts surrounding hearing loss and by understanding the process and importance of early identification and intervention, the pediatrician is in the ideal position to support and assist the family in the necessary referral process to relevant services and sources (Cherow, Dickman & Epstein, 1999; Lutherman & Kurtzer-White, 1999).

In partnership with other healthcare professionals, the pediatrician must assure that an audiological assessment is conducted on all infants who do not pass the screening and initiate referrals for medical evaluation to determine the etiology of the hearing loss. Middle-ear status should be monitored, since the presence of otitis media can further compromise hearing (Hall, 2000). The infant's history should be reviewed for the presence of risk indicators that require monitoring for delayed onset and/or progressive hearing loss. Periodic audiological evaluation of infants at risk should be ensured since 30-40% of infants/children with confirmed hearing loss will demonstrate developmental delays or other disabilities (Hearing loss is a component of more than 200 inherited syndromes) (Tomaski & Grundfast, 1999). Interdisciplinary assessment and intervention is essential in order to address all the developmental needs of infants and children who are hearing impaired.

1.2.1.3 Typical clinical setting

The goal is to identify hearing loss between 1 and 3 months of age and to start the intervention services before infants are 6 months of age (Yoshinaga-Itano, 2001). Although hearing screening has been both recommended and even routine in many countries, some pediatricians remain unfamiliar with the rationale for universal hearing screening of all newborns (Finitzo & Crumley, 1999). This problem is confirmed if one compares it to the results of the study done by Boswell (2001). In 1997, the "*Centers for Disease Control and Prevention*" (CDCP) monitored the prevalence of children with hearing loss between the ages of 3 years and 10 years. The results were shocking. Of the 413 children identified, only 8% were identified in their first year of life, 47% were not diagnosed before 3 years of age (or older), and 29% showed one or more additional developmental disorders (Boswell, 2001). Another study done in Pretoria showed that the

mean age of hearing loss onset of children who received amplification through hearing aids or a cochlear implant was 4 years and 2 months (Slabbert, 2002). No legislation for hearing screening in the neonatal period and effective follow-up, diagnosis and intervention exists in South Africa (Finitzo & Crumley, 1999).

1.2.1.4 Factors that may lead to late diagnosis and intervention

All professionals involved with pediatric audiology need to enhance their knowledge and skills in order to serve the population in need of service. "*A unique set of competencies is required to provide pediatric assessment, rehabilitative and consultative services as well as to be competent to support families at different stages in their child's development*" (Boswell & Cherow, 1999:3). An audiologist should provide professional assistance to the rest of the professional team members because of the continuous technological advances in procedures in diagnostic testing of young children and amplification options (White, 2002).

In current medical practices, the professional personnel are under constant pressure to provide ways of increasing the efficiency of patient care, as well as maintaining a high standard of care (Vowles, Jefferis & Smith, 1997). Hearing loss is a 'silent, hidden' impairment in a highly heterogeneous population (Joint Committee on Infant Hearing, 2000). If the hearing loss goes undetected and untreated it can lead to many infants/children experiencing a delay in diagnosis from the time of the first suspicion of hearing loss (Kittrell & Arjmand, 1999). Inconsistent evaluation/assessment by team members lead to the late diagnosis of children with sensorineural hearing loss, while the alert pediatrician can eliminate this time lag by utilizing the screening techniques (Kittrell & Arjmand, 1999). During their study Kittrell and Arjmand (1999) also found that many infants/children with a risk factor for sensorineural hearing loss are diagnosed no earlier than infants/children with no risk factors. (This is presented in Table 1.1) This leads to the average age of diagnosis of infants/children with sensorineural hearing loss to remain unacceptably high.

Table 1.1: Median age, in months, for an age of suspicion, diagnosis and hearing instrument fitting for children with and without known risk factors. Also included are lag times between diagnosis and hearing instrument fitting.

Children with no known risk factors				
Hearing loss	**Suspicion**	**Diagnosis**	**Hearing aid fitting**	**Delay between diagnosis and fitting**
Mild to moderate	15 Months	22 Months	28 Months	6 Months
Severe to profound	8 Months	13 Months	16 Months	3 Months
Children with known risk factors				
Mild to moderate	8 Months	12 Months	22 Months	10 Months
Severe to profound	7 Months	12 Months	15 Months	3 Months

Source: Harrison and Roush (1996)

In some areas, where extensive otologic and audiological services may be lacking, the family pediatrician can be an important resource person for assisting and supporting parents in their search for appropriate professionals. Unfortunately it has been said by the parents that the pediatricians do not always follow up, on their suspicions and concerns regarding their child's hearing loss (http://www.oraldeiafed.org/library/devices/ 1998-2003). A general rule to be taken into account is that the mother will usually be the first person to become aware of the hearing problem and any parental concern about hearing status or speech-language delay should prompt further referral and evaluation, regardless of the developmental screening outcome (Kittrell & Arjmand, 1999).

Yet another problem is the fact that pediatricians displayed questions with regard to the effectiveness of EHDI, and audiologists must be able to provide convincing feedback, in order to ensure increased participation of the pediatrician (Finitzo & Crumley, 1999). The following issues are often questioned by pediatricians:

- Pediatricians' primary concern is whether infants really benefit from early hearing detection and intervention (Finitzo & Crumley, 1999).

- Is early-hearing detection and intervention standard care? Standard care is defined as "what reasonably prudent practitioners do". Current government and professional agencies have recognised the importance and benefits of early detection, diagnosis and intervention of hearing loss in infants through the implementation of EHDI programmes (Finitzo & Crumley, 1999).

- Does a failure of the birth admission screening cause undue parental anxiety? Counseling the parents of these infants is challenging, but pediatricians have an important role in communicating screening results to parents. After discharge, the pediatrician's offices become the medical home for infants. Pediatricians are the experts parents seek and are often the source for referral for these services. Parents seek guidance from their pediatrician and programmes which can prove good outcomes and have strong pediatric advocacy. One needs to provide the necessary information in order to make the parents sufficiently aware of the importance of a follow-up screening (Finitzo & Crumley, 1999).

Additional factors exist which contribute to the delay from diagnosis to the fitting of the correct amplification (Sjoblad, Harrison, Roush & McWilliam, 2001). In Table 1.2 and Chapter 2 (Section 2.8) factors are described that influence early identification and intervention.

Table 1.2: Reasons for not detecting hearing impaired children (birth-contingent 1995-1999)

Reason for non-detection
Born in a hospital without a hearing-screening programme
Parental failure to keep the appointment for a final audiological assessment
Delay of hearing loss confirmation due to more urgent intensive care treatment
Progressive hearing impairment
Acquired hearing loss, for example ototoxic therapy

Source: Stephens, Stephens & von Eisenhart-Rothe (2000)

Adopting universal newborn hospital screening (UNHS) in developing countries is doubtful, due to poor public healthcare facilities at all levels. Not only do a significant number of births occur outside the hospitals, but current attitudes, customs and superstitious beliefs in many communities cause parental denial of impairments. Economic implications in developing countries in terms of funding, personnel training and administration are beyond the resources and capacities of most governments (Stephens, Stephens & von Eisenhart-Rothe, 2000). Families who live in under-served areas may have less accessibility and fewer professional resources available to assist them (White 2002). These factors underscore the necessity of providing comprehensive, culturally sensitive information to families – information that fulfils their needs and that results in informed choices.

1.2.1.5 How audiologists are viewed by other professionals

Audiologists are on the verge of a fundamental shift in service delivery as they prepare to meet the needs of the increasing number of infants now being identified through EHDI (Boswell, 2001). Audiologists have a growing role of service delivery in partnership with children and their families and related professionals to optimize development, language learning and life choices for children with deafness and hearing loss. Providing age-

appropriate, efficient and accurate services combined with decision-making synchronised with a family's culture and preferences is a difficult balancing act.

Speech and hearing professionals are well aware that communication disorders can restrict a child's learning and/or social-emotional development. Unfortunately the general public and policy makers cannot always be convinced of the critical importance of communication skills and remedying of communication disorders (Loggemann, 2000). In research, physicians indicated that they did not know the type of intervention children received and remained limited in their understanding of which specific intervention programmes were available for children with significant hearing loss (Smith, 1994; Calderon, Bargones & Sidman, 1998).

Audiologists are involved with infants and children with sensorineural hearing loss on a daily basis and fulfil an important role during the diagnosis and intervention of this population (White, 2002). Audiologists' role is to act as service coordinators, facilitating the tracking and follow-up of infants who fail the birth admission screening or who are at risk of delayed-onset of progressive hearing impairment. Audiologists teach, train and supervise the staff with regard to hearing loss in infants. Without audiologic involvement and pediatrician advocacy EHDI programmes fail either in quality or altogether (White, 2002).

1.2.2 Rationale underlying the study

When the pediatrician is not aware of the audiologist's potential role, the client may not receive optimal diagnosis and intervention during the critical first 6 months. For optimal identification, diagnosis and intervention it is essential to realize that pediatricians be aware of the audiologist's extensive knowledge in this particular field and the existing problems surrounding effective identification and intervention of a hearing loss. Thereafter emphasis is placed on the positive contributions both the audiologist and the pediatrician can make in an infant's or child's life.

1.2.3 Objective of the study

The importance of developing effective health teams in order to implement primary health care for infants/children in developing countries cannot be overemphasized. The objective of this study is to improve the skills and knowledge of participating team members. Improved teamwork skills and knowledge lead to more optimistic attitudes among members as well as to the delivery of more coordinated planning and management of problem issues at hand. Motivating team members also enhances effectiveness of services. Further improvements will rely on actions taken by the involved team members and at national level (Conn, Jenkins & Touray, 1996).

In order to reduce delays in diagnosis and intervention of pediatric sensorineural hearing losses there is a need to identify the factors responsible for such delays as well as the assessment of the effective medical evaluation of these infants/children (Kittrell & Arjmand, 1997). There is a need to enhance pediatrician's awareness of infancy and childhood deafness and to develop guidelines during the diagnosis and intervention of these infants/children.

1.3 DISCUSSION OF RELEVANT TERMINOLOGY

Different professionals have different perspectives regarding approaches to the identification and intervention of an infant/child with sensorineural hearing loss. In order to avoid confusion of terminology and for the sake of clearness, some of the terms used throughout the study are defined.

1. **Attitude**: a settled opinion of a way of thinking (Encarta Encyclopedia, 1998).

2. **Children**: one year to twelve years (Berkow, Fletcher & Beers, 1992).

3. **Deafness**: [1] denoting one in whom the sense of hearing is nonfunctional, with or without amplification, for the ordinary purposes of life;

[2] loss of ability to hear, without designation of the degree of loss or the cause stimulus (Nicolsi, Harryman & Kieheck, 1996).

- **Congenital**: [1] loss of hearing sensitivity existing at or dating from birth.
  [2] born either totally deaf or sufficiently deaf to prevent the establishment of speech and natural language stimulus (Nicolsi et al., 1996).

- **Acquired**: [1] loss of hearing sensitivity occurring after birth and due to injury or disease.
  [2] became deaf in childhood before language and speech were completely established (prelingual deafness);
  [3] or became deaf after having acquired speech and language skills (postlingual deafness), thus significantly impairing communication skills stimulus (Nicolsi et al, 1996).

4. **Degrees of hearing loss**:
   - **Profound hearing loss**: 90+ dB
   - **Severe hearing loss**: 71 – 90 dB stimulus (Nicolsi et al, 1996).

5. **Diagnosis**: identification of a disease, abnormality, or disorder by analysis of the symptoms presented (Nicolsi et al, 1996).

6. **Disorder**: occurs as a result of some type of disease process or malformation of the auditory system (Nicolsi et al, 1996).

7. **Electrophysiologic testing**: procedure using various types of objective audiometry designed to measure an individual's response to a sound stimulus (Nicolsi et al, 1996).

   - **Auditory Evoked Response (AER)** is a type of electrophysiological assessment in which electrical activity, evoked by sounds arising from the auditory portions

of the peripheral or central nervous system, is recorded with electrodes stimulus (Nicolsi et al, 1996).

- **Auditory Brainstem Response (ABR)** in which electrical activity is evoked by very brief sounds from the VIII cranial nerve and brainstem; findings allow inference of hearing level and identification of site of lesion as the cochlea, VIII cranial nerve, or brainstem stimulus (Nicolsi et al, 1996).

- **Otoacoustic emissions**: sounds generated within the normal cochlea, either spontaneously or in response to acoustic stimulus (Nicolsi et al, 1996).

8. **Hearing**: the sense, receptive in nature through which spoken language is received by response to sound pressure waves. The ears, the auditory nerve and the brain are involved in the process of hearing (Nicolsi et al, 1996).

9. **Impairment**: any loss or abnormality of psychological, physiological or anatomical structure or function (Nicolsi et al, 1996).

10. **Infants**: birth to one year (Berkow, Fletcher & Beers, 1992)

11. **Intervention consists of**:

- **Habilitation**: act or process of developing a skill in order to be able to function within a given environment (Nicolsi et al, 1996).

- **Rehabilitation**: restoration to normal, or to as satisfactory a status as possible, of impaired functions (Nicolsi et al, 1996).

12. **Knowledge**: [1] awareness or familiarity gained by experience.
[2] a person's range of information.

[3] theoretical or practical understanding of a subject, etc. (Encarta Encyclopedia, 1999)

13. **Screening**: any gross measure utilized to separate those who may require specific help in a specific area, such as hearing (Nicolsi et al, 1996).

14. **Sensorineural hearing loss**: hearing impairment resulting from a pathological condition in the inner ear or along the nerve pathway from the inner ear to the brain stem. In sensorineural hearing loss, the sound waves are transmitted to the inner ear, but they are not translated into nerve signals that are interpreted by the brain as sound sensations. The defect can lie in the organ of Corti or the auditory nerves. (Berkow et al, 1992)

1.4 DIVISIONS OF CHAPTERS

Chapter 1

Chapter 1 consists of an introduction that highlights the problem statement and the rationale of the study. The motivation and the importance of this study are also highlighted. A discussion follows of terminology and definitions that will be used throughout the study.

Chapter 2

In chapter 2 an overview and discussion of the literature of the role of the audiologist and the pediatrician regarding the diagnosis and intervention on infants and children with a sensorineural hearing loss is presented.

Chapter 3

The research methodology is described in this chapter. It includes the following:

- Research aims: the aims will be viewed and discussed.

- Research design: decision and motivation for the specific type of study is explained. A discussion ensues of how the research aims will be achieved, as well as the planned process that will follow until the solution for the problem statement has been found.

- An overview on the respondents who participated in this study is given.

- Apparatus and material includes a discussion on the background and the use of the questionnaire that is used to collect the data. A discussion follows on the type of questions used in the questionnaire as well as motivation thereof.
- A discussion following the course of the study, namely the pilot study, the main study and the data analysis.

- An analysis of the collected data by using conventional statistical methods up to the point where it is represented as the results of the study.

Chapter 4:

The results and a discussion of the study are presented. The most important/main results will be interpreted, evaluated and comparisons with similar research will be made.

Chapter 5

This is a conclusive chapter providing a summary, evaluation and clinical implications of the study. The chapter will answer the theoretical and clinical aspects of the research problem.

References

This will indicate the primary sources used throughout the study.

Appendices

The appendices include, among others, the questionnaire that was used during the data collection. Other information deemed important during the study is also available for explanation of the research.

1.5 SUMMARY

A lack of skills and proficient knowledge is a major constraint during the implementation of efficient primary health care services in developing countries (Kane-Berman, Henderson & De Souza, 2001). Issues of inefficient staffing, budgeting, planning and a lack of skills and motivation necessary for strengthening health management limit the effectiveness of these services (Conn et al., 1996). These are common problems despite growing advocacy for more effective services for early diagnosis and intervention of children with hearing loss.

Knowledge appears to be the key to prevention, identification and intervention of infants and children with hearing loss. The importance of knowledge and skills regarding research and findings thereof, as well as the rapid, changing technology, specific amplification selection and fitting procedures that are used for infants and children cannot be overestimated. Technology develops at a rapid rate and it is each professional person's role and responsibility to keep up with the latest intricacies. By showing a greater understanding of the different family systems, cultural beliefs and diversity in terms of knowledge and attitude, audiologists and pediatricians can make a difference in the life of infants and children with hearing loss (Guralnick, 1997).

The purpose of this study is to increase the pediatrician's general awareness of the significance of hearing loss in children. As the gatekeepers for children's health care, pediatricians are typically the primary recipients of parental expressions of concerns and the initiators of evaluations or referrals to address these concerns (Tharpe & Bess, 1999).

CHAPTER 2: OVERVIEW AND DISCUSSION OF THE LITERATURE AND ISSUES SURROUNDING SENSORINEURAL HEARING LOSS IN INFANTS/CHILDREN RELEVANT FOR PEDIATRICIANS IN THE SOUTH AFRICAN CONTEXT.

2.1 INTRODUCTION

The following quote applies to a child with a serious to profound, congenital hearing loss: "*he cannot ask, for he has no words. He has no words in which to think; no words to understand explanations. Never having heard any, he does not even know such things as words exist*" (Greinwald & Hartnick, 2002).

To give infants and children the best possible health care, especially those with a severe-to-profound sensorineural hearing loss, professionals must integrate their knowledge to form a meaningful whole. Therefore one needs a positive attitude surrounding teamwork and learning from other professional team members' field of specialty. Such a team is willing to learn from one another and is collaborative, not competitive (Morsink, 1991).

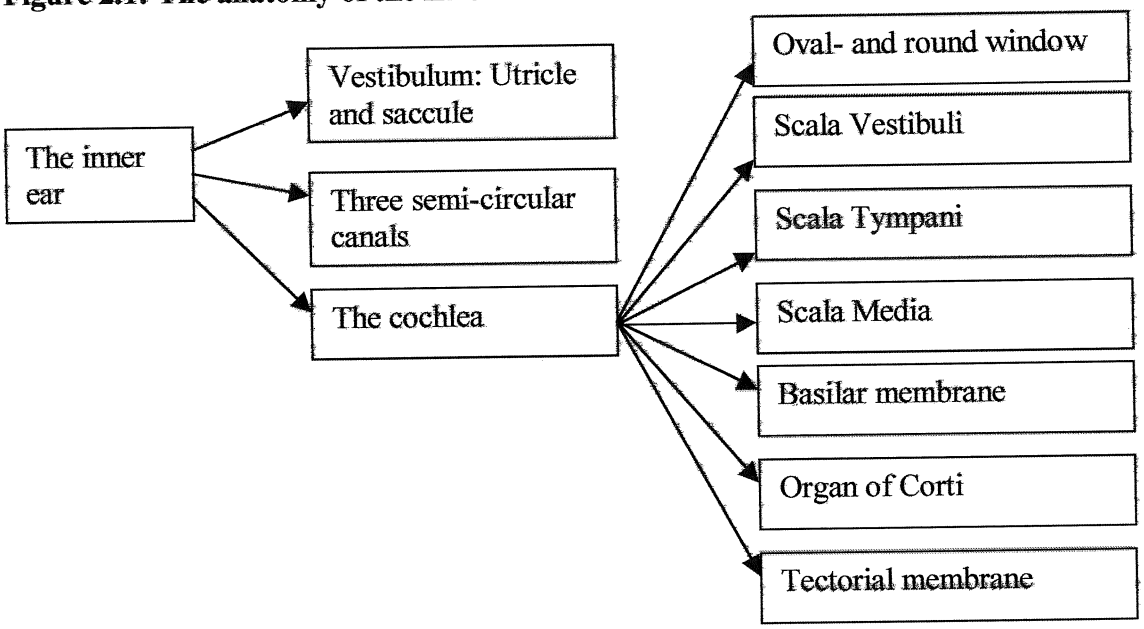
The factors (neurological and physiological) surrounding sensorineural hearing loss are presented in this chapter and a discussion on early hearing screening and early intervention is provided. The need for teamwork is discussed quoting previous research by emphasizing the role of both the audiologist and the pediatrician. A need exists to provide pediatricians with the newest research and technical development for diagnosis and intervention of babies and children with sensorineural hearing loss.

2.2 THE ANATOMY AND THE STRUCTURE OF THE (INNER) EAR

The hearing mechanism is an amazingly intricate system. The hearing organ is divided into three different parts. The external ear which receives and transfers the sound waves to the middle ear. The middle ear which transfers the vibration of the tympanic membrane to the fluid in the cochlea, amplifying the sound energy in this process. In the inner ear are the receptors for hearing which are found in a highly specialized membrane structure, the cochlea (Sherwood, 2001).

The anatomy of the inner ear is presented schematically in figure 2.1.

Figure 2.1: The anatomy of the inner ear.

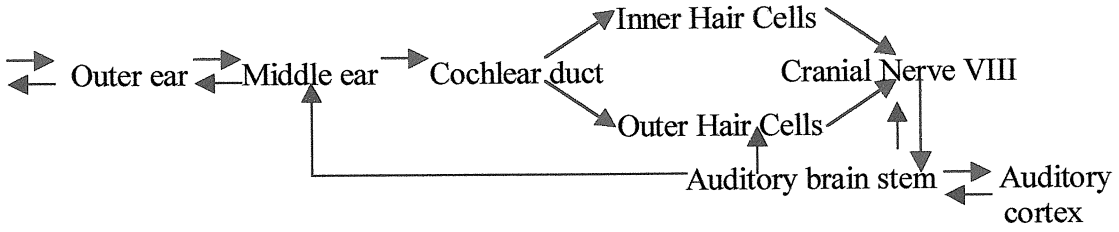


Sources: Sherwood (2001) and Vander, Sherman & Luciano (2001)

The cochlea houses the sensory system for hearing. It is a fluid-filled space interfaced between the middle ear and the auditory nerve. The cochlea acts as a device for converting sound into electro-chemical energy that transmits information to the brain concerning the frequency, decibels and the phase of the sound waves (Vander, Sherman

& Luciano, 2001). In figure 2.2 a schematic representation of the structures and functions of the auditory system is given, illustrating both the afferent- and efferent pathways.

Figure 2.2: A representation of the structures and function of the auditory system.
(* afferent; * efferent)



Sources: Sherwood (2001) and Vander, Sherman & Luciano (2001)

Information concerning the functions of the structures involved in the cochlear mechanism could help towards understanding the causes and effects of sensorineural hearing loss during cochlear development (Lenoir, Puel & Pujol, 1987).

2.3 OVERVIEW ON SENSORINEURAL HEARING LOSS

The aim of this paragraph is to show the importance of being knowledgeable about sensorineural hearing loss. The discussion on this type of hearing loss is to aid the understanding of this complicated problem and the interwoven issues that lead to barriers in early diagnosis and intervention. The knowledge important for understanding hearing loss motivates the rationale underlying this study.

A pathology of the inner ear is a lesion or obstruction that occurs between the inner ear and the brain, resulting in the prevention of sound being perceived (Hall, 2000). Sensorineural hearing loss is the type of hearing loss that occurs when there is an interference with the action of the hair cells in the cochlea or the acoustic nerve (Cranial Nerve VIII) (Shipley & McAfee, 1998). Hair cell action may be mechanically impeded or the hair cells may be damaged or destroyed. About 1/600 infant has a congenital hearing loss (occurs at birth) and many more acquire a hearing loss (occurs after birth) owing to conditions encountered during the neonatal period (Guralnick, 1997). Children requiring

intensive medical treatment during the neonatal period are 1/25-30 (Guralnick, 1997). This puts them in a high-risk category for hearing loss. 2/1000 infants are born with a severe-to-profound hearing loss and 5-6/1000 have a mild-to-moderate hearing loss (Guralnick, 1997). More than 90% of congenital hearing losses are of cochlear origin (Jakubikova, Kabatova & Zavodna, 2003).

The term sensorineural hearing loss indicates uncertainty whether the loss of hearing is due to a lesion in the inner ear or the neural pathways (Berkow et al, 1992). It is important therefore to differentiate between sensory- (cochlear) and neural pathologies (N VIII – vestibulocochlearis) since the results can be life threatening if left untreated (for example a tumor). In table 2.1 the differences between sensory and neural hearing loss is listed.

Table 2.1: Differences between sensory hearing loss and neural hearing loss

Test applied	Sensory hearing loss	Neural hearing loss
Discrimination of speech	Moderate decrement	Severe decrement
Discrimination with increasing intensity	Improves	Deteriorates
Recruitment	Present	Absent
Acoustic reflex decay	Absent	Present
Sensitivity to small recruitments in intensity	Good	Poor
Tone decay	Mild	Marked
Waves in auditory brainstem response (ABR)	Well formed with normal latencies	Absent or with abnormal long latencies

Source: Berkow et al, 1992

Sensorineural hearing loss has three fundamental effects:

- Reduction in cochlear sensitivity;
- Reduction in frequency resolution;
- Reduction in the dynamic range of the hearing mechanism (Berkow et al, 1992).

(It is important to note the differences between the different losses for adequate diagnosis and intervention but for the purpose of this study, the term sensorineural hearing loss will be used throughout the text.)

2.4 THE POSSIBLE CAUSES OF SENSORINEURAL HEARING LOSS

The detection of an infant/child with a hearing impairment does not only rely on the results of the audiometry tests, but on the understanding of the relevant high-risk conditions as well as the behaviours and responses that might suggest a hearing impairment (Calderon, Bargones & Sidman, 1998).

In the following paragraphs a discussion on the possible causes of sensorineural hearing loss is given. The reason being to emphasize why pediatricians must have sufficient knowledge of the given risk factors in order to identify a possible loss of hearing.

A) Prenatal causes

In newborn babies structural defects, known as congenital abnormalities, can be due to embryological malformations or structural changes secondary to infections (Berkow et al, 1992).

Congenital abnormalities:

- **Syndromes and /or inherited disorders**

This is one of the most common causes of congenital hearing loss. Some babies are born with hearing loss that is either an autosomal recessive or an autosomal dominant genetic condition (Martin, 1997). The autosomal recessive inheritance accounts for about 80% of genetic hearing losses while autosomal dominance accounts for about 50% of inherited hearing losses (Martin & Clark, 2000).

A syndrome is the combination of symptoms. Hearing loss might occur as only a part of other medical and physical disorders that occur together. A group of symptoms present can be considered diagnosing a particular disorder. Examples of syndromes that usually present hearing loss are Waardenburg; Klippel-Feil; Treacher-Collins etc. (Martin & Clark, 2000)

Hearing loss that occurs together with a syndrome or an inherited condition might be partial or complete.

- **Virus infections**

A virus infection results from teratogenic effects of an infection of the mother during the embryologic development of a fetus (during the first three months of pregnancy) (Berkow et al, 1992). Hearing losses presented are usually sensorineural with a greater loss at the higher frequencies (from 2000Hz upwards). The degree of the hearing loss can range between 20dB and a 100dB and can occur uni- or bilaterally (Berkow et al, 1992).

(a) Cytomegalovirus (CMV)

This type of herpes virus when contracted by the mother can be transmitted into the uterus (Berkow et al, 1992). This condition can be a result of the human immunodeficiency virus (HIV). 31% of infants infected have a serious hearing impairment, together with complications like microcephaly and mental retardation (Ladewig, London & Olds, 1998). Hearing impairment is a particular concern and

close monitoring beyond the neonatal period is thus of great importance. Another reason is that hearing loss usually has a delayed onset. The characteristics of this type of hearing loss are sensorineural, asymmetric and progressive (Berkow et al, 1992).

(b) Rubella (German Measles)

During the first three months (trimester) of pregnancy the cells of the ear and central nervous system differentiate rapidly. Congenital Rubella results from a primary maternal infection (Berkow et al, 1992). This viral infection can cross the placental barrier and may invade the developing inner ear (viral endolymphatic labyrinthitis), resulting in much destruction and a profound sensorineural hearing loss (mostly unilateral) (Berkow et al, 1992). Effects on the fetus may vary, but close observation is required. (See Table 2.2) Other common signs to look out for by the pediatrician are cardiac defects, pneumonia, otitis media, brain damage, blindness and mental retardation (Ladewig et al, 1998; Enkin, Keirse, Neilsen, Growther, Duley, Hadnett & Hofmeyr, 2000).

Table 2.2: Possibility for defects at different stages of the pregnancy

Duration of pregnancy	Percentage chance of defect
First gestational month	30% to 100% chance of defect
Second gestational month	20% to 50% chance of defect
Third gestational month	13% to 40% chance of defect

(Berkow et al, 1992)

(c) Syphilis

Syphilis is a venereal (contagious systemic) disease (Farber & Ballard, 2000). It can affect any tissue or vascular organ of the body and can be transmitted from an infected mother to the fetus via the placenta. There is a 60% to 80% chance of the fetus being infected (dependant on the stage of the mother's infection and the stage of pregnancy) (Berkow et al, 1992). Most babies are asymptomatic at birth. A progressive loss of hearing (uni-or bilateral) may appear at any stage from birth

onwards. Other related symptoms may be skin lesions, failure to thrive, meningitis, convulsions, optic atrophy, fissured skin lesions, etc. (Enkin et al, 2000).

(d) Human immunodeficiency virus (HIV)

This infection caused by a cytopathic human retrovirus, results in a continuously changing and progressive spectrum of immune deterioration and associated clinical conditions of which the end stage is acquired immune deficiency syndrome (AIDS) (Farber & Ballard, 2000). In short, it affects the immune system. During the course of the virus, it is characterized by a wide range of complications, and conditions that progress as the immune systems deteriorates. Mothers with HIV have a 50% chance of delivering a baby with the disease (Berkow et al, 1992). Congenital or perinatal infections like fever, meningitis and otitis media usually manifest during the first and second year of life (Enkin et al, 2000). Hearing is at risk mostly from opportunistic infections such as meningitis that are secondary to the disease or from the ototoxic drugs used as treatment (Berkow et al, 1992). With the increase of individuals who test positive for HIV, hearing loss, related to bacterial and viral infections may increase dramatically.

- **Incompatibility of the mother's and the baby's blood types**

A protein molecule, called the Rh-factor is found in the fetus blood, but is absent in the mother (Berkow et al, 1992; Martin & Clark, 2000). The mother's body produces antibodies for protection against the harmful effects of the Rh-factor. The count of antibodies increases with each succeeding pregnancy (Berkow et al, 1992; Martin & Clark, 2000). If a sufficient number of antibodies are produced the developing red blood cells of the fetus are damaged, to the extent that they cannot properly carry oxygen to the essential body parts, that includes the cochlea. The cochlea then becomes damaged, and a sensorineural hearing loss is present (Berkow et al, 1992).

- **Metabolic disturbances**

The most common example here is diabetes mellitus. Cardiac effects, congenital malformations of major organs including the ear, have been associated with the use of

oral hypoglymic agents in the first trimester. Because of the elevated glycosylated hemoglobin (HbAlc) concentrations at conception and during embryogenesis the baby's inner ear degenerates and leads to hearing loss at birth (Berkow et al, 1992).

- **Ototoxic drugs or agents**

This indicates agents or medication that is poisonous (Martin & Clark, 2000) to the ear. The ear especially is very sensitive to certain medication and chemical substances, for example neomycin, dihydrostreptomycin, nicotine and alcohol (Ladewig et al, 1998; Enkin et al, 2000). These medication or substances generally damage the outer hair cells of the cochlea at its basal end. The hearing nerve, more than any other, is highly susceptible to chemicals and medication, since it leads to the degeneration of the hair cells (Berkow et al, 1992). The hearing loss that may result is usually permanent, bilateral and symmetric (Martin & Clark, 2000).

B) Acquired hearing loss

(I) Perinatal causes (occur during the process of birth)

- **Anoxia**

A difficult, long or early birth can cut off the oxygen supply, which leads to oxygen deprivation to important cells. The ears are extremely susceptible to oxygen deprivation, especially the hair cell and the stria vascularis (Martin, 1997). The structures of the ear can degenerate and lead to sensorineural hearing loss (Berkow et al, 1992). Anoxia is a common cause of damage to the cochlea and the central nervous system.

- **Prematurity**

This classification refers to newborns who are born before 37 week gestation and weigh less than 1 500 grammes (Berkow et al, 1992). Prematurity is a matter of concern, since the level of organ system maturation is determined primarily by the infant's gestational age (Martin, 1997).

- **Trauma to the fetal head**

Fractures of the temporal bone may be due to the uterine contractions which can lead to damage to the brain and can even cause bleeding in the inner ear. A profound sensorineural hearing loss is present in 35% of the cases (Berkow et al, 1992; Martin, 1997).

(II) Postnatal causes (occur after birth)

- **Kernicterus**

This cause is usually evoked by maternal and fetal blood group incompatibility. After birth, bilirubin builds up in the newborn's circulation, and high levels can be deposited in the basal ganglia of the brain, resulting in Kernicterus. Clinical symptoms are poor feeding, flaccidity, seizures, apnea, sensorineural hearing loss and neonatal death (Berkow et al, 1992).

- **Purulent Labyrinthitis**

The invasion of the inner ear by a bacterium leads to the inflammation of the membranous labyrinth of the cochlea (Martin, 1997). This might be secondary to serous otitis media or purulent meningitis. During the case of serous otitis media, bacterial toxins may gain access to the inner ear through the membranes of the oval or round windows (Berkow et al, 1992). A sensorineural hearing loss may occur since the pressure of the fluid damages the inner ear structures (Jókay, Papp, Soós, Sziklai,& Dezsö 2001). If the inner ear itself is damaged or infected, a complete hearing loss may occur (Martin, 1997).

- **Ototoxins and medication**

Already discussed. (See A)

- **Infection of the baby/child**

Infections can lead to severe and complete hearing losses and have been identified as the causative factors in cochlear hearing loss. There is usually a sudden onset and the hearing loss can be uni-or bilateral (Martin, 1997).

(a) Measles

Measles is a highly contagious, acute disease and may cause a sudden, unilateral hearing loss. Other complications are fever, pneumonia, otitis media and encephalitis (Martin &Clark, 2000).

(b) **Mumps**

This acute, viral disease, causes painful enlargement of the salivary glands (Berkow et al, 1992). The highest incident occurs between the ages of 5 and 15 years. Mumps may occur along with a sudden, permanent, profound, unilateral sensorineural hearing loss (Martin & Clark, 2000).

(c) **Meningitis**

Inflammation of the meninges is due to a bacterial invasion, and usually occurs during the first four weeks of life (Berkow et al, 1992). This process includes the filling of the labyrinth with pus, and as the healing takes place, the membranes and other loosely attached structures of the labyrinth are replaced by bone. This happens to 2 out of 10 000 full-term babies and 2 out of 1000 low-birth-weight babies (Berkow et al, 1992). Due to the damage to the labyrinth a profound-complete, bilateral hearing loss can be found.

- **Fever**

During excessive fever, cells, including those of the cochlea, may become damaged (Martin, 1997).

- **Otitis media**

A factor that enjoys a lot of attention in terms of research and the fact that it may be related to the possible development of sensorineural hearing loss is otitis media (Papp, Rezes, Jókay & Sziklai, 2003; Mutlu, Osabasi, Metin, Basak & Erpek, 1998). Otitis media is the most common childhood disease of which the highest prevalence is between 75% and 95%, amongst neonates and children between the age of 6 and 12 months (Arick, 1995; Papp et al, 2003).

Several hypotheses have been made to confirm these associations. One of the reasons being that otitis media occurs along a continuum, and thus may result in a secondary pathology other than middle ear infection (Paparella, Schachern & Cureoglu, 2002). It is believed that the inner ear is vulnerable to chronic supportive otitis media (Papp, Rezes, Jókay & Sziklai, 2003). The proximity of the sensory cells to the potential source of harm (inflamed middle ear) may lead to more exposure, as reflected by the fact that sensory cells processing higher frequencies may be more seriously damaged (Papp, Rezes, Jókay & Sziklai, 2003).

Another theory on the relation between otitis media and a possible sensorineural hearing loss is that the toxins from bacteria in the middle ear may enter the inner ear by way of the round or oval window, or pus may enter the labyrinth from the middle ear or the meninges, the protective covers of the brain and the spinal cord (Papp, Rezes, Jókay & Sziklai, 2003).

According to the study being done by Cherow et al (1999) a large percentage of pediatricians and physicians are of the opinion that a hearing test by an audiologist is not necessary in the case of otitis media. Another issue that arises is that some pediatricians view the presence of otitis media primarily as a medical problem and not as a resulting hearing loss with possible devastating effects and consequences (White, 2002).

- **Idiopathic causes**

Other causes are usually of unknown (idiopathic) origin, and cause a sudden, unilateral hearing loss.

As seen in these paragraphs, this type of hearing loss can be caused by various factors, either congenital (occur by birth) or acquired (occur after birth as the result of pre- or postnatal factors) (Greinwald & Hartnick, 2002; Martin, 1997). Knowledge of patophysiology forms the basis for intelligent and successful prevention and intervention of a hearing impairment. Signs of these serious otologic (ear) diseases indicate the need for an evaluation by a specialist. "*Physicians should provide recommended hearing screening, not only during infancy but also through early childhood for those children at risk for a hearing loss, and for those demonstrating clinical signs of a possible loss.*" (American Academy of Pediatrics, 1999, p.1)

2.5 ASSESSMENT OF SENSORINEURAL HEARING LOSS

Modern technology has enabled audiologists to test the hearing of newborns and children with great accuracy. These tests use reflexive, behavioural and physiologic responses to auditory stimuli of controlled intensity. Infants with normal hearing show reaction to sound only a few hours after birth (Martin & Clark, 2000). Identification audiometry, a component of a hearing conservation program involves screening or testing individuals at risk for hearing impairment (Yasuhara, 1996).

A screening procedure is part of the preventative health care to detect disorders before clear symptoms of an impairment exists. The goal of screening is to identify an infant with a possible hearing impairment and to initiate treatment by six months of age (Yoshinaga-Itano, 2001). The purpose of identification is to differentiate between individuals with a hearing loss and those with normal hearing (Joint Committee on Infant Hearing, 2000).

Hearing impairment is difficult to detect, thus extraordinary efforts must be made to assess hearing during infancy and early childhood in order to prevent irreversible impairments (Joint Committee on Infant Hearing, 2000). During the past 25 years newborn hearing screening programmes were compiled to improve early identification of profound hearing loss and to ensure habilitation as soon as possible (Diefendorf, 1997). As a result of advances in understanding the auditory anatomy, physiology and advances in test equipment and procedures, audiologists are now able to differentiate between sensory and neural sites of lesions. The goal for all children with hearing loss should be early detection and the correct diagnosis, followed immediately by appropriate intervention (Guralnick, 2000). The underlying rationale is to decrease or even eliminate the effect that hearing loss has on speech, language, literacy, academic skills and social development (McGrath, 1998).

Successful prevention, identification, the correct intervention and possible medical treatment of mentioned causes are dependant on early screening programmes as well as the knowledge of professionals regarding hearing loss (Hugo & Pottas, 1997). In short, the essentials for an effective hearing-screening program are:

- Initial screening;
- Identification;
- Evaluation;
- Tracking and follow-up; and
- Intervention.

Universal hearing screening is necessary. The high-risk registry, for instance, is a procedure that can detect almost half of newborns with hearing loss (Lutherman & Kurtzer-White, 1999). Unfortunately if only the infants and children who fall in a high-risk category are being screened, 30-50% of infants and children with hearing loss will be missed (Oudehuys-Murphy, Van Straaten, Bholasingh & Van Zanten, 1997). Therefore, it is important for infants to undergo ongoing attempts at being diagnosed within the first three months of life. A combination of tests must be used as a cross-check principle in order to make the correct identification and diagnosis of neonatal hearing impairment.

Screening of infants' hearing before they leave the hospital or clinic, is part of the law in most states of the USA (Hall, 2000). Impressive gains in the development of instrumentation and test protocols have been made to identify hearing loss in infancy, yet many communities still do not have any hearing screening programmes or they are unaware of these tests (Hall, 2000). As soon as hearing loss is suspected, audiologic assessment should be undertaken. Electrophysiologic testing includes auditory brainstem response (ABR), immittance measurements and oto-acoustic emissions (OAE). The use of these objective techniques does not require the patient's behavioral responses and is ideal for infants (Joint Committee on Infant Hearing, 2000).

The two electrophysiological techniques which are mostly used during screening of hearing, is the auditory brainstem response (ABR) and oto-acoustic emissions (OAE) (Hall, 2000). Both tests are recordings of the physiological activity that underlies normal auditory function, and are easily applied to infants and children and both correlate with the degree of peripheral hearing sensitivity (Joint Committee on Infant Hearing, 2000). These tests are also capable of detecting unilateral or bilateral hearing losses of approximately 30dB and above (Diefendorf, 1997).

A screening procedure should use objective criteria to define the method for a technically correct screening test and to set a guideline for a "pass versus refer" outcome. Thereby the need and driving force for automated testing in screening technology is - (a) control and (b) monitoring of testing. In short the number of babies who require testing far exceeds highly skilled professionals available to perform the conventional tests. Automated technology for ABR and OAE is at present highly recommended and favored for using. The reasons being:

- Less skilled personnel can now do the above screening.
- It test signals and objectively analyses data, thus being efficient and cost-effective.
- Maintain accurate, consistent and effective hearing outcomes (Katz, 2002).

This automated system has proven to be a valid and reliable way to screen babies and children successfully (Katz, 2002).

2.5.1 Automated brainstem response (ABR)

ABR testing is the cornerstone of objective audiometry in infants and children (Tomaski & Grundfast, 1999). ABR reflects the activity of the cochlea, auditory nerve and auditory brainstem pathways. Using ABR, frequencies between 1 and 4 kHz can be obtained from neonates, young children, or uncooperative children (Tomaski & Grundfast, 1999). ABR is well suited for estimating hearing levels in infants, and is unaltered by sleep or sedation (Greinwald & Hartnick, 2002). When appropriately used, premature infants as young as 30 weeks of gestational age can be tested at low stimulus intensity levels. ABR is highly accurate in detecting sensorineural hearing losses in infants in excess of 30dB HL (Martin & Clark, 2000).

2.5.2 Oto-acoustic emissions (OAE)

OAE screening is an objective and quick procedure and tests a wide frequency range simultaneously (Diez-Delgado Rubio, Espin Galvez, Lendinez Molinos, Ortega Montes, Arcos Martinez & Lopez Munoz, 2002).. Hearing screening programmes based on transient-evoked otoacoustic emissions (TEOAE) can expect to identify hearing impairment in approximately 80% of infants screened (Jakubikova, Kabatova & Zavodna, 2003). It is particularly useful in screening for peripheral auditory dysfunction, especially in infants, since OAE's tend to be immeasurable in ears with greater than 25-30 dB of peripheral hearing loss (Martin & Clark, 2000). OAE's are sensitive to outer hair cell dysfunction, detecting cochlear (inner ear) hearing loss. The disadvantage of OAE is that it is unable to detect neural (eight cranial nerve or auditory brainstem pathway) dysfunction, and cannot be used when the middle ears are abnormal (Martin & Clark, 2000).

2.5.3 Auditory steady-state evoked potentials (ASSEP)

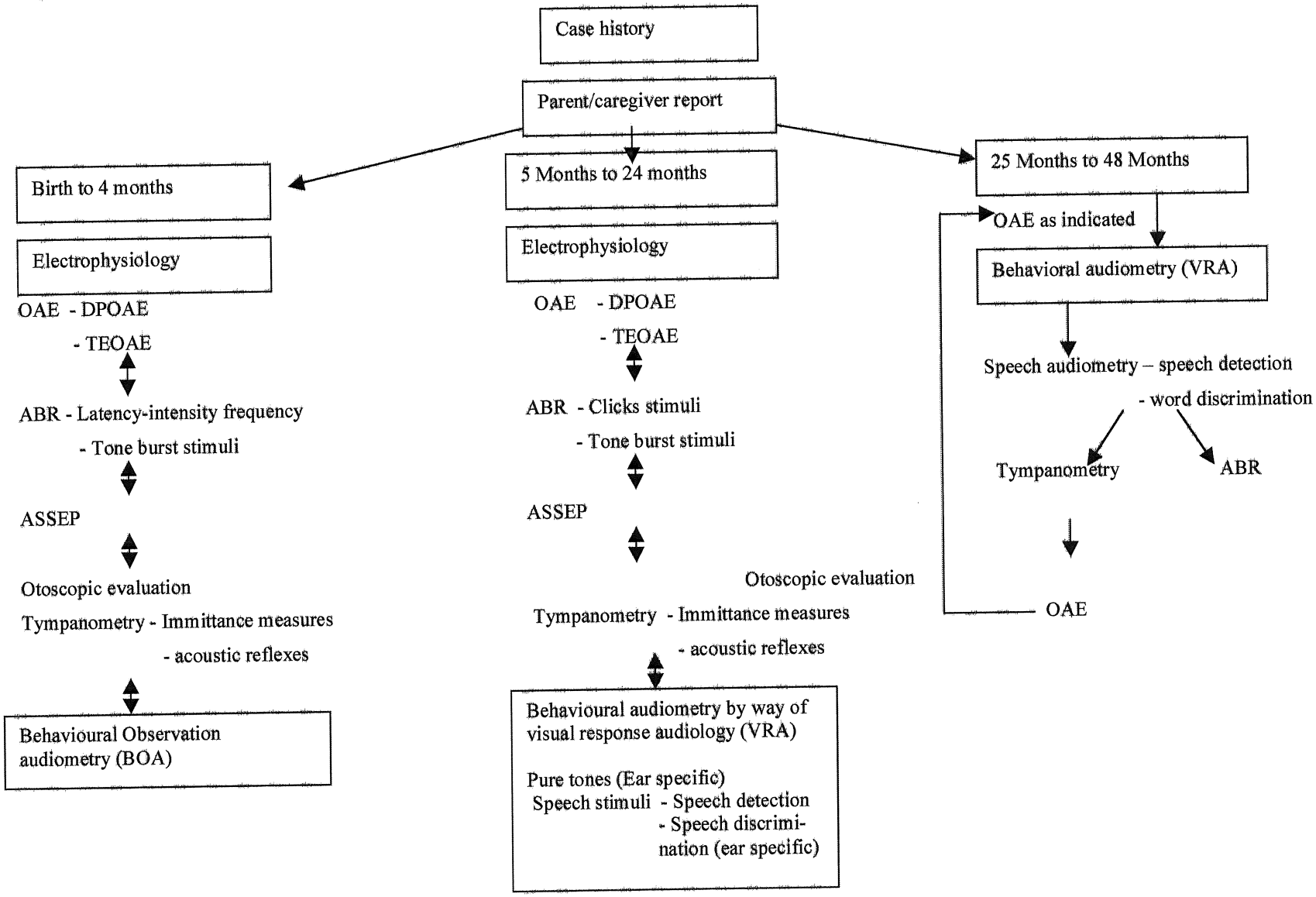
Another test that has been proved reliable during neonatal hearing screening is the auditory steady-state evoked potential (ASSEP) (Rance & Briggs, 2002). ASSEPs are continuous scalp-recorded potentials that arise in response to periodically time-varying

stimuli such as amplitude- and frequency-modulated tones. Rates around 70 to 100Hz have been most effective for infant testing. This procedure provides an objective, frequency specific assessment of hearing that can be used to confirm results obtained behaviourally, particularly in cases of significant sensorineural hearing loss (Sininger & Cone-Wesson, 2002). Studies proved that the ASSEP-thresholds obtained can be used as the basis for hearing-aid fittings for infants and children with sensorineural hearing loss and that all babies tested through this process, were successfully amplified within one month after evaluation (mean age is 4 months) (Rance & Briggs, 2002).

The basic hearing assessment/evaluation through a test battery must not be underestimated (Hall, 2000). The test battery is the foundation that leads to responsible and effective auditory assessment. The results of all given tests provide information on the auditory functions; normal and abnormal. This information is critical during the management planning after the diagnostic phase is completed.

The test battery approach is based on the cross-check principle. This implies that the results of a single test are never accepted and interpreted in isolation as conclusive proof of the nature or the site of the hearing impairment without support from various objective assessments (e.g. ABR) (Katz, 2002). The reason for applying the cross-check principle during hearing assessment is because of the fact that the results of the assessments will have a direct impact on the infant's/child's life. In figure 2.3 a flowchart outlines the various assessments used with infants and young children.

Figure 2.3: Pediatric audiometric flowchart



2.6 INTERVENTION METHODS MOST SUCCESSFUL FOR SENSORINEURAL HEARING LOSS

Intervention services are designed to help individuals overcome the challenges posed by their disability. These services are designed to provide an individual with the most appropriate technological support that will help maximize the use of residual auditory abilities and ensure the best possible hearing for the development of oral language and speech (Boothroyd, 1998). Early intervention is secondary prevention. The goal is to prevent, evaluate and provide relevant treatment in order to minimize potential negative outcomes (Fair & Louw, 1999).

The majority of hearing losses are caused by damage to the inner-ear structures. When the hair cells in the cochlea are damaged, the transferring of sound to the rest of the structures is obstructed. The problem occurring with a sensorineural hearing loss is that the damage to the inner ear is mostly not medically treatable (Martin, 1997). The most effective way of intervention is usually the use of hearing aids or sensory aids (Pediatric Working Group of the Conference on Amplification for Children with Auditory Deficits, 1996). Prompt initial probatory treatment with a conventional hearing aid is necessary to take advantage of the sensitive phase of development and maturation of the auditory pathways (Martin, 1997).

An increasing number of very young children with marked developmental delays, especially in speech and language, are being referred to the audiologist. This trend reflects a growing awareness within the professional community and amongst parents about the importance of early identification and habilitation of infants/children with a hearing impairment. Several reasons exist for providing amplification as early as possible:

- To avoid possible effects of sensory deprivation, which refers to both the physiological and psychological aspects of development.
- The enhancement of language development during critical periods of readiness.

The fitting of the hearing aid is the first step in the intervention process. Hearing aids provide the hearing-impaired infant/child with optimal use of the residual hearing so that speech and language milestones can be achieved at appropriate age levels.

Hearing aids increase the intensity of environmental sounds and may modify the sound spectrum and tailor/amplify it to the patient's particular pattern of hearing loss at higher or lower frequencies. A hearing aid's secondary function is to increase the quality of life of a hearing-impaired person. It cannot provide normal hearing but increases the ability to communicate; makes a person an active participant in life because the person is able to experience sounds of every day life. Every hearing aid is selected and adapted to the individual's needs. Unfortunately it is true that not every person with a hearing loss receives the same benefit from a hearing aid because it depends on the cause, nature and degree of the hearing loss. The fitting of an appropriate hearing aid is essential to ensure an optimally aided performance. Assessment of the hearing aid fitting is critical, as it provides valuable information regarding the patient's ability to make use of auditory cues in speech, and therefore aids in the prediction of potential cochlear implant performance.
Current results in young infants and children with a hearing impairment have exceeded the expectations of professionals. Technology is continually improving in terms of better speech processing paradigms (Northern & Downs, 2002).

Hearing aid optimization is an essential part of the pre-operative assessment for cochlear implant patients. The patient's hearing aid fitting must be rigorously evaluated before an informed decision van be made as to whether a cochlear implant would be of more benefit compared to a standard hearing aid fitting. A cochlear implant is a useful procedure for those with severe and profound sensorineural hearing loss but a trial period with hearing aids must first be followed (Al-Shaikh, Zakzouk, Metwalli, Dasugi & Metwalli, 2002).

A device that has developed in the last 20 years to an aid of high standard and safety for even the pediatric population with a profound to severe sensorineural hearing loss is the cochlear implant (Arts, Garber & Zwolan, 2002; Gysin, Papsin, Daya & Nedzelski, 2000). A cochlear implant is an electronic device that, through the strategic placement of electrodes in the cochlea, provides direct stimulation of the

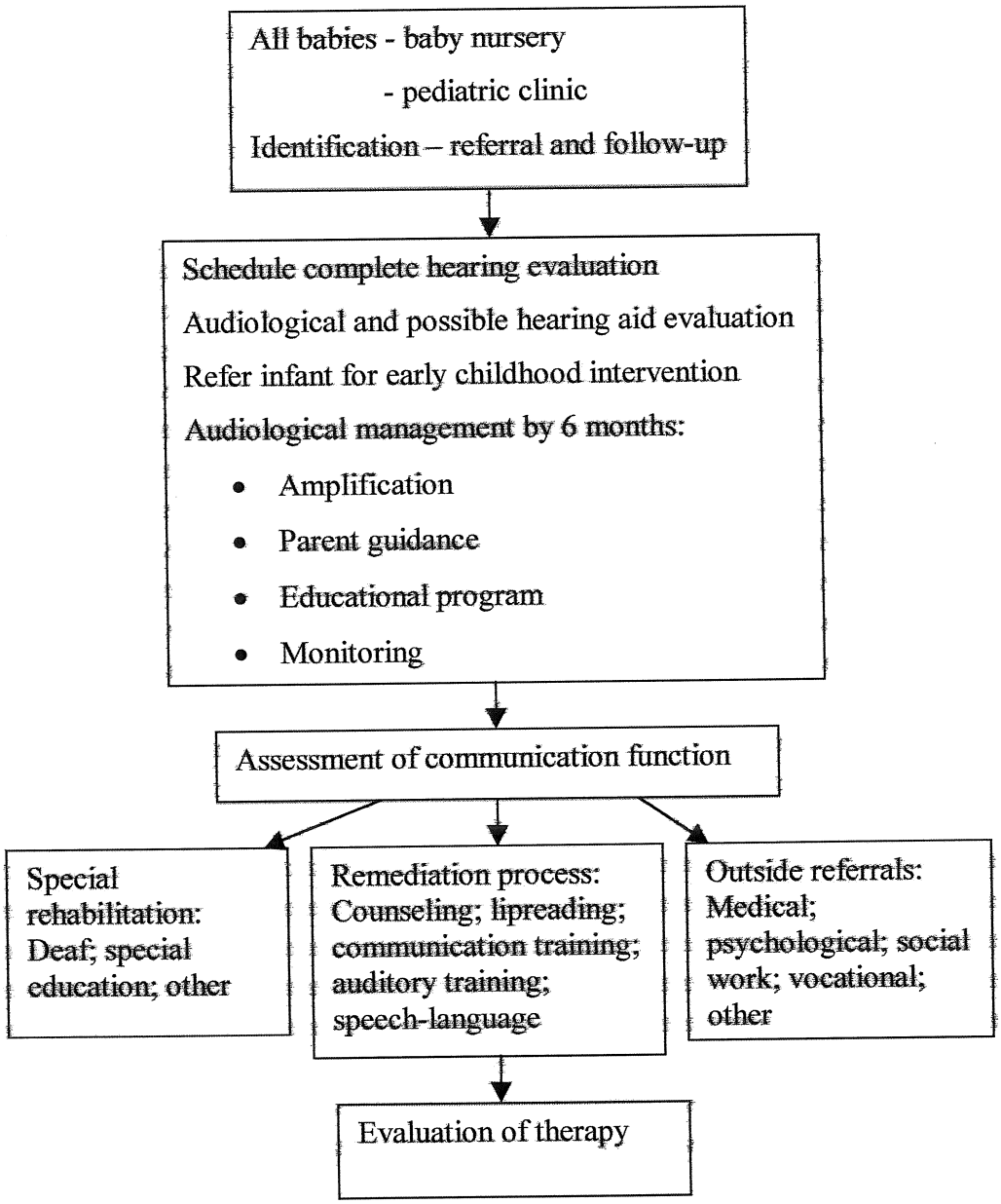
auditory nerve (Martin, 1997). It consists of a surgically implanted receiver and electrode array connected to an external transmitter coil, microphone and speech processor. A cochlear implant provides meaningful auditory information to the person that was implanted, which increases the functional perception of speech and communicative skills (Franz, 2002). Cochlear implants are now firmly established as effective options in the habilitation and rehabilitation of individuals with a severe and profound hearing impairment who do not benefit from traditional personal hearing aids when maximum stimulation of the auditory system is desired.

Children with cochlear implants show continuous improvement in their speech perception and use of oral language. The younger the child was when he/she received an implant, the greater the improvement and the better their oral language (Family Practice News, 2002). The importance of early referral to a cochlear implant clinic cannot be underestimated. An early referral allows time to plan the approach to be followed for intervention. An additional important task at the time of referral is to obtain and collate existing medical and audiological records of the child. The positive benefits of implantation for both pre- and postlingually profoundly deaf children are beyond doubt. Such benefits have been shown to include increased capacity for spoken language acquisition. The improved auditory information following implantation further improves the ability of the individual to learn, which has rendered mainstreaming a more attainable social and academic goal.

The goal of amplification (both hearing aids and cochlear implants) is to give infants and children maximum accessibility to sound and speech. The period since the confirmation of the hearing loss until the fitting of the amplification system must be minimal (Arehart, Yoshinaga-Itano, Thomson, Gabbart & Stredler Brown, 1998). Because early intervention is a prerequisite for successful speech- and language development, infants and children must be referred to an Intervention Programme, like the Cochlear Implant Team, for an assessment as soon as his/her hearing loss is diagnosed (Sirimanna, 2001; Nucleus Cochlear Implant, 2000). With professionals becoming more confident in implanting younger children and realizing the benefits of early implantation, especially for speech and language development, there is a growing demand for referring infants as early as possible to the implant programmes. Providing amplification is only the beginning of the process of habilitation.

Technology growth will continue to result in more possible options for children. Unfortunately, without appropriate audiological services and technological support, these children will not have the opportunity to access information and participate in learning, as well as they deserve. Without intervention children with a bilateral sensorineural hearing loss of approximately 50 dB may have an academic delay of as much as 3 years (Lewis, 2000). An interdisciplinary team approach is extremely important in the process of rehabilitation (Sirimanna, 2001). (Figure 2.4 provides a summary of the rehabilitation process from screening to intervention.)

Figure 2.4: Flow chart of the rehabilitative audiology process



Source: Hall (2000); Finitzo & Crumley (1999)

2.7 THE IMPORTANCE OF EARLY DIAGNOSIS AND REHABILITATION

The most crucial period for the development of phonology (speech) is during the first twelve months, while language development must be developed during the first three years of life. Hearing is a key component in the infant's development of speech, language and cognition, therefore early detection of an infant's hearing loss is critically important (Boothroyd, 1998).

The importance of early diagnosis of hearing loss is that the type and degree of the hearing impairment can be measured, hearing aids can be fitted and parents are put in touch with the correct and relevant professional personnel (Boothroyd, 1998). The primary objective of early diagnosis of hearing impairment in babies/children should be followed by intervention (Purdy, 2000). Intervention means a goal-orientated and time-limited process aimed at enabling the baby or child to reach an optimum functioning level. It can involve measures intended to compensate for a loss of function or a functional limitation or to prevent and/or reduce the impact of impairment on their development (Boothroyd, 1998).

The emotional and psychological development, as well a communication development of a baby/child is greatly dependent on normal hearing. A baby/child with a hearing loss foregoes all of this. His/her needs are similar to the baby/child with normal hearing, as is the need to make his/her needs known. The link between infant hearing loss and speech and language deficits is well established. The baby/child is excluded from normal everyday conversations and therefore has difficulty in understanding language, in expressing him-/herself, in forming words and in all the other areas of language (Boothroyd, 1998). These difficulties are due to the fact that a part of the ear or nervous system is not functioning and his/her brain is deprived of information provided by listening under normal conditions (Purdy, 2000). This has a profound impact on speech and language development, since the child is not able to hear adequately during the most critical period of brain growth and speech- and language development. These inabilities lead to frustration, emotional disturbances, school and learning problems as well as possible behavioural problems.

Appropriate pediatric care may help other professional members to identify and diagnose a hearing loss at an earlier age, thereby preventing some of the influences of a hearing impairment. The astounding effects of early diagnosis and intervention confirm this statement. Studies have shown that hearing-impaired children who are amplified and who receive educational support within first 6 months of their lifes have significantly greater potential for speech and language development than do children who receive intervention after six months (Rance & Briggs, 2002; Yoshinaga-Itano, 2001).

Once a child has been diagnosed by a pediatrician, audiologist or ear-nose and throat specialist as having a sensorineural hearing loss, immediate audiological and educational management should be instituted. Children with a newly identified sensorineural hearing loss should be assessed by an audiologist, preferably every 3 months during the first year, every 6 months during their preschool years and at least once a year while in school (Tomaski & Grundfast, 1999). Early audiological and educational treatment is crucial to children's later performance in the formal educational arena (Tomaski & Grundfast, 1999).

Pediatricians' ability to diagnose and treat hearing loss is related to suspicion, physical examination, evaluation of the audiogram, knowledge of hearing loss and common disorders and armamentarium of where and how to make a timely referral for further workup and expeditious treatment (Tomaski & Grundfast, 1999).

A useful eponym for pediatricians to approach children with a suspected hearing loss is as follows:

ALOUD:

A: Ask about family history.

L: Look for physical findings known to be present in some types of hearing loss.

O: Obtain appropriate assessments to include an audiogram, temporal bone CT scan and other studies that may be indicative of a hearing loss.

U: Use consultants to include otolaringologists and an audiologist experienced in dealing with hearing loss.

D: Determine an appropriate plan of action for children newly diagnosed with a hearing loss. (Tomaski & Grundfast, 1999, p.42).

The above-mentioned is relevant and well functioning in developed countries but unfortunately these standards are still not met in South Africa (a developing country). The reasons have been discussed in chapter one as well as chapter 2, paragraph 2.8.

Infants and children that have been identified with hearing problems through the use of these hearing tests must be referred as soon as possible (before 3 months of age) for a complete audiological evaluation (Joint Committee on Infant Hearing, 2000). The relationship between hearing, oral language development, cognitive development and psychosocial development defines the need for early diagnosis and intervention and teamwork (Purdy, 2000). The importance of early diagnosis and intervention cannot be overemphasized in order to make it a reality. During this evaluation the presence of a hearing loss is confirmed, as well as the nature, degree and possible cause of the hearing loss is discussed (Shonkoff & Meisels, 2000). The diagnosis of a hearing loss is only the beginning of a complex intervention process that varies on a continuum of medical intervention to speech and language intervention (Purdy, 2000; Katz, 2002).

In conclusion it can be said that the core of problems surrounding a hearing loss is not only the defective functioning of the hearing mechanisms, but it includes the whole person. This statement is confirmed by the words of Helen Keller: " *The problems of deafness are deeper and more complex, if not more important, than those of blindness. Deafness is a much worse misfortune. For it means the loss of the most vital stimulus – the sound of the voice that brings language, sets thoughts astir and keep us in the intellectual company of man*" (Whetnall, 1946).

2.8 THE IMPORTANCE OF TEAMWORK

Because of the complex nature of most abnormalities which requires high standards and different levels of specialization, the success of early hearing detection and intervention is dependant on the professional people who work together as a coordinated team (Sraka & Bricker, 1996; Guralnick, 1997). Team approaches during the intervention of infants/children with special needs are being emphasized throughout the literature, since it constitutes a critical component of the larger system of services and support for patients and their families, (Bailey, 1996; Ryan-Vincek,

Tuesday-Heathfield & Lamorey, 1995). The approach that is generally advocated in infants and children with hearing impairment is the interdisciplinary approach (Rossetti, 1996). This approach is described as the conscious attempt of different disciplines to exchange and combine information, skills and knowledge in order for a practical approach to the problems that exist with a hearing impairment (Bailey, 1996 and Rossetti, 1996). (See figure 2.5)

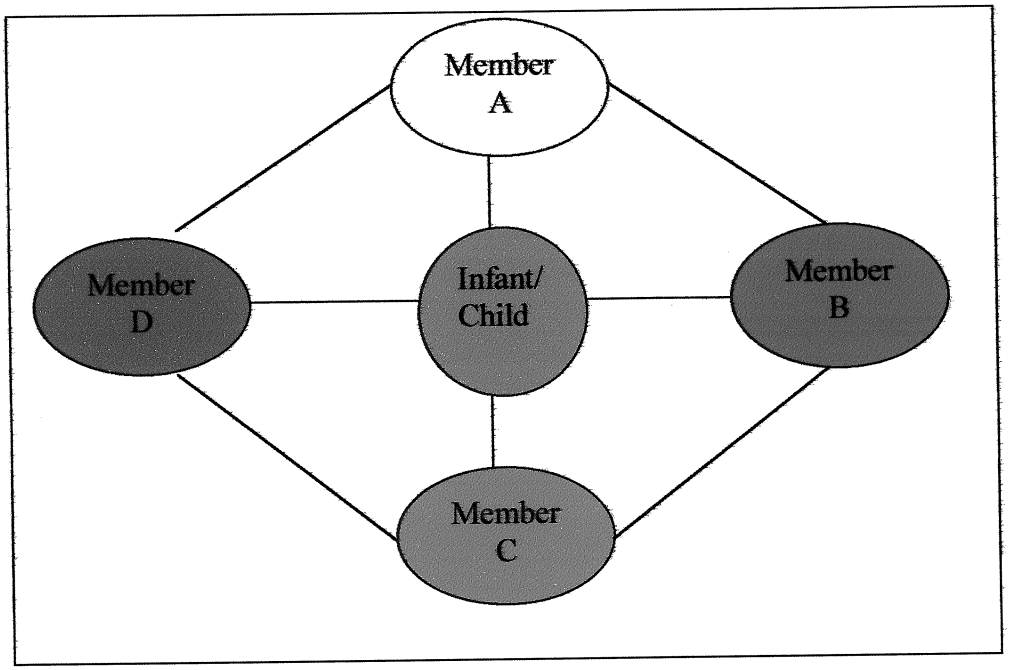
Members of the different professions work together in order to reach a joint goal and to share the responsibility regarding intervention and results (Halper, 1993). This is because the intervention for a patient with a sensorineural hearing loss, involves the combined efforts of audiology, medicine, education and speech-language pathology. No professional has all the knowledge and skills which is required for every patient's problem. The importance of gaining insights from many disciplines and exchanging one's knowledge with respect to a child's development is crucial for success in the health sector (Klein & Moses, 1994). Teamwork leads to a more effective intervention programme as well as a more positive attitude and greater participation amongst members (Krueger, 1990).

A need exists for expanded in-service educational opportunities. The explosion of information created a need for continuing education. Professionals from other disciplines need in-service education, both to establish a better understanding of hearing impairment and its implications and to enable them to assist with the identification of undetected hearing losses (White, 2002). Physicians are increasingly dependent upon one another for the highest quality care for their patients (White, 2002). With every discipline there are some tasks that cannot easily be modified. Yet many activities are not only amenable to broader participation but are greatly enhanced by the involvement of other professionals (Hall, 2002).

To develop an effective working relationship with other professionals, one must know what their roles are in relation to the services that one provides (Rossetti, 1996). Teamwork between the audiologist and the pediatrician is important not only for documenting and monitoring hearing losses, but also for determining the implications of hearing losses and the effects of various management strategies (De Conde, Benson & Seaton, 1997). In the above-mentioned paragraph the importance of coordinated

teamwork is emphasized. Therefore it is important to provide an overview on the audiologist and the pediatrician's expertise and the importance of coordinating their skills when an infant/child with a sensorineural hearing loss is involved.

Figure 2.5: The interdisciplinary model



Source: Rossetti (1996) & Roodt (1994)

2.8.1 The role of the pediatrician

Most pediatricians are the primary care practitioners who direct their services in keeping babies and children well (Finitzo & Crumley, 1999). This is done through illness prevention, early detection, treatment and provision of guidance and support to the parents (White, 2002). Pediatricians are especially concerned with any disturbances of the health or the orderly growth and development of babies and children (Finitzo & Crumley, 1999). Thus it is important for pediatricians to be sufficiently familiar with the normal patterns and milestones of babies and children in order to recognize deviation from the normal ranges that might prevent them from reaching their full potential.

The pediatrician is the front line and has an important role to fulfill in terms of the diagnosis, referral and treatment of infants/children with a hearing impairment.

(Tomaski & Grundfast, 1999). The pediatrician should review the infant's history for the presence of risk indicators that require monitoring for delayed onset and/or progressive hearing loss and should ensure periodic audiological evaluation for children at risk (Tomaski & Grundfast, 1999). The pediatrician's ability to communicate effectively to parents is particularly important in order for satisfactory care of babies and children in the first five years of their life. Pediatricians examine infants at month 1, 3, 6, 9, 18, and at 3 years of age in order to detect a hearing loss as early as possible (Yasuhara, 1996). Another reason for the frequent examinations is that 30% to 40% of children with confirmed hearing loss will demonstrate developmental delays or other disabilities (Family Practice News, 2000).

Pediatricians are asked to evaluate and treat an ever-increasing number of both routine and complex medical problems. It is important that the pediatrician be knowledgeable in a broad spectrum of routine medical problems, yet also recognize when the consultation of another specialist is required (Cherow et al, 1999). Through the necessary concerns, knowledge of the family history, a physical examination, evaluating the audiogram and efficient knowledge of the causes and nature of a hearing loss, the pediatrician can make a timely diagnosis and appropriate referrals (Tomaski & Grundfast, 1999). The assessment by the Cochlear Implant Team as part of early intervention for infants and children with a confirmed hearing loss usually occurs after a diagnostic assessment and the correct referral of professionals (Bagnato & Hofkosh, 1990 and Oski, DeAngelis, Feigin & Warshaw, 1990). Since pediatricians are usually in early contact with most infants and children with a high- or confirmed risk factor, they are also the first professionals to evaluate and treat this population. This puts the pediatrician in the ideal position to identify, counsel and make the necessary referrals of infants and children who may be considered candidates for amplification devices like hearing aids or cochlear implants (Wachtel & Compart, 1996).

Pediatricians must be familiar with many types of diseases that might be of concern regarding speech, language and auditory development. This serves as reference for the decision-making of whether the patient is going to be treated in the primary care environment and whether he/she should be referred (Cherow et al, 1999). Referrals to other medical specialists are important for additional help in the diagnosis and

treatment of a child with a hearing impairment. This avoids delay in detection of significant hearing impairment and the associated lack of essential skills in speech, language and social interaction (Tomaski & Grundfast, 1999). No child is too young for a hearing assessment.

2.8.2 Role of the audiologist

As experts in identification, evaluation, and auditory habilitation of infants who are hard- of-hearing and deaf, audiologists are involved in every component of the EHDI process (Knightly, 1994). For the hearing-screening component, audiologists provide program development, management, quality assessment, service coordination, and effective transition to evaluation, habilitative and intervention services (Knightly, 1994). For the follow up component, audiologists provide comprehensive audiological assessment to confirm the existence of the hearing loss, evaluate the infant for candidacy for amplification and other sensory devices and assistive technology, and ensure prompt referral to early intervention programs. Specialized audiologists also participate in the assessment of candidacy for cochlear implants (Family Practice News, 2000).

Audiologists specialize in the prevention, identification and non-medical management of hearing loss (Knightly, 1994). The goal of pediatric audiology is to lessen the impact of hearing loss on language acquisition and consequently on the social, emotional, educational and ultimately vocational status of the child (Knightly, 1994). This goal can only be achieved through early identification and prompt intervention. The audiologist possesses the skills and technology necessary to identify hearing loss and initiate management as early as the newborn status (Hall, 2002). Efficiency of the technology used by the audiologist is parallel to their skills and attitudes. Technology does not function in isolation, especially not in the healthcare system (Masterson, Wynne, Kuster, & Stierwalt, 1999). Table 2.3 provides an overview on the role of the audiologist.

Table 2.3: Functions of the audiologist

Function/role	Definition/description
• Identification	Planning, initiation, implementation, management and monitoring of any identification programmes for hearing problems.
• Assessment	All activities which are focused on the description (non-medical diagnosis) of people with a hearing loss as well as the decision-making regarding intervention. The goal: • To determine the presence, nature and degree of the impairment. • To describe the impairment. • To identify steps relevant to intervention. • To formulate a prognosis for progress. • To convey the implications of the impairment to the parents.
• Intervention	Activities that focus on the modification of the hearing impairment through the following strategies: • To provide hearing aids, cochlear implant as part of an aural rehabilitation programme. • To provide strategies for auditory stimulation for language acquisition. • To obtain compensation for irreversible hearing impairment. • Change the attitudes regarding hearing loss in order to improve

	hearing and communication. • To educate the parents to help them communicating effectively with their child.
• Counseling	Services being provided to the individual with the hearing loss and the family in order to decrease the problems that are associated with, or is the result of the hearing loss.
• Consultation	Activities that focus on service delivery to other professionals who are involved with the individual with a hearing impairment.
• Education	Planning, implementation and assessment of educational programs regarding aspects such as normal hearing and hearing disorders, professional roles in terms of knowledge, skills and attitudes.

(Hugo & Pottas, 1997; Knightly, 1994)

Referral to a skilled audiologist for an ongoing management of a child with a hearing loss is essential. By developing a positive relationship with pediatricians, the audiologist can best address the client's needs as well as to secure a stable referral base (White, 2002). Pediatricians, together with other professional personnel, play an important role in the linking of families to the relevant healthcare facilities (Cherow et al., 1999).

Early detection and intervention are best done through an interdisciplinary team approach (Tomaski & Grundfast, 1999). The audiologist can assist the pediatrician in making the diagnosis of a hearing loss. It is important to document whether the hearing loss is stable or progressive, and ongoing audiological follow-up is imperative. The pediatrician needs the diagnostic, treatment and support services provided by audiologists (White, 2002). It is important that the audiologist has a proactive role in seeking opportunities to inform pediatricians of the value and importance of hearing assessments (White, 2002).

2.8.3 The role of the parents or caretakers

The roles of the professionals have shifted to acquiring information from the parents about their needs, strengths, resources and intervention priorities (Kricos, 1993). By making parents partners in the effort to facilitate the child's development the parents are empowered to master the problem areas in their lives. The family-centered perspective, enables each unique family to capitalize on its strengths in meeting the challenge of raising a hearing-impaired child (Kricos, 1993).

Parental involvement during the habilitation process of their hearing-impaired children is crucial to the success with amplification. The child's needs are best met by meeting family needs. It is the parents, not the professionals, who must make the decisions regarding the child's habilitation because they must accept and take the ultimate responsibility (Northern & Downs, 2002).

Parents should be considered as expert informants about the child's communicative competence. Caregivers have opportunities to observe and interact with the child far more frequently and in a more familiar and emotionally secure situation than professionals (Watson, Crais & Layton, 2000).

The family plays a significant role in providing the context in which the hearing-impaired child will grow (Kricos, 1993). The hearing-impaired child's chances for successful communication, academic achievement and life satisfaction are enhanced when the parents can accept the child and are dedicated to maximizing his/her potential (Kricos, 1993).

With new technology at hand, a greater sensitivity and understanding of family systems, culture beliefs and diversification of children and their families, audiologists and pediatricians can make a critical difference in the lives of children with hearing loss (Boswell, 2001). Joint assertation of quality indicators among all EHDI stakeholders avoids future misunderstandings.

2.9 CONTRIBUTING FACTORS LEADING TO THE LATE DIAGNOSIS AND INTERVENTION OF HEARING LOSS IN SOUTH AFRICA

In the less developed countries, like South Africa, child development and health is dominated by problems of nutritional deficiency, infectious diseases, diversity and multi-cultural characteristics of the population (Kane-Berman, Henderson & De Souza, 2001; Morley, 1985). Culture includes the total of customs, beliefs, attitudes, values, goals, laws, tradition and moral codes of the people (Morley, 1985). This might include, for instance, the different group views on medical support, hearing loss, hearing aids and cochlear implants as well as their ignorance on technological progress. According to the Medical Research Council (MRC), between 75% and 80% of the South African population rather consult traditional healers than educated medical personnel (Kane-Berman, Henderson & De Souza, 2001). The high incidence of illiteracy, poverty and unemployment contribute to the fact that a great deal of the South African population is deprived of general necessities namely water, electricity, sanitation, housing and transport. All these aspects contribute to unsatisfactory attendance of health services (Kane-Berman, Henderson & De Souza, 2001).

Negative attitudes towards children with hearing loss and the reasons for the perception of such attitudes within a community can be divided into three categories:

- Socio-economic conditions: puts additional strain on the family, making the deaf family member an undesirable burden;
- Lack of understanding concerning the nature of disability; and
- Beliefs about the etiology of the disability (Stephens et al., 2000).

The above reasons have a tendency to lead to the concealment of the condition of the child. The overriding attitude toward these children is one of pity, sympathy and even negative attitudes (Stephens et al., 2000). Some parents will initially either ignore the impairment or take their children to traditional healers before accepting rehabilitative intervention from professionals. This would appear to stem in part from traditional attitudes and in part from the relatively high cost of hearing aids in the country relative to outcomes (Stephens et al., 2000).

Parents of infants/children diagnosed with hearing loss may experience such intense grief, losing the hopes, dreams and aspirations they had for their child (Kricos, 1993). This might result in the non-acceptance or denial of their child's condition. Hearing impairment is relatively easy to deny since it is invisible. Parents might deny the hearing impairment in a number of ways. One being that they might reject the diagnosis or they will start 'shopping' around (Kricos, 1993). This meaning that they will take their child to a number of different professionals and clinics in the hope of a more positive outcome. Many parents of infants and children with a hearing impairment have thus not sought professional help or followed advice given to them at the time being (Shimon, 1992). This leads to a time consuming process where important time goes by for the hearing impaired baby/child.

Another concern is the unavailability of health services. According to the director of labour relations, Department of Health, professor Rachel Gumbi, only one doctor is available for every 800 people in the city areas, and only one doctor for 26 000 people in the country (rural) areas (Kane-Berman et al., 2001). There appears to be a shortage of medical personnel in South Africa. A shortage of pediatricians, especially in the country (rural) areas exists. The realization of early diagnosis of infants and children in South Africa with hearing loss causes concern because of the fact that South Africa is a developing country with limited economical growth (Kane-Berman et al., 2001).

As discussed in chapter 1, hearing loss is a 'disguised' impairment (Joint Committee on Infant Hearing, 2000). A baby/child with hearing loss does not look any different and one cannot detect a hearing loss by looking into the patient's ear (Hampton, 1999). To identify a possible loss of hearing within 48 hours after birth is ideal. However, a lack of infrastructure at hospitals and clinics as well as a lack of knowledge has deprived many babies and children of the opportunity of being diagnosed early and of receiving adequate rehabilitation (Bhengu, 2002). It is important that professionals, who do not deal with hearing impairment on a daily basis keep well informed of the current changes and developments in the assessment and intervention of hearing impairment (Hall, 2000). The technology is evolving at a rapid pace and professionals must keep up to date with current developments. A deficiency in knowledge can lead to problems during the initial phases of referral to the relevant professional instance.

Tremendous technological advances regarding amplification in the hearing aid as well as cochlear implants have been made over the past decades. Technology regarding amplification such as cochlear implants is a new and highly specialized field. Improvements in technology lead to the rapid development and broadening of the selection criteria for candidates who qualify for cochlear implants as well as other forms of amplification (Lenarz, 1998). (See Table 2.4 and 2.5 for the changes in the selection criteria for infants and children for cochlear implants).

The most important intervention to help infants/children with hearing impairments is amplification – hearing aids. The ideal is to fit hearing aids on the pediatric patients as soon as hearing loss is confirmed. The process of selecting the correct amplification is a complex one though and several problems may arise, especially in a developing country like South Africa. The selection of children's hearing aids requires special consideration. The hearing aids must have maximum flexibility, so that significant ranges of adjustments and modifications can be made without the need to purchase new hearing aids as the child's needs change. Unfortunately, higher technology in hearing aids costs more, for example the costs of batteries, new ear molds that need to be made every six months while the child is growing. It also requires accurate individual threshold measurements and may depend on a remote control unit to operate the hearing aid. A child's hearing aid must also be durable and an insurance protection plan for extended warranty or loss or damage is required. Since poverty is a problem in South Africa, there are a lot of parents, clinics and hospitals that will not be able to endure the high costs.

The reason for the focus being on hearing aids, is because cochlear implants are very expensive and few parents will be able to carry the cost for the operation. It is therefore assumed that the majority of hearing-impaired children in South Africa will receive hearing aids prior to cochlear implants. Another reason being cochlear implantation can only be considered after the infant/child was fitted with appropriately fitted hearing aids and little or no benefit from this amplification system was indicated.

A major problem encountered in the initial stages of referral for cochlear implants is the amount of inaccurate information about implants in the community. This arises

from a number of different sources including groups who are apposed to implants in children, media information which is exaggerated or incomplete, opinions based on subjective information, or even professionals with little knowledge of this field (Stephens et al., 2000).

In terms of early identification, diagnosis, intervention and referral especially for cochlear implants, the following factors may be of importance:

- Rapid advance of medical technology,
- Involvement of other relevant professional areas (ie. Ear-Nose-and-Throat Specialist, Speech-Language Therapist, Audiologist, etc.).
- The devices that are currently used: In the UK once a referral is made, the patient falls under the care of the World of Cochlear Implants and the referring agent no longer needs to be concerned. These professionals do not have the opportunity to see the progress being made (Novy, 2003).

Table 2.4 refers to the history of the selection criteria for infants and children in order to receive a cochlear implant, while table 2.5 gives the current selection criteria.

Table 2.4: An overview of the selection criteria for candidates from 1985 – 2000 (Nucleus Coclear Implant System, 2000)

	Infants and children
1985	• The FDA (Food and Drug Association) does not recommend Cochlear Implants for infants/children.
1990	• The FDA approves implantation candidates that are 2 years and older in the following scenarios: ➢ Severe to profound bilateral sensorineural hearing loss. ➢ Little or no benefits received by a hearing aid. ➢ The candidate as well as the family must be motivated and must have realistic expectations.
1995	• The criteria of 1990 stay unchanged.
1998	• 18 Months or older. • 3-6 months hearing aid trial period. • Less than 20% on the MLNT or the LNT tests.
2000	• 12 months and older (FDA approval). • 3-6 months hearing aid trial period. • Lack of improvement of the auditory skills or less than 30% on the MLNT or the LNT tests.

Table 2.5: The current selection criteria according to the Cochlear Corporation (Nucleus Cochlear Implant System: General Selection Criteria; 2000)

Pediatrics and children candidacy population
❖ Bilateral, severe to profound sensorineural hearing loss. ❖ No minimal age for referral is necessary (Hall & Meuller; 1998). ❖ Receives no to little useful benefit from the appropriate hearing aids: • Younger than 5 years: does not develop the basic auditory skills e.g. localization. • Older than 5 years: 50% or less on the open set word recognition. • Amplified thresholds are outside the speech spectrum at 2kHz +. ❖ No medical contra-indications are apparent e.g. cochlear ossification, hearing loss because of a retro-cochlear or a central auditory scarring, chronic otitis media, absence of cochlear development. ❖ The family and the candidate must be motivated and need to show realistic expectations.

2.10 SUMMARY

The most important information in this chapter is that the hearing system is a complex one and that there are many aspects surrounding hearing loss to be taken into account, especially sensorineural hearing loss. These factors are interwoven with different professionals' field of expertise and therefore the early diagnosis and intervention of an infant/child with sensorineural hearing loss cannot be realised if professionals work in isolation.

A role description of both the audiologist and the pediatrician are provided. It is evident that both members contribute a great deal within an interactive team towards the effectiveness of early diagnosis and intervention. Cooperation between the mentioned team members lead to a positive attitude and working relationship. Buchholz and Roth (1987: 43) states: "*...in a work unit where shared responsibility is encouraged, you can also expect to find employees who show a sense of excitement, who express a feeling of camaraderie, and who feel they are a part of something bigger than what they themselves are responsible for singly*".

Technology is improving at such a fast and rapid rate that it is becoming increasingly difficult to keep up-to-date with current issues. It is thus important to determine how one can combine the skills, knowledge and attitudes of the above-mentioned professionals to the benefit of all hearing-impaired infants/children and their families.

A well-coordinated team leads to early identification and intervention. All practitioners are therefore required to update their knowledge and clinical skills to meet the challenge of universal neonatal hearing screening (Hall, 2000).

The earlier in life a baby or a child with a hearing impairment is identified and intervention is implemented the greater the chance they have to develop normally and be successful (Martin, 2000). Therefore, testing an infant's hearing immediately after birth is none too soon (Martin, 2000). Unfortunately, there is a delay between suspected hearing loss and diagnosis, which means the goal to intervene with all

infants before or by 6 months is not met. In this study an investigation will be made in order to determine the possible cause(s) of late diagnosis and intervention.

In viewing an infant/child with sensorineural hearing loss holistically, and taking into account the need for interdisciplinary teamwork of the literature, the importance of this study can be detected as well as the positive implications it holds for the long term.

3. METHODOLOGY

3.1 INTRODUCTION

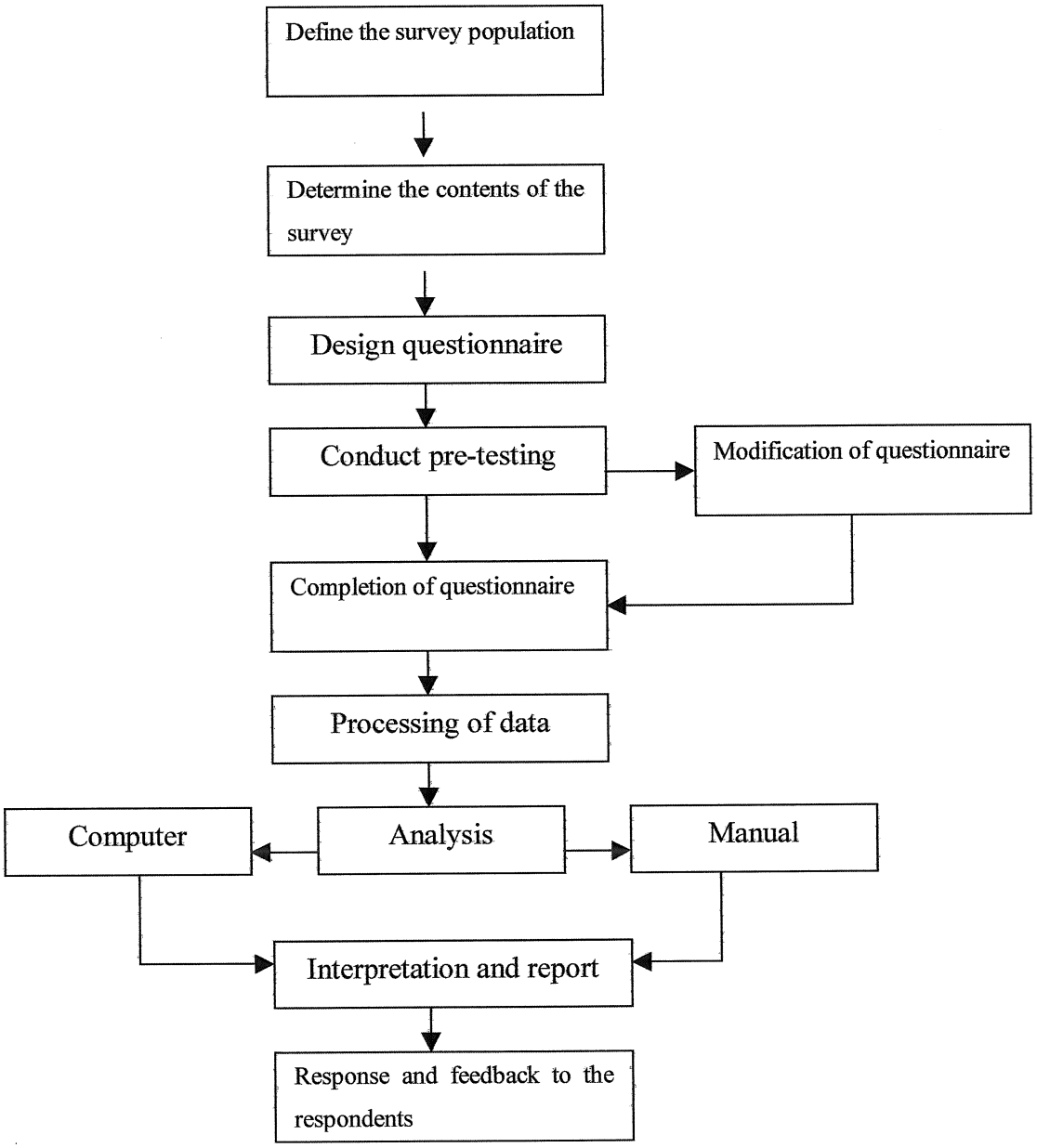
Early detection, screening and intervention of infants with hearing loss, is part of a highly specialized field with ongoing technological improvements. Pediatricians, who consult with infants on a daily basis, need the necessary skills to recognize the early signs of an infant or a child with a possible hearing loss. The maintenance of a positive attitude among team members, as well as teamwork is also crucial to ensure efficient referrals and intervention of infants with hearing loss.

In South Africa, a developing country, a high degree of multi-cultural and multi-lingual factors influence effective intervention of infants and children. There appears to be a lack of early diagnosis and referrals of infants and children with hearing loss as well as a lack of sufficient funds and manpower to meet the needs of all infants, children, families and medical personnel.

The research question and setting, which motivates this study, has been elaborated on in Chapters 1 and 2. In short, the need for pediatricians in South Africa is to continuously upgrade their knowledge with regards to the ongoing technology in screening and intervention of infants with a hearing loss. In a process of identifying the needs of the pediatricians, as well as giving answers to their questions concerning hearing impairment and early referrals of all infants and children with risk factors might prove useful in solving the problem of 'finding an infant or child too late' for the most effective intervention.

The aim of this chapter is to describe the methodological approach implemented in the conduction of the research component of this study (See figure 3.1).

Figure 3.1: A schematic representation of the survey process



Source: Swanepoel & Prinsloo (1998)

3.2 AIMS OF THE RESEARCH PROJECT

The aims of this study are:

3.2.1 Main aim:

The main aim of this study is to investigate Pediatricians' knowledge and attitudes regarding the diagnosis and intervention of infants and children with a sensorineural hearing loss.

3.2.2 Sub aims:

The following sub aims have been formulated in order to achieve the main aim:

1. Determining the biographical and educational background of the respondents.
2. Determining high-risk indicators that may cause sensorineural hearing loss amongst babies and children.
3. Determining the pediatricians' knowledge regarding the symptoms and characteristics infants and children with sensorineural hearing loss may display.
4. Determining the pediatricians' knowledge regarding early identification of a hearing loss;
5. Determining the management procedures (referral procedures), followed by pediatricians, of infants and children with sensorineural hearing loss;
6. Determining the knowledge and attitude regarding the intervention methods (amplification systems) available for infants and children with sensorineural hearing loss (this includes hearing aids, as well as cochlear implants);
7. Determining the attitudes of pediatricians regarding the role and efficiency of audiologists in terms of diagnosis and intervention of infants and children with sensorineural hearing loss;

8. Determining the needs of pediatricians for additional information regarding diagnosis and intervention of infants and children with hearing loss.

3.3 RESEARCH DESIGN

The research design includes a plan or structured framework of how the research process will be conducted in order to solve the research problem (Babbie & Mouton, 2001; Thyer, 1993). For this research project, a quantitative approach is followed. This approach is the "*numerical representation and manipulation of observations for the purpose of describing and explaining a phenomena that those observations reflect*" (Babbie & Mouton, 2001).

For the purpose of this study, an explorative, descriptive research design is used (Leedy & Ormrod, 2001). Such a research design provides quantitative information regarding the specific characteristics of the respondents and the specific programmes in which they are established (Kritzinger, 2000; Neuman, 1997). It is also an excellent method that is available for measuring the attitudes and orientations of a large population (Uys, 1995). According to de Vos (1998) the following requirements are important when using a quantitative-descriptive research design:

- A questionnaire as data collection method.
- Respondents are selected by means of randomized sampling methods.

The research design is also a guideline within which a choice about which data collection methods has to be made (de Vos, 1998). A survey is the most widely used data gathering technique. Survey research is especially appropriate for describing a large population; thus selecting a chosen group considering generalization of the results on the total population (Babbie & Mouton, 2001). It also produces quantitative information about the respondents believes, opinions, characteristics and behavior (Neuman, 1997).

This study has only one uniform source of data gathering, namely the questionnaire, since the researcher is interested in the extent to which the respondents hold a particular attitude or perspective (Babbie & Mouton, 2001).

3.4 RESPONDENTS

The pediatricians, who provide the data for analysis by responding to the survey questionnaire, are referred to as respondents (Babbie & Mouton, 2001). The selection criteria and procedure of relevance to the respondents that are used for this study as well as a thorough description of the respondents are subsequently explained.

3.4.1 Selection criteria

The following criteria were chosen for the selection of respondents in order to separate those who are eligible for the study from those who are not.

3.4.1.1 Qualifications

Firstly, only pediatricians registered with the *South African Medical Association* (SAMA) are used for this study. The tertiary instance where the pediatrician obtained his/her qualifications is not of importance. It is of importance though that the pediatrician, is currently practicing during the period of the research, whether in a clinic, a private practice or in a hospital. Pediatricians, who moved to another province, other than Gauteng, or currently practicing overseas, or retired, are not included in this study.

3.4.1.2 Geographical area

Secondly, all the participants who took part in this study, must currently be practicing in Gauteng province, since it is demographically more convenient for the researcher in terms of reaching the respondents. The geographical area is also limited to the Gauteng area in order to increase the return rate of the responses (Mulder, 1998). This is a practical criterion to conserve resources (Fink, 1995).

3.4.1.3 Language ability

Thirdly, all the respondents must be able to speak either Afrikaans or English, since the questionnaires are only composed in these two languages.

3.4.1.4 Willingness

Lastly, it is important that all the respondents are willing to cooperate in this study.

3.4.2 Selection procedures

Firstly, a research proposal was submitted to the University of Pretoria and the Ethics Committee in order to obtain permission for the research to be conducted (Appendix A).

In order to gather the needed information, a part (in this study, Gauteng Province) of the total amount of the pediatricians in South Africa will be used. Strydom and Venter (2002:199) defines sampling as *"a small portion of the total set of objects, events or persons"*, and provide the following rationale for the use of sampling: *" The observation or study of a phenomenon in its entirety would be tedious and time-consuming and would produce a massive amount of data, which by implication would be difficult to process, analyse and interpret."* Saranttakos (2000:139) is of the opinion that viability is the most important underlying rationale for sampling, and states: *"A complete coverage of the total population is seldom possible...even if it were theoretically possible to identify, contact and study the entire relevant population, time and cost considerations usually make this a prohibitive undertaking."*

- Sampling is a process of systematically selecting cases for the inclusion in a research project (Neuman, 1997). The sampling for this study as the crux of the larger population is limited to all pediatricians in Gauteng. The researcher decided to use all the names on the list provided by SAMA, since she is compelled to use only the volunteers as participants.

The above selection procedure and method of work are in line with Babbie and Mouton's (2001:169) requirements for a valid sampling method namely: "*To provide useful descriptions of the total population, a sample of individuals from a population must contain essentially the same variations that exist in the population*".

3.4.3 Description of the respondents

This section describes the respondents involved in the study in terms of the following groups:

- Original list of pediatricians selected for the sample
- Subjects not participating in the study
- Actual respondents

Originally all 257 subjects on the name list of SAMA were approached to participate in the study. In table 3.1 the possible reasons for not participating in the study are given.

	Immigrated, retired or practicing outside Gauteng	**Not interested**	**Personal and contact details incorrect**
Total of 257 subjects			
Approximate amount not used in the study	10	130	50

Table 3.1: Reasons for not participating

In the end only 47 pediatricians returned the questionnaire who all met the selection criteria as set out in 3.4. Taking into account that of the original 257 subjects only 200 could officially be used (50 subjects were non-existing on the list) the anticipated 30% return rate was almost achieved.

3.5 MATERIAL AND EQUIPMENT

Data was collected in the form of a composed questionnaire that will be used as research material (see appendix D). The questionnaire has been composed in such a manner that it serves as the point of departure in answering the main aim as well as the sub aims (Mouton 1996). The questionnaire serves as an instrument to obtain data, as well as a measurement instrument (Leedy & Ormrod, 2001). Each questionnaire was accompanied by a cover letter (see appendix B) and an instruction sheet (see Appendix C).

3.5.1 Cover letter

In the absence of personal contact and interaction with the respondents, the goal of the cover letter is to explain the research project, and thereby obtain the respondents' cooperation (Leedy, 1997). The cover letter describes the value and the potential of the study, and this serves as encouragement for respondents to participate in the study and to complete the questionnaire.

3.5.2 Instruction sheet

This page follows with the necessary guidelines for the completion of the questionnaire. The guidelines include the way in which the questionnaire must be completed as well as the time allocated for the questionnaire's completion. The instruction sheet also contains the terms and definitions of relevance in the questionnaire. By using the instruction sheet any vagueness will be clarified. This is a way of increasing the validity and reliability of the study.

3.5.3 The questionnaire

3.5.3.1 Motivation for the use of the questionnaire as data collection instrument

A questionnaire as data collection instrument is used in this study because of all the benefits it holds (Neuman, 1997). The questionnaire serves as a tool to achieve the aims of the study.

A questionnaire allows great volumes of data to be collected from different sources, simultaneously, and within a specific time frame (Bailey, 1994). Hence, a questionnaire is timesaving and relatively cheaper than other forms of data collection (Neuman, 1997). By assuring the anonymity of the respondents, they are encouraged to express the feelings and opinions freely and honestly (Sellitz, 1971). Accordingly the researcher can obtain reliable and a representative reflection of the total population (Strydom & Venter, 2002.).

It must be taken into account that there are specific limitations and disadvantages associated with a questionnaire. The following disadvantages are applicable to this study:

(i) a relatively low response rate (de Vos, 1998);
(ii) representative address lists are difficult to obtain and are sometimes outdated (Fowler, 1993);
(iii) little, if any, control over the circumstances under which the questionnaire is being completed (Neuman, 1997).

Regardless of the abovementioned disadvantages associated with a questionnaire, it was still decided that the questionnaire was the most appropriate data collections instrument for this specific study. The underlying reason for this decision is that the questionnaire is still the instrument that is the most used in social-scientific research (Alreck & Settle, 1985).

3.5.3.2 Design of the questionnaire

The questionnaire is designed for obtaining data from the respondent's population. "*This instrument may have two parts: an 'attitude' section, in which participants are invited to respond to a series of opinion statements; and a 'coding' section, in which they are asked to provide a minimum of organisational and demographic information*" (Hofmeyer and Maitland, 1984:39).

The questionnaire is then presented to a representative group of pediatricians in order to:

- Determine whether the coding section is accurate;
- Determine whether the instructions regarding completion of the questionnaire have been understood;
- Determine whether the individual questions are unambiguous; and
- Evaluate the appropriateness of the response scales (Swanepoel & Prinsloo, 1998).

The questionnaire is an instrument with open and/ closed questions or statements to which a respondent must react (de Vos, 1998). During the design of the questionnaire it is important to use only questions relevant to the research aims (Fink, 1995). The content of the questionnaire will be structured according to the sub aims. Furthermore, the importance of deciding on the specific question type for this study is crucial (Neuman, 1997). It must be taken into account that the respondents have limited time and a busy schedule, therefore emphasis is placed on closed questions. Therefore, questions can be answered in a quick yet accurate manner (Leedy & Ormrod, 2001). To ensure that the questionnaire is complete and comprehensive, the researcher made use of multiple categories (de Vos, 1998).

The questions in the questionnaire consist of the following:
Open-ended questions: write any answer in open space. It is also useful to provide an open-ended question section, where the respondents are invited to make general comments. Valuable information can be obtained from response to this section.

- Closed-set questions: offer opportunity to select (according to instructions) one or more response choices from a number provided.
- Multi-choice questions: this type of question is utilized to obtain information that can logically be divided into categories.
- Statements: used to obtain data of a subjective nature e.g. about dispositions, attitudes and opinions (agree/disagree) (de Vos, 1998).

3.5.3.3 Content of the questionnaire

The content of the questionnaire was compiled through similar studies done by Lemmer (2002), Mulder (1998) and Moolman (1997). These studies served as basis for the formulation of the questions, and adaptations were made for the current research. The questionnaire consists of 18 questions that are divided into seven categories namely:

(i) **Biographical information:**

These questions include information with regard to the respondent's academic background. This includes university of graduation and years of specializing as a pediatrician.

Also included in this section is the previous information and knowledge the respondents received on the specific topic, surrounding sensorineural hearing loss. The reason that this was included is that pediatricians should be aware of the current technologies available for assessment and intervention, services available for these infants and children, the fast and efficient manner of referral to relevant professionals and aspects surrounding hearing loss (causes, symptoms etc.). Without sufficient knowledge, pediatricians may not be able to act early enough or as an effective team member. By obtaining information regarding the respondents' background and knowledge on sensorineural hearing loss, the researcher is able to make the necessary correlation and comparisons between the other questions.

(ii) Risk factors which may cause, or lead to sensorineural hearing loss:

Hearing loss is a 'silent, hidden' handicap because it cannot be seen. Unfortunately, routine medical care seldom includes a proper evaluation that can identify infants and children with a possible hearing loss (Northern and Downs, 2002). The ear and hearing mechanism is extremely complex, and hearing loss can be associated with problems in each part of the ear. The ear is also interwoven with the rest of the body and can be influenced or destroyed by a variety of causes. Therefore knowing about disorders or factors that might lead to a possible hearing loss leads to a better understanding of hearing loss.

(iii) Characteristics of infants and children with a hearing loss:

Hearing loss which is undetected in infants and young children leads to delays in their optimal development. There is a great variation within this population (babies and children with a hearing loss) depending on the age of onset of the hearing loss. The age of onset and the causes of the hearing loss will help to determine the possible influence the sensory impairment will have on the individual. It is important to take the following factors into account when a hearing loss is suspected and to be aware of all the possible symptoms namely:

- Atypical general development
- Decrease in babbling patterns
- Decrease in social interactions
- Inconsistent/ or no reaction to sound

(iv) Determination of the respondents' knowledge regarding the early identification of hearing loss:

Technological advances in instrumentation and test protocols have recently been made, yet in many communities hearing screening programmes have not been established or communities are unaware of such programmes (Blake and Hall, 1990). This causes unnecessary time lags between the identification of the hearing loss and intervention. Within every discipline there are tasks that cannot be easily modified. Therefore teamwork and further education, regarding a better understanding of hearing impairment and its implications

are crucial. This will assist professionals with the correct identification methods of undetected hearing loss and to make the necessary appropriate referral options.

(v) **Determining the knowledge of the respondents concerning the possible intervention methods namely amplification systems (hearing aids and cochlear implants) and intervention procedures:**

The most important type of intervention is fitting an infant or a child with amplification (Northern and Downs, 2002). Amplification technology is rapidly developing, and pediatric evaluation and hearing aid fitting includes the coordinated effort of many people, including the pediatrician.

(vi) **Determining the knowledge of the respondents with regard to the referral procedures followed in terms of evaluation and intervention:**

See point (iv).

(vii) **Determining the impression of the pediatricians regarding the role of the audiologist during hearing evaluation and intervention:**

The traditional role of the audiologist, which included hearing measurements and amplification, significantly broadened to a participatory role in the early intervention process. In order to plan an early intervention, a sharing of professional roles and responsibilities are required. The audiologist has always been the professional person involved with the rehabilitation of a person with hearing loss.

(viii) **By analyzing all the information a needs analysis is determined (including diagnosis, intervention and facilities available).**

The content of the questionnaire depends on the specific information needs of the study. According to Hofmeyr and Maitland (1984:38), "*it is possible to survey attitudes both towards the organisation as a whole and towards specific policies and practices. Further, one can conduct a general inquiry into particular subject areas.*"

It is important to carry out a fairly comprehensive survey in terms of areas covered. The reason for this is that many areas may have an impact on the quality of service delivery during early diagnosis and intervention (Swanepoel & Prinsloo, 1998).

It is essential, when embarking on a comprehensive study, to determine the areas of interest and concern, that is the content of the study (Swanepoel & Prinsloo, 1998). On the basis of this information, it is possible to formulate unique items which specifically address the issues and problems that pediatricians may experience relevant to early diagnosis and intervention (Swanepoel & Prinsloo, 1998).

3.5.3.4 Completion of the questionnaire

On completion of the questionnaire the respondents are informed of the survey that is going to be conducted (Swanepoel & Prinsloo, 1998). Telephone calls are made before sending the questionnaire. This communication is essential to promote respondent confidence in the research.

To gain further confidence and cooperation of the respondents, it is also important to guarantee the anonymity of those being surveyed. This is done by clearly stating in the cover letter or on the questionnaire, that the respondent will remain anonymous (Swanepoel & Prinsloo, 1998).

Questionnaires are faxed or posted to the practice of the respondent, with a week's time for the completion of the questionnaire. A follow-up call is made after the week. Adopting this procedure ensures a large percentage of returns. It is important however, to make the completion of questionnaires voluntary, and this should also be communicated to respondents in advance (Swanepoel & Prinsloo, 1998).

3.6 DATA COLLECTION PROCEDURES

The study consists of a preliminary study as well as the main study.

3.6.1 Preliminary study

The preliminary study was carried out to ensure that the questions are clear, precise and free from bias (Leedy, 1997). The questionnaire in its semi-final form is to be thoroughly tested before utilizing the main investigation. This gives the researcher the opportunity to identify any problems in the questionnaire. Any errors can be changed and modified immediately (de Vos, 1998). The accuracy and applicability of the instrument is therefore tested. The time and effort taken to complete the questionnaire is determined by the preliminary study and in order to determine the reliability and validity of the questionnaire as a collection instrument, the preliminary study is necessary.

A few respondents similar to those in the final survey were chosen to participate in the preliminary study (de Vos, 1998). Two subjects were chosen who met the selection criteria except for the fact of:

- retirement;
- practicing outside the Gauteng Province.

These respondents are contacted telephonically to request their participation in the study. A letter together with the questionnaire stating the purpose of the study is faxed to them. After feedback, changes, if necessary, are made to the questionnaire.

Following the results on the preliminary questionnaires it was concluded that the format of the questions as well as the content was clear. The completion time of the questionnaire was approximately 15 minutes. Regarding these outcomes, it was decided that the data collection procedure for the actual research sample could proceed.

The data collection and data procedures of the main study are discussed next.

3.6.2 Data collection procedures

The goal of scientific research is to produce knowledge that truly reflects the social world (de Vos, 1998). According to Kerlinger (1986) data collection is the categorizing, ordering, manipulating and summarizing of data to obtain answers to research questions. The goal is to reduce data to intelligible and interpretable form so that the relations of research questions can be studied, tested and conclusions drawn.

This phase includes a series of decisions that is associated with the process of data collection; including, the definition of the population, the selection of the test sample procedure and the method of the data collection (Cloete, 1997:39). For the reliability and validity of the study it is necessary to identify the parameters that were used for the data collection namely the research context (where the research took place), the researcher, the respondents (the people who were questioned or observed) and the process (Cloete, 1997).

The following procedures were followed during the data collection of the respondents:

- A list of addresses of all the practicing and registered pediatricians in the Gauteng Province was obtained through the South African Medical Association (SAMA).
- An initial telephone call was made in order to explain the purpose and nature of the study and to determine the willingness of the respondent to participate in the study.
- A cover letter and a questionnaire was faxed or posted to all the respondents.
- A call was made a week after the questionnaires had been faxed or posted to increase the return rate.

3.6.3 Data analysis procedure

During data analysis the questionnaire is divided into different sections in order to facilitate the eventual processing of data (de Vos, 1998). It entails data being divided into constituent parts to obtain answers to research questions. "*The interpreting of data: to interpret is to explain, is to find meaning*" (de Vos, 1998). The data analysis is an attempt to find correlations (if any) between the newly processed data. These patterns include specific forms in order to organize data (Simmonds en McCall, 1985).

The data retrieved from the questionnaires is processed with a 'Microsoft Word 2000 Excel software'-program in order to organize the data. The Statistical Analysis System (SAS) is used to process the data.

"*Statistics may also be regarded as a method of dealing with data. This definition stresses the view that statistics is a tool concerned with the collection, organisation, and analysis of numerical facts or observations...the major concern of descriptive studies is to present information in a convenient, usable and understandable form.*" (Runyon & Haber, 1980, p.6)

Data analysis is performed to interpret the data obtained. The following medians are used in order to describe the emerging patterns found:

- Frequency distributions are used in order to find a definitive pattern among the facts obtained from the questionnaires.
- Graphic presentation / figures are pictorial devices to illustrate data.

The procedures are visually effective and easy to interpret. Graphic presentation is often of great help in enabling a researcher to comprehend the essential features of frequency distributions and in comparing one frequency distribution with another.

3.6.4 Feedback to respondents

The overriding purpose of this study is to improve performance and output in the form of increased knowledge and a positive attitude.

Hofmeyr and Maitland (1984:40) are of the opinion that: "*The effectiveness of a survey exercise is as much a function of the way in which these areas of agreement and disagreement are handled and communicated, however, as it is of the changes and improvements that are usually made.*"

Feedback should be done as soon as possible after the processing and interpretation of results. The feedback to the respondents will be done in a summarized article (and if possible in a pediatric magazine) with the results obtained during the study. It will also elaborate on the questions asked in the questionnaire and the importance thereof.

3.6.5 Ethical issues

As researcher, it is important to keep the personal information of participating respondents confidential (Fink, 1995). Since personal information of the respondents may appear on the questionnaires, it is important to give the necessary reassurance to the participating pediatricians, that all information will be handled with confidentiality.

During statistical processing of the results, all the questionnaires will be documented with a number and all personal information irrelevant to the study will be detached. This will ensure that no personal information will be displayed.

3.7 SUMMARY

Methodology can be described as the methods, techniques and procedures that are employed in the process of implementing the research design as well as the underlying principles and assumptions constituting their use.

According to Mouton (1996) the research process from a quantitative perspective is as follows:

1. Statement of the problem
2. Conceptualization
3. Operationalization
4. Selection of cases
5. Analysis
6. Interpreting the findings
7. Writing the research report

The above-mentioned process was used as an outline to accomplish the aim of the study. The procedures used to carry out the research were explained in order to ensure the accountability of the study.

"*A wide variety of methods and techniques are used during empirical research. The methods used and their application are depending on the aims and objectives of the study, the nature of the phenomenon being investigated and the underlying theory or expectations of the researcher. This will influence the methods, technique of sampling, data collection methods to the data analysis method.*" (Babbie and Mouton, 2001).

CHAPTER 4

DESCRIPTION AND DISCUSSION OF THE RESULTS

4.1 INTRODUCTION

In the first chapters of this study the literature relevant to the research question are described. The literature relevant to the research question is the source from where the researcher can collect and process information in order to identify a pattern in the data.

In this chapter the results of the study are presented, discussed and interpreted in relation to the relevant literature. The results of this study are discussed according to the formulated sub-aims (as stipulated in chapter 3) in order to address the main aim of this study namely: **The knowledge and attitude of pediatricians regarding the diagnosis and intervention process of infants and children with a sensorineural hearing loss.**

The results are presented through graphs, followed by a discussion and interpretation in order to draw conclusions, in accordance to the formulated sub-aims.

4.2 DESCRIPTION AND DISCUSSION OF THE BIOGRAPHICAL AND EDUCATIONAL BACKGROUND

The sub-aim formulated in 3.2.2.1 was to determine the respondents' years of experience as practicing pediatrician, their current instance of practice as well as previous education received regarding infants and children with a sensorineural hearing loss.

The results are presented respectively in Figure 4.1, Figure 4.2 and Figure 4.3.

Figure 4.1 is a visual display of respondents' years of experience as a practicing pediatrician

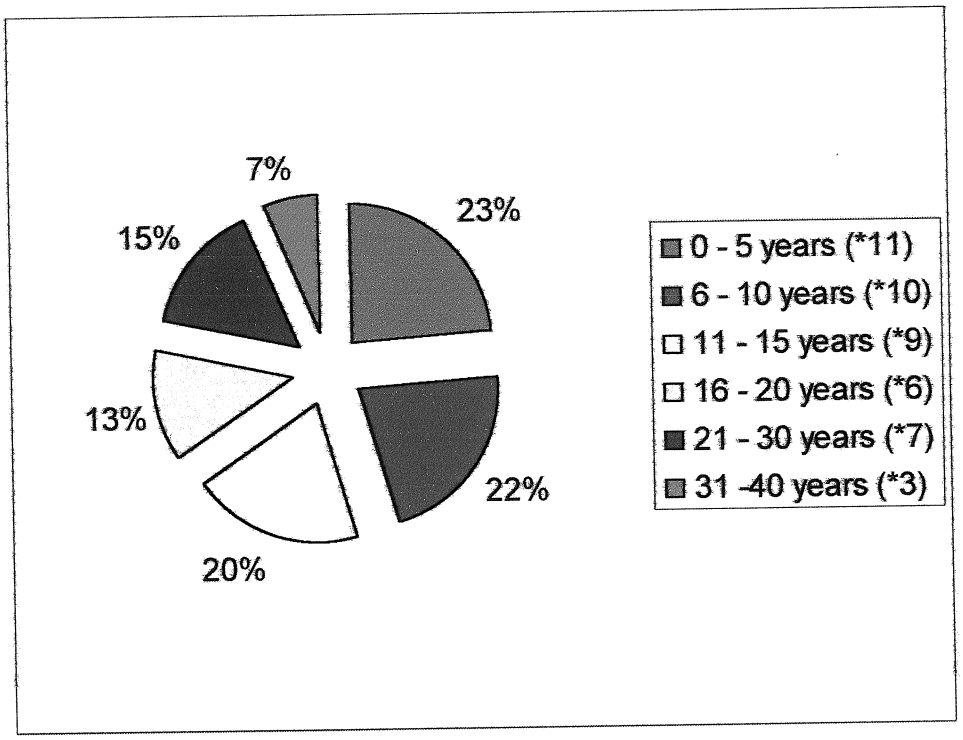


Figure 4.1: Years of experience as a practicing pediatrician

(* the amount of participating respondents in that specific year group)

From the above figure it is shown that there is a proportional spreading amongst the participants in terms of their years as practicing pediatricians. Respondents that have been practicing as pediatricians: 0 to 5 years (23%), 6 to 10 years (22%), 11 to 15 years (20%), 16 to 20 years (13%), 21 to 30 years (15%) and 31 to 40 years (7%) The random sample can therefore be seen as representative of the sample group (Leedy & Ormrod, 2001).

The majority of the respondents fall in the group of between nil to five years of experience field (23%). The researcher experiences their participation in the study positively, as they are eager to learn more about the topic of sensorineural hearing loss. The rest of the participating respondents are experienced pediatricians that have six or more years of experience in the clinical practice. Their participation in this study is just as important, since continuous education in the fast growing field of audiology is of utmost importance. In the researcher's opinion the study conducted is

of value to all pediatricians. The field of audiology has expanded at a rapid pace regarding the identification and intervention of pediatric hearing losses. Therefore the syllabus is changing continuously in order to keep up to date with the latest development in pediatric audiology. It is important for all pediatricians, those who have just started practicing as well as those who started a long time ago, to be on an equal level regarding their skills and knowledge.

Technology is evolving at a rapid pace and it is therefore important to gain knowledge in order to keep up to date with these developments. Infants/children with hearing loss as well as their families are dependent on pediatricians for expert consultation (Boswell & Cherow, 1999). Information is the key to developing a shared commitment for early hearing detection and intervention programmes (Finitzo & Crumley, 1999).

Research in early detection of hearing loss and intervention before the age of six months of age has proved the importance of knowledge by all professionals involved (Yoshinaga-Itano, 2001).

The goal of continuous education, regardless of experience, is to transfer and gain technical knowledge, related skills, values and attitudes in order to develop proficiency and abilities to improve capabilities as a medical member (Masterson et al., 1999).

Figure 4.2 illustrates the respondents' current position of practice

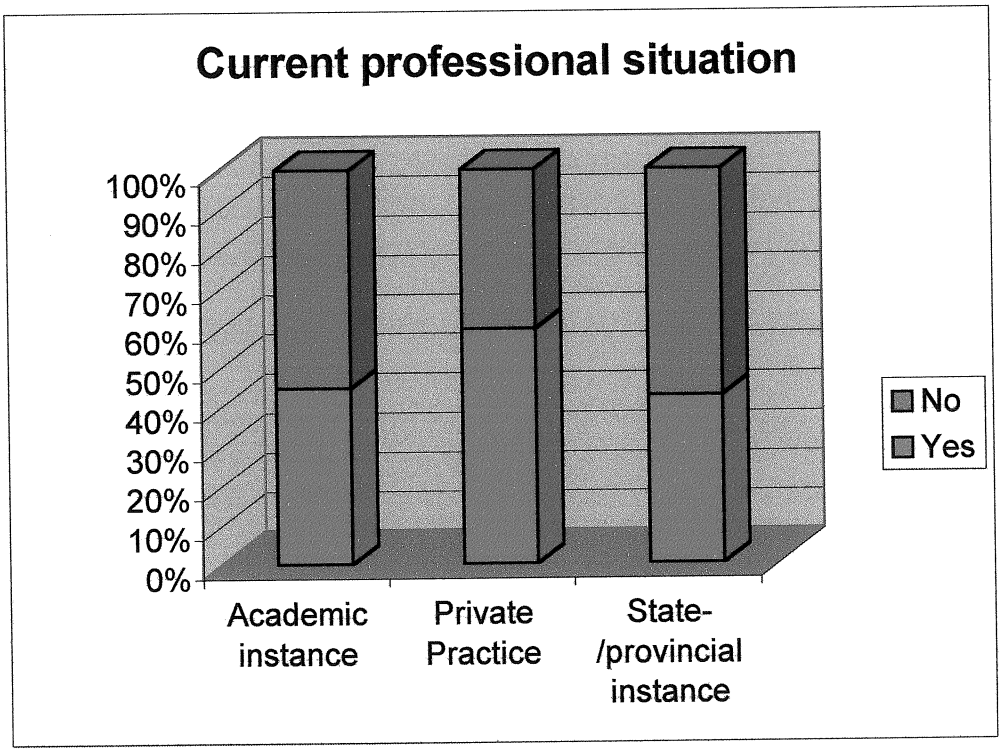


Figure 4.2: Current position of situation

As seen in Figure 4.2 the majority of the respondents are currently occupied in a private practice (53%), while 38% are in an academic situation and the minority (34%) of the respondents are practicing in a state- or provincial instance. This information is important to obtain, since all pediatricians, regardless of instance of practice, needs sufficient knowledge regarding infants and children with sensorineural hearing loss.

In order to treat the infant/child with hearing loss optimally, an interdisciplinary team approach must be followed (Rossetti, 1996). Since late diagnosis of infants/children with hearing loss is still preventing timely intervention the following conclusion can be made regarding pediatrician's situation of practice. When working in a private practice the pediatrician is usually working alone or in conjunction with other pediatricians. They have a busy schedule and this might lead to isolation from other medical practitioners or programmes. It can therefore easily happen that important current development and research surrounding hearing loss goes undetected. This statement is made accordingly to studies done that some pediatricians are unfamiliar with the rationale for hearing screening for newborns prior to hospital discharge

(Finitzo & Crumley, 1999). This reflects a poor state of awareness regarding hearing care.

In the academic instance it is easier to keep up-to-date with current trends and research done on the identification and intervention methods for a sensorineural hearing loss. The same goes for a state- or provincial instance where pediatricians' are surrounded by other members of the medical team.

Since professionals concerned with infants and children with sensorineural hearing loss might not always have had the necessary specialized training, it is important to keep abreast of the latest development and in-service training. It is not only the academic hospital with its interdisciplinary team approach that has a contribution to make to secondary prevention and therefore the optimum development of the hearing impaired infant/child, but also the pediatrician in the private practice, who is often the first link between the hearing-impaired infant/child and the appropriate medical service.

By secondary and tertiary prevention is meant the mitigating or eliminating of an incapability/disability as a result of a deficiency, and preventing incapability from becoming an impairment (Rossetti, 1996).

In Figure 4.3 the education received by the respondents during their studies regarding intervention of infants and children with sensorineural hearing loss is illustrated.

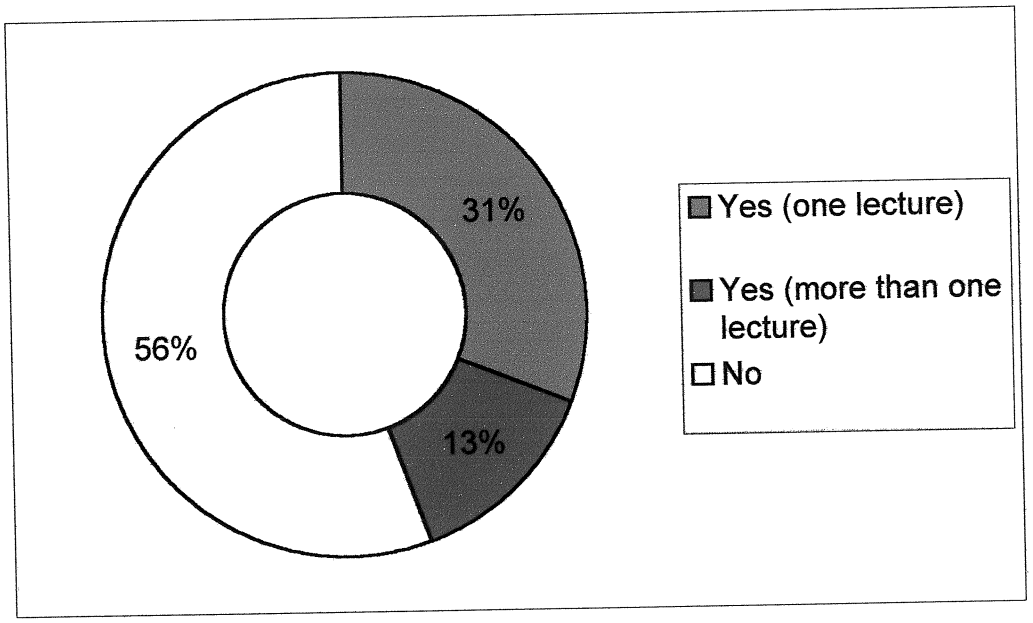


Figure 4.3: Received education

According to Figure 4.3 the majority of respondents (56%) received no formal lectures on the intervention of infants and children with sensorineural hearing loss during their time of studies. 31% of the respondents received only one lecture, while only 13% received more than one lecture on the topic surrounding intervention of sensorineural hearing loss.

The researcher came to the conclusion that the respondents' education surrounding the intervention of sensorineural hearing loss was insufficient, and that current training programmes are also lacking with regard to the early observation. Therefore detection and handling of hearing impairment as well as the referral thereof might also be lacking.

In order for the respondents to treat their patients holistically and to the best of their abilities it is of utmost importance that they obtained sufficient knowledge of the diagnosis and intervention of sensorineural hearing loss. Therefore continuous education cannot be overemphasized. Only when sufficient knowledge is obtained, and an interdisciplinary team approach is followed, can patients receive the best intervention possible (Rossetti, 1996).

It was important to determine the biographical and educational background of the respondents in order to evaluate the existing services and to formulate an overall policy for the care of hearing-impaired infants and children and to devise appropriate strategies.

4.3 DISCUSSION OF THE RESPONDENT'S KNOWLEDGE OF RISK FACTORS

Results regarding the respondents' knowledge on the risk factors that can lead to sensorineural hearing loss are given in Figure 4.4. The respondents were to indicate if the following risk factors might lead to sensorineural hearing loss by marking "Yes", "No" or "Never".

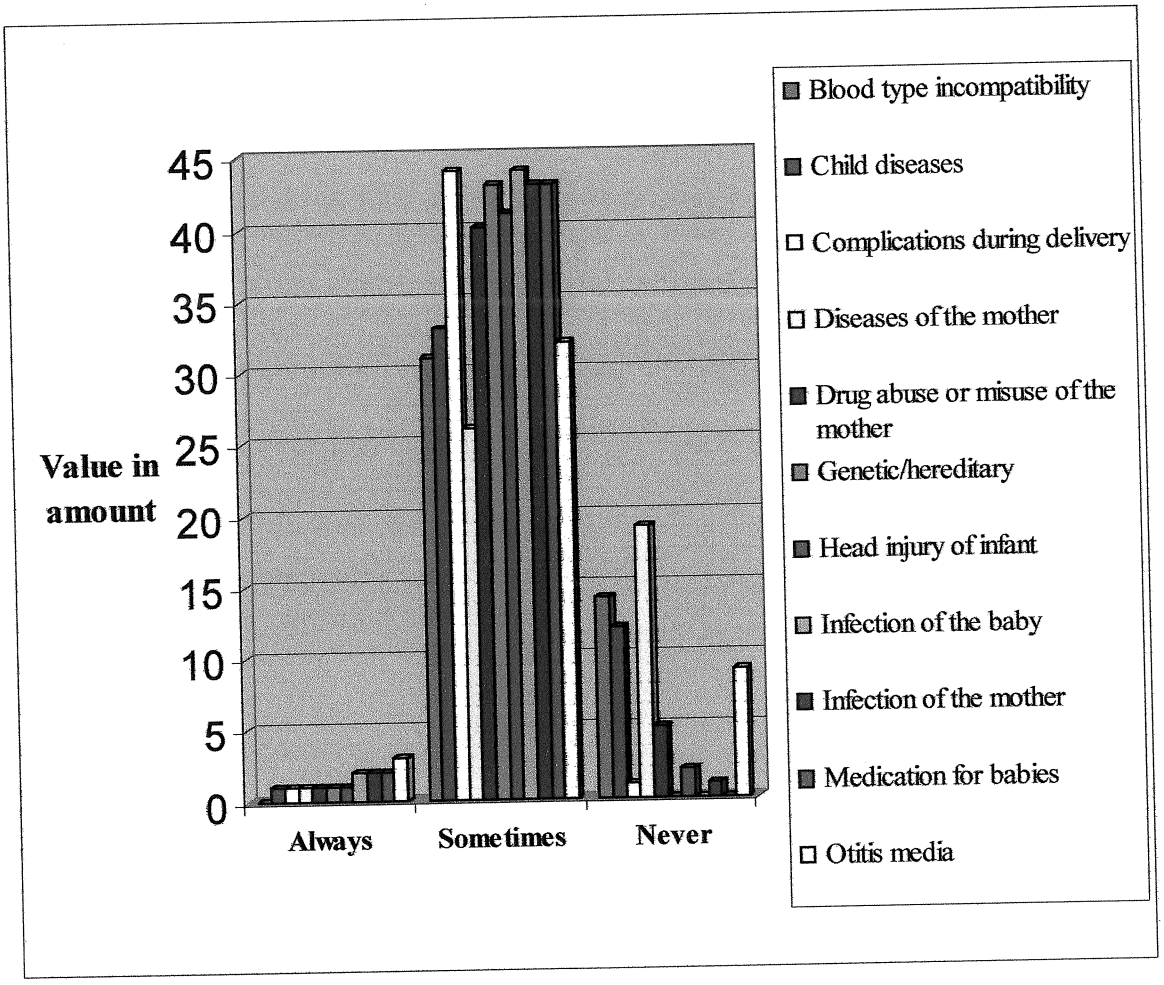


Figure 4.4: Knowledge of risk factors

About 1/600 neonates suffer from a congenital hearing loss, and many more acquire a hearing loss owing to conditions encountered during the neonatal period or during the course of the neonate's life (Hall & Meuller, 1998). There are a few known, as well as few less known causes of hearing loss. The cause of the hearing loss is thus an important guideline during the consideration of diagnosis and intervention criteria's.

In the visual presentation of Figure 4.4 it is clear that there is a strong tendency to the answer '*sometimes*'. The possible reason being that all above-mentioned factors might lead to a sensorineural hearing loss, depending on the severity, nature and possible combinations of risk factors present (Discussed in more detail in Chapter 2).

The other reason to be considered is uncertainty reflected by the respondent. It is the researchers opinion that the cause is that 56% of the respondents (in Figure 4.3) did not receive any formal education on aspects relevant to sensorineural hearing loss.

It is also seen from the results, where lesser-known risk factors are said not to cause a sensorineural hearing loss at all. This include the following:

In Figure 4.4 it can be seen that 14/47 respondents said that the blood type incompatibility between the mother and child could never lead to sensorineural hearing loss. In the case of childhood diseases 12/47 respondents said that diseases of the child, for example mumps, measles etc., cannot lead to a sensorineural hearing loss, while 28/47 respondents said that diseases of the mother cannot cause a hearing loss. 9/47 respondents did not see otitis media as a risk factor. The typical pediatrician viewed the presence of otitis media as a medical problem and not as resulting in a hearing loss (White, 2002).

It is important to note this fact, since these factors might well lead to a sensorineural hearing loss (Martin & Clark, 2000; Berkow et al, 1992; Enkin, et al, 2000; Papp et al, 2003; Mutlu et al, 1998). If pediatricians are unaware of factors that can lead to sensorineural hearing loss, the infant/child stand a chance to be diagnosed late. With late diagnosis it is meant that the impact of the hearing loss already affected the development of the child (Berkow et al. 1992). Hearing-impaired children do not develop language without normal hearing and special training. They require special

education, which needs to start as soon as the hearing loss has been identified. Thus the earlier in life the problem is identified and intervention begun the less serious the impact on the infant/child (Yoshinaga-Itano, 2001).

Pediatricians often face difficulty in accurately identifying the causes of sensorineural hearing loss in infants and children (Zakzouk & Al-Anazy, 2002). Working within a team allows each professional to contribute significantly to the well-being of the infant/child (Kim, Bothwell & Backous, 2002).

Knowledge surrounding risk factors that might cause sensorineural hearing loss is important for all professional members for early identification, the correct diagnosis and correct referrals (Kittrell & Arjmand, 1997). Therefore, it is the researcher's opinion once again on how important continuous education and an interdisciplinary team approach is.

4.4 DISCUSSION ON THE SYMPTOMS AND CHARACTERISTICS OF INFANTS AND CHILDREN WHO ARE DIAGNOSED WITH SENSORINEURAL HEARING LOSS

In order for pediatricians to detect a possible hearing loss it is necessary for them to be able to identify some crucial behaviours, responses and characteristics that might suggest a loss of hearing (Roodt, 1994). In Figure 4.5 the respondents' knowledge and insights regarding symptoms and characteristics that might accompany sensorineural hearing loss is presented visually.

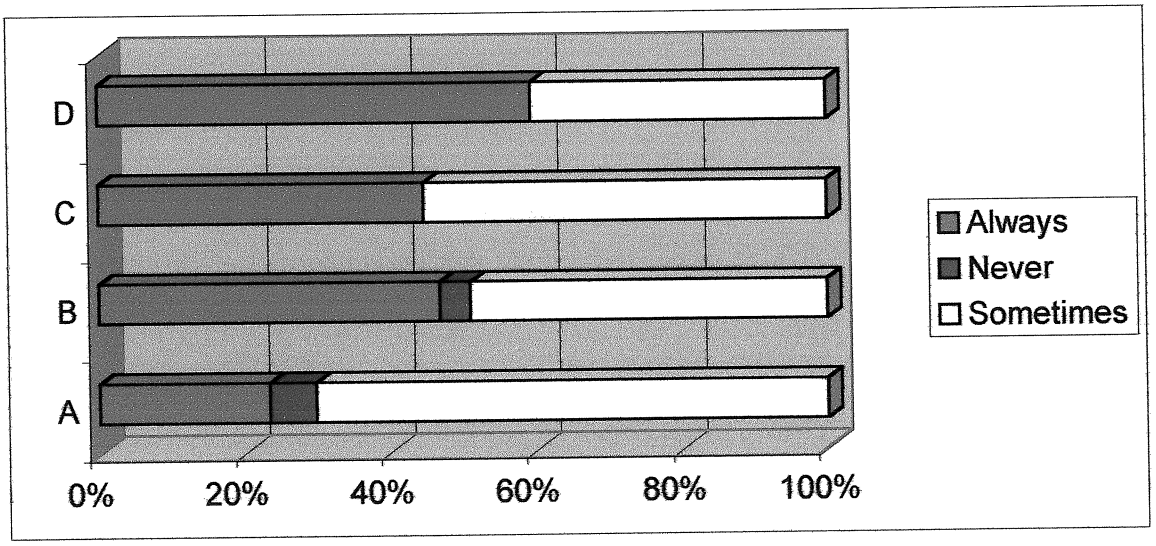


Figure 4.5: Symptoms and characteristics of sensorineural hearing loss

Keys:

A. Atypical general development

B. Decrease in babbling patterns

C. Decrease in social interactions

D. Inconsistent/ or no reaction to sound

In Figure 4.5 the respondents had to indicate their knowledge surrounding the symptoms and characteristics of an infant/child with a hearing loss. The majority of the respondents answered '*sometimes*' and '*always*'. In Figure 4.5, 23% of the respondents indicated that atypical development would always be a characteristic of sensorineural hearing loss, while 6 % answered 'never' and 71% answered 'sometimes'. Decrease in the infant's babbling patterns as a characteristic of hearing loss revealed the following answers: 47% answered 'always', 4% answered 'never' and 49% said that it might occur. Respondents indicated that a decrease in social interactions would have an effect 45% of the time, while 55% said that it '*might*' have an effect. As for infants having inconsistent or no reaction to sound 60% of the respondents said it would always be present, while 40% said it '*might*' be present.

This is a positive indication in the sense that the respondents are aware of the characteristics that might appear with a hearing loss.

It is well recognized that hearing is critical to speech and language development, communication and learning. The major areas in which an infant/child is affected by hearing loss are:

- A delay is caused in the development of receptive and expressive communication skills.
- It may cause a deficit in language development leading to learning problems; thus affecting development.
- Communication difficulties often lead to poor self-esteem and social isolation.
- It may have an impact on vocational choices (Rossetti, 1996 and Roodt, 1994).

Infants who do not pass the above-mentioned performance standards should be referred for a hearing test. With limited knowledge or uncertainty about the characteristics of infants and children with hearing loss, early diagnosis and intervention may not realize. The earlier a hearing loss occurs in an infant's life, the more serious the effects of the hearing loss will be (Yoshinaga-Itano, 2001). If a hearing loss is suspected, it is crucial to have a hearing assessment done as soon as possible in order for early intervention to realise (Yoshinaga-Itano, 2001).

4.5 DESCRIPTION AND DISCUSSION OF THE IDENTIFICATION METHODS USED FOR INFANTS AND CHILDREN WITH A SENSORINEURAL HEARING LOSS

In question 7 the knowledge of the respondents regarding the identification methods of infants/children with a sensorineural hearing loss was determined. The results are presented through visual presentation in Figure 4.6.

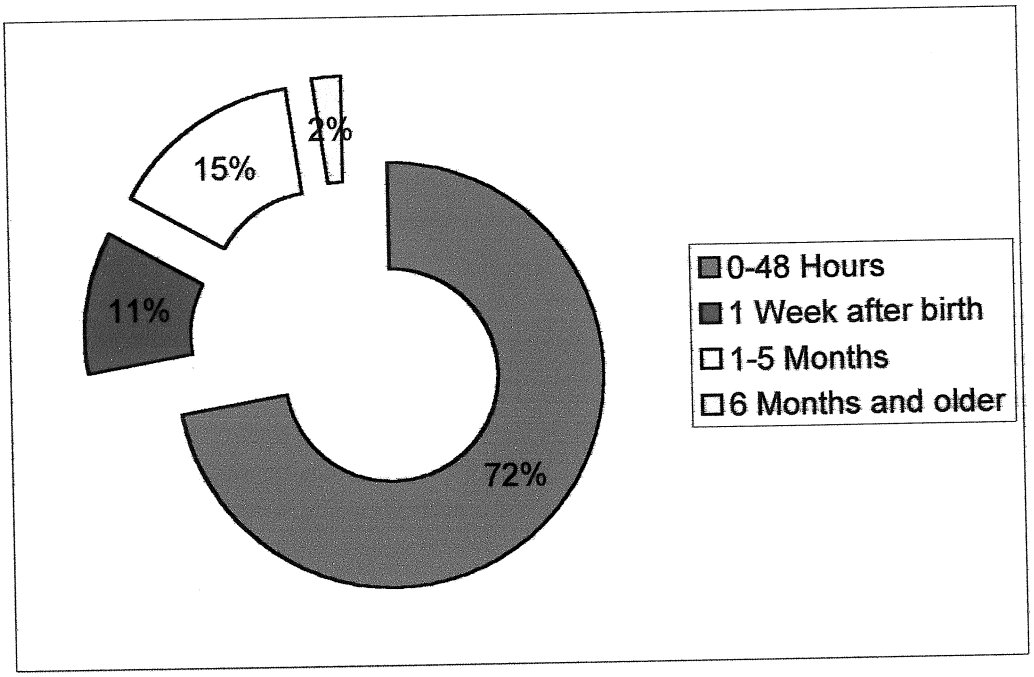


Figure 4.6: Age of identification of hearing loss

Early identification and intervention of hearing loss is, as already stated, essential for normal development of speech and language (Campbell, 1998). If risk factors are present and identified, a complete hearing evaluation should be conducted before 3 months of age (Yoshinaga-Itano, 2001). With the advanced technology of audiometric tests, the hearing of an infant can already be assessed at birth (Martin & Clarke, 2000).

Throughout the literature it is stressed that there is an optimum time for language acquisition and therefore early diagnosis of infants and children is essential (Boothroyd, 1998). Amplification with a hearing aid should be started as soon as possible after the diagnosis has been made, even as early as 6 months of age (Yoshinaga-Itano, 2001).

The results indicate a very positive approach from the respondents about when an infant/child can be tested for hearing loss. In Figure 4.6, 72% of the respondents indicated that an infant can be tested in the first 48 hours after birth. These results might have a positive outcome regarding early identification, appropriate referrals, amplification and intervention of infants. The minority of the respondents indicated

that identification could only occur: 1 week after birth (11%), 1 to 5 months after birth (15%), and at the age of 6 months or older (2%).

Proper care in terms of early identification and intervention of hearing-impaired infants/children remains a world-wide problem. If a lack of early detection is followed by improper action, referral, assessment and planning it will mean that preventative steps are inadequate. The early detection/identification of disabilities is often of critical importance to successful secondary prevention and the intervention of the hearing-impaired infant/child. The older a baby or a child with a hearing impairment is when identification and intervention occur, the greater the chance that it will not develop normally and be successful (Martin, 2000). Therefore there is an urgent need for better training and continuous education of professional members.

4.6 DESCRIPTION OF THE MANAGEMENT PROCEDURES USED BY PEDIATRICIANS

The fourth sub-aim formulated in 3.2.2.5 is determining the management procedures used by pediatricians. This included the referral procedures followed by pediatricians for infants and children with sensorineural hearing loss.

Determining when the respondents deem it important to refer infants/children for a hearing test, is visually represented in Figure 4.7.

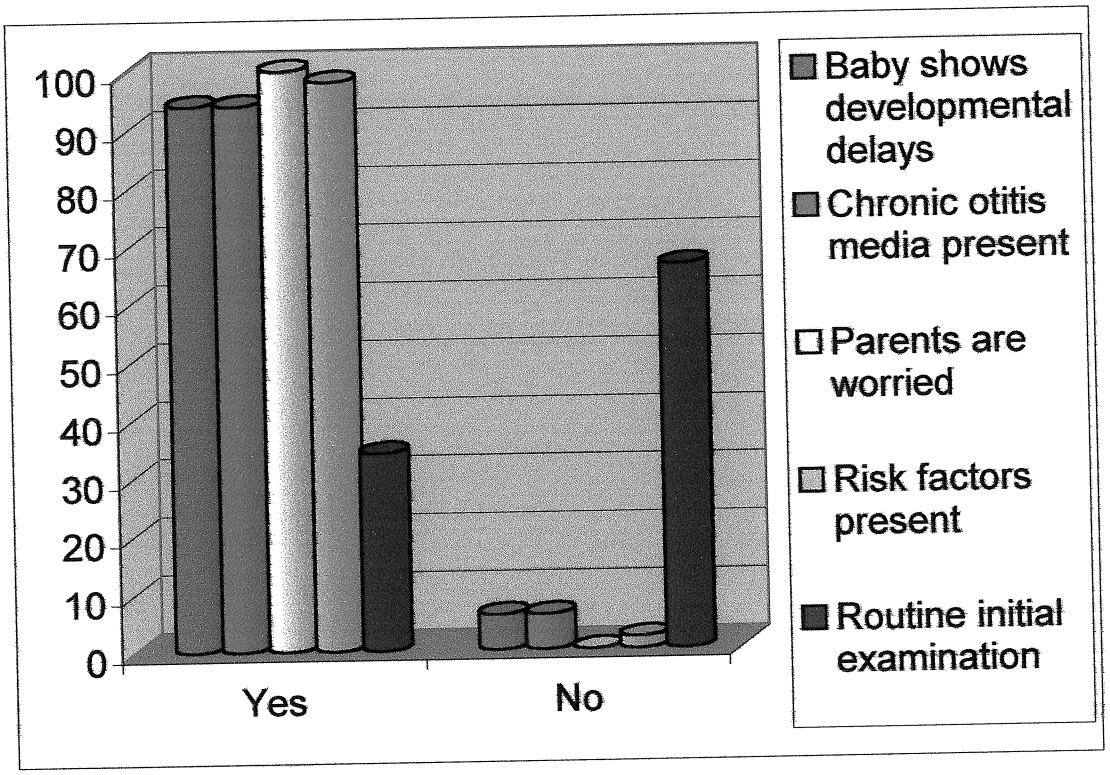


Figure 4.7: Preferences of referrals to an audiologist

It is essential that pediatricians refer infants/children with possible hearing loss to the correct disciplines or programmes as soon as possible to minimize or rule out the effects of hearing loss. A hearing test can even be requested as an initial examination (Hall, 2000). This is deemed important to cancel out any risk factors that might cause a hearing loss (Hall, 2000).

The results in Figure 4.7, indicate that most respondents refer their patients for a hearing test under the following circumstances:

If the infant/child shows a developmental delay, 95% of the respondents indicated that they would refer the infant/child to an audiologist for a hearing evaluation. In the case of chronic otitis media, 95% of the respondents also indicated referral. If risk factors are present, as indicated in paragraph 4.3, 98% of the respondents were said to refer to an audiologist. When the parents show concern about the infant's/child's hearing, 100% of the respondents indicated referral to an audiologist for a hearing test.
These results show a positive awareness in terms of references of infants/children for a hearing test. It can also be concluded that the respondents are aware of factors that

can lead to, and characteristics that can follow hearing loss. It must be noted that infants/children with a possible hearing loss do not always present the same pattern to indicate the presence of hearing loss. Therefore the pediatrician must be alert for any vital signs that can indicate hearing loss.

Also noted in Figure 4.7 is that only about 36% of the respondents refer infants/children to an audiologist as part of an initial examination. As already mentioned, many infants/children with hearing loss go undetected because loss of hearing is a hidden handicap (Boswell & Cherow, 1999). If hearing tests can become part of an initial examination, earlier referrals can be made, problems can be diagnosed earlier, eliminated or treated. An infant/child must be evaluated holistically; therefore respondents must not hesitate to integrate services of other relevant disciplines.

4.7 A DISCUSSION ON THE KNOWLEDGE AND ATTITUDE OF PEDIATRICIANS REGARDING THE INTERVENTION METHODS AVAILABLE FOR SENSORINEURAL HEARING LOSS

This section was divided into the following categories namely:

- Hearing tests preferred by the respondents;
- Efficiency of amplification methods available for infants/children, as well as the pediatric selection criteria for cochlear implants;
- Knowledge of the ideal age for amplification for infants/children.

In order to determine the hearing tests preferences by pediatricians, a visual presentation is given in Figure 4.8.

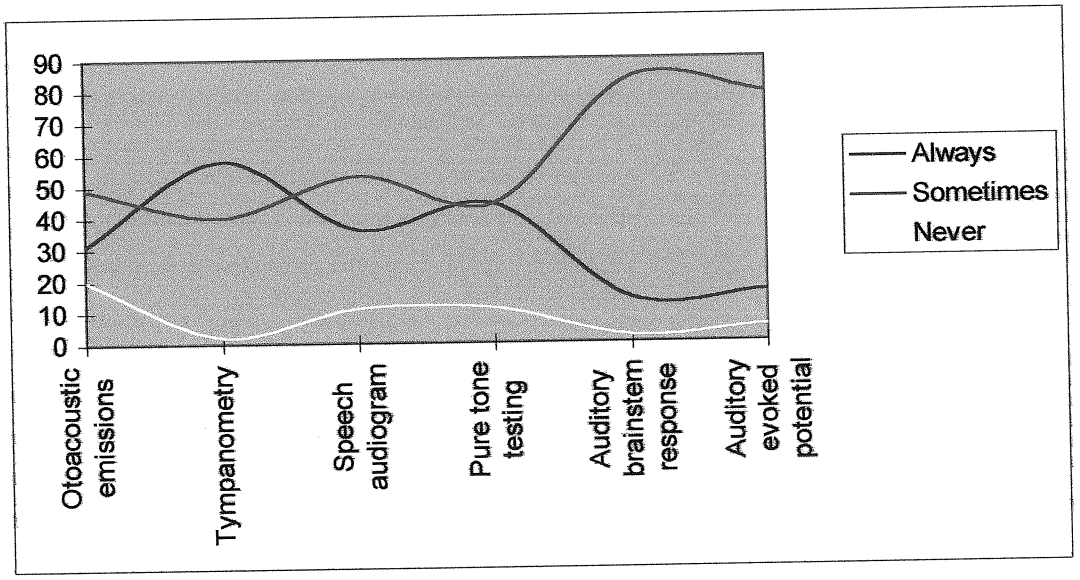


Figure 4.8: Hearing tests preferred by respondents for infants and children

During this section the knowledge of the respondents, regarding the tests available for hearing evaluation, was determined. This was as a result of the rapid development and improvement of technology regarding pediatric hearing evaluation. Another reason being that it takes more than one test to get reliable and valid results (the cross-check principle). Different tests show different points of possible damage from the outer ear up to the auditory nerve. These results can therefore be compared with the results obtained by the pediatrician.

The results show that the majority of respondents use some method to test hearing. The most preferable method of conducting hearing tests required by the respondents is tympanometry (58%) and pure tone testing (42%). Other assessments that are sometimes required with tympanometry and pure tone tests, are auditory brainstem response (82%) and auditory evoked responses (79%). These results are positive since the pediatricians do show an awareness of available tests.

As mentioned the use of more than one test is recommended. The results indicate that the majority of the respondents request appropriate hearing tests as well as a combination thereof. Unfortunately, it is also true that the infants/children are still identified and diagnosed later than expected. The researcher is of the opinion that the reason might be because the older respondents do not appear to be aware of all hearing tests available as well as the uncertainty of when it is necessary to refer (see

Figure 4.8). During the results it became evident that 20% of the respondents never request an immittance test, and this is crucial to determine the middle ear volume, pressure and compliance and the reflexes of the stapedius muscle as well a test for the presence of otitis media (Martin & Clarke, 2000). Other assessments that have never been requested before by some respondents are speech audiometry (10%) and pure tone testing (10%). Without the necessary assessments and referrals from pediatricians on a regular basis, early identification, diagnosis and intervention cannot be realized. The effectiveness of technology is linked to the health care professionals skills and attitude. Technology and the use thereof does not function in isolation, especially in hearing health care services. Patient care must be the focus of the integration of technology into service (Masterson et al., 1999).

In Figure 4.9 and Figure 4.10 a visual presentation is provided on how valuable/effective the respondents deem the hearing aid as well as the cochlear implant.

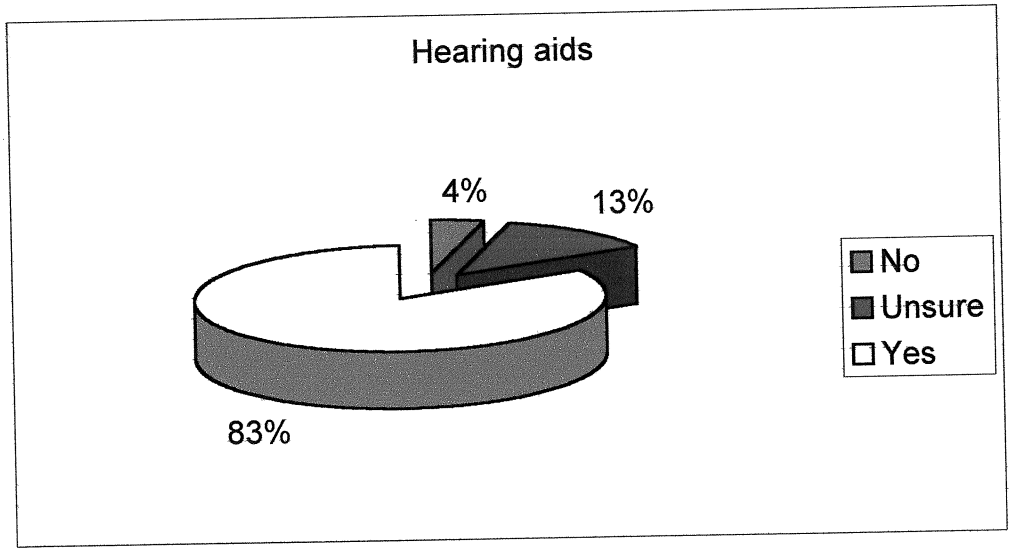


Figure 4.9: Efficiency of hearing aids

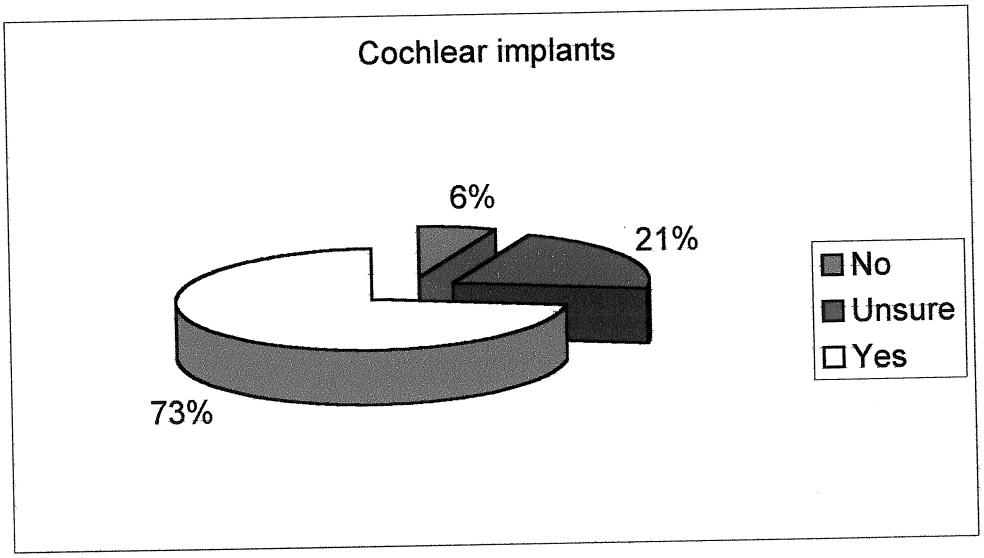


Figure 4.10: Efficiency of cochlear implants

In order for adequate intervention to take place it is important that other disciplines are aware of the devices available for intervention of hearing-impaired infants and children. It is also necessary for them to have knowledge of the effective devices available, in order to educate and motivate families. The two devices used mostly for a person with a hearing impairment are hearing aids and cochlear implants. With the appropriate amplification, infants and children with a hearing loss, can lead '*normal*' lives and develop at the same rate as their peers. In order to motivate parents about the importance and efficiency of both the hearing aid and the possibility of a cochlear implant, other medical personnel (in this study, the pediatricians) must believe in the device being part of the habilitation programme for the child with severe hearing loss.

As seen in figure 4.9, 83% of the respondents said that they experience hearing aids as an efficient solution for hearing impairments in infants and children, 13% were unsure and 4% didn't think hearing aids are effective. The results are positive regarding hearing aids, since hearing aids are mostly used for infants and children with sensorineural hearing loss. This positive attitude of respondents will also increase referrals to and teamwork with audiologists.

In terms of their attitude towards cochlear implants, it is seen in figure 4.10 that 73% of the respondents believe that this method is effective, 21% were unsure and 6% believe it to be insufficient.

Hearing aids have come a long way and most medical personnel are comfortable with hearing aids as well as the safety surrounding their usage. Technology surrounding cochlear implants on the other hand is developing at a rapid pace and implantation of infants and children at a young age is becoming more favourable. The researcher is of the opinion that this might be the cause of the large percentage of uncertainty surrounding efficiency of cochlear implants for infants and children. This lack of knowledge can be ascribed to insufficient education during studies (see Figure 4.3).

Even though the majority of infants and children receive hearing aids, rather than cochlear implants (see chapter 2), it is important to determine the respondents' knowledge of the selection criteria before they are assessed for a cochlear implant. The reason for this is that cochlear implantation is a relatively new, and fast-developing field and, as seen in Figure 4.10, a large amount (21%) of respondents are still unsure about the benefits and outcomes of this device. As technology develops, so to must education, in order to keep pace with changes as the specially designed adaptive technology will increase and change (Davila, 1994).

In Figure 4.11 the respondents' knowledge surrounding the selection criteria establishes the need for pediatricians to gain more knowledge and information.

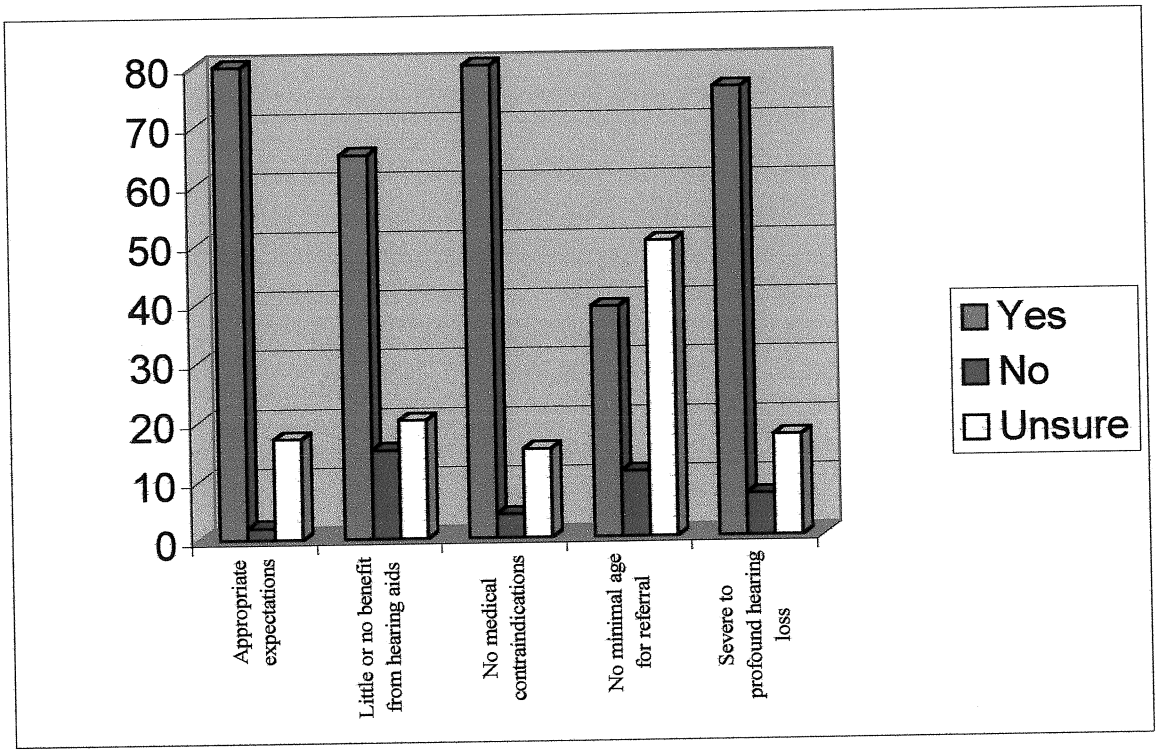


Figure 4.11: Selection criteria for cochlear implants in the pediatric population

From the illustration in Figure 4.11 it is clear that most respondents are aware of the selection criteria which are required for a cochlear implant for infants and children. The following results were found in terms of the positive indication of respondents regarding the pediatric selection criteria: 80% of the respondents replied that both the patient as well as the family need to have appropriate expectations regarding the outcomes of the cochlear implant. Another 65% said that a cochlear implant could only be implanted if no or little benefit is received from the hearing aid. Regarding the absence of indications of medical constraints and the patient having to have a severe-to-profound hearing loss, the results were respectively 80% and 76%.

With professionals becoming more confident in implanting younger children and realising the benefits of earlier implantation, there is a growing demand for referring infants as early as possible to the implant teams (Sirimanna, 2001). Therefore it is especially important to note that only 39% of the respondents replied that they were sure that there was a minimum age for referral for a cochlear implant. The researcher came to the conclusion that this might be one of the main reasons why ear-nose-and-

throat specialists and audiologists get late referrals of infants and children for a cochlear implant.

It must also be noted that there is a need for more information, since a large percentage of the respondents answered the questions with '*unsure*'. With both 'appropriate expectations of the patient and family' and 'the patient must present with a severe-to-profound hearing loss' 17% of the respondents indicated uncertainty about the criteria selection. With 'little or no benefit from hearing aids', 20% of the respondents indicated uncertainty, while 15% were said to be unsure about whether a patient is to be implanted if 'medical contra-indications' were present. Yet again, it became evident that there is a need for pediatricians' to realize that an infant/child cannot be evaluated soon enough, since 50% said that they are unsure whether there is a minimal age for referral.

In Figure 4.12 the knowledge of the respondents regarding age of intervention is portrayed.

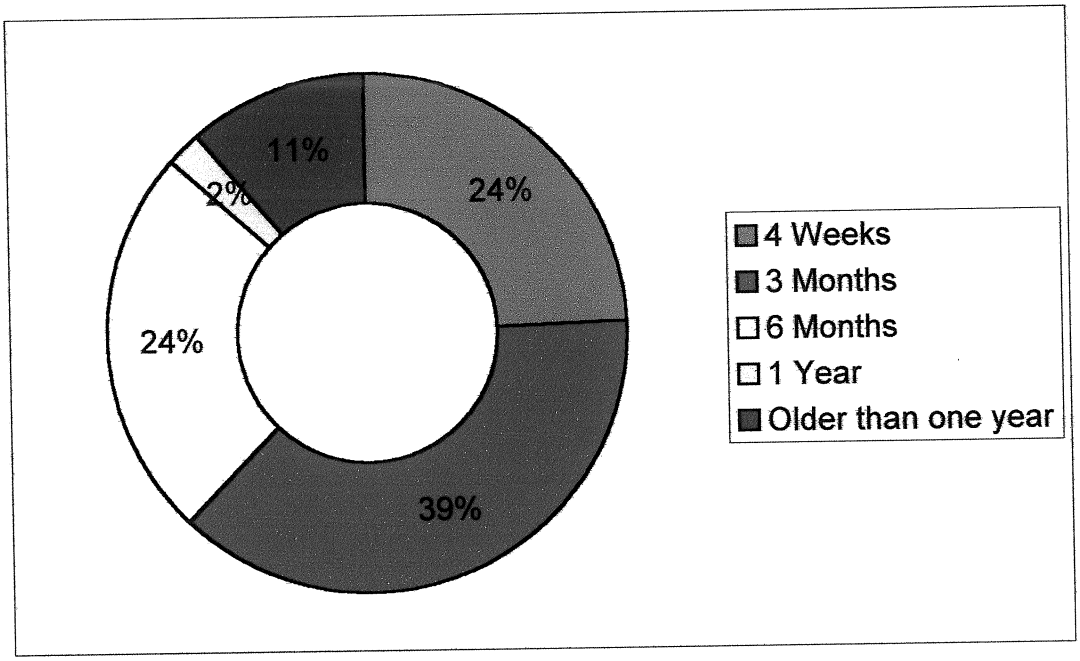


Figure 4.12: Age for intervention to take place

According to Yoshinaga-Itano (2001) the goal of early intervention is to identify infants with hearing loss at or before the age of 3 months and to provide appropriate

intervention before or by 6 months. If this does not happen the infant/child starts to show a delay in areas of development (usually in language and speech development).

As seen in figure 4.12 the respondents appear to be up-to-date regarding the age of intervention for infants and children. An aggregate of 24% of the respondents said that intervention could already be conducted at 4 weeks of age, while 39% said that intervention could start at 3 months of age. As said by Yoshinaga-Itano (2001) the ideal is for intervention to start as early as 6 months of age, and 24% of the respondents agreed to this age of intervention.

Unfortunately, 13% of the respondents still replied that an infant/child could only be fitted with amplification from the age one year and above. This indicates the need for further education of pediatricians in order to continue reinforcement of optimal intervention of infants and children in all areas.

Professionals involved in the pediatric evaluation and amplification must work together closely, in a coordinated effort, to ensure that the hearing-impaired infant/child obtains maximum benefit from amplification.

4.8 DISCUSSION OF THE ATTITUDES OF PEDIATRICIANS REGARDING THE ROLE AND EFFICIENCY OF AUDIOLOGISTS

The seventh sub-aim formulated in 3.2.2.7 determines the attitudes of pediatricians regarding the role and efficiency of audiologists, as well as hearing programmes, in terms of diagnosis and intervention of infants and children with sensorineural hearing loss.

In Figure 4.13 the frequency of respondents who consult with professionals at Hearing Programmes is illustrated.

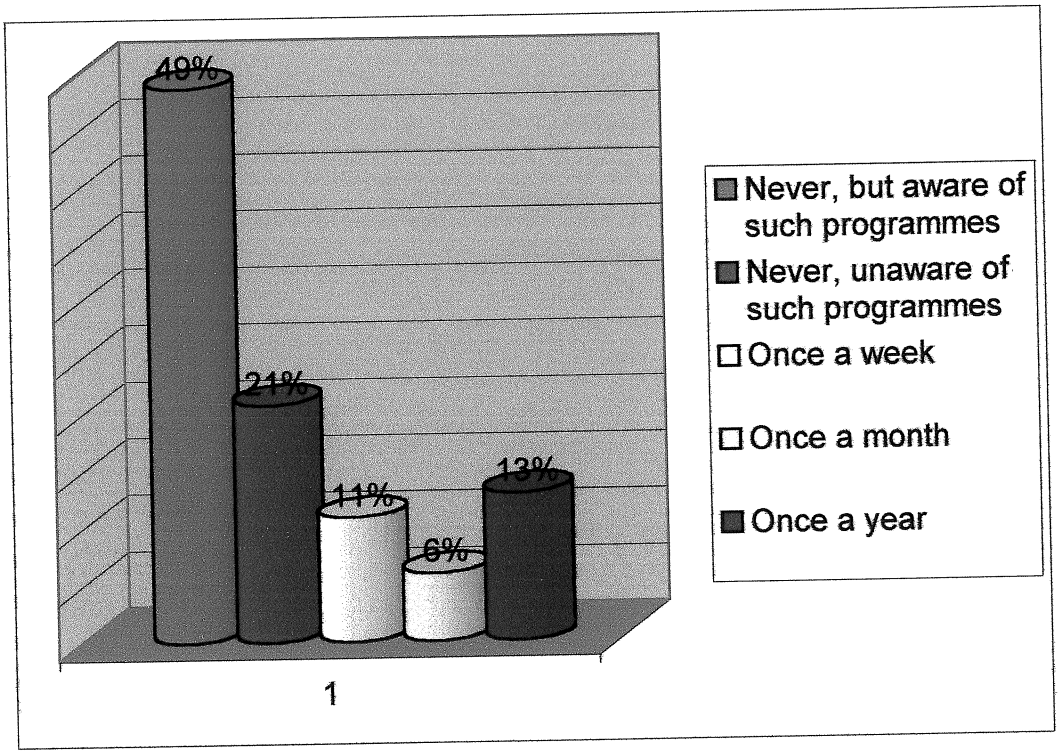


Figure 4.13: Consultation with professionals at hearing programmes or hearing clinics

Teamwork between the different disciplines is crucial in order to ensure that services are being coordinated and that early identification and intervention is ensured. As found in the literature, no discipline can have sufficient knowledge surrounding all aspects of pathologies. It is therefore important that the professionals of the different disciplines must be aware of the different programmes available for continuous education. By drawing on such programmes their knowledge surrounding all aspects of hearing development and pathologies will be improved.

The results found in Figure 4.13 may be a good indication of why so many infants and children with sensorineural hearing loss are diagnosed incorrectly or referred at a late age. The results were disturbing, since 70% of the respondents admitted never to have consulted with any hearing programmes.

The remaining 30% of respondents appears to be consulting with professionals at clinics or hearing programmes along the following frequency:

- Once a week: 11%
- Once a month: 6%

- Once a year: 13%

The researcher is of the opinion that close co-operation with hearing programmes and clinics is essential for pediatricians for the following reasons:

- After the identification and diagnosis of the hearing-impaired infant/child suitable recommendations must be made with regard to intervention. Recommendations should be implemented through a team process on the basis of a holistic approach of the infant/child.
- Monitoring the infants/child's progress in order to determine whether the original intervention methods used were correct. This is done by receiving reports from the professional people working with the infant/child.

It is important to note the importance of co-operation and mutual confidence between these programmes and the team members involved.

In order to improve service delivery to patients and their families, pediatricians must be empowered with knowledge and skills for appropriate referral and treatment of patients. There is also a need for interdisciplinary assessment centers to provide a coordinated service and to undertake the training for the intervention of hearing impairment.

In Figure 4.14 the efficiency, values and accessibility of hearing programmes and clinics according to the respondents is illustrated.

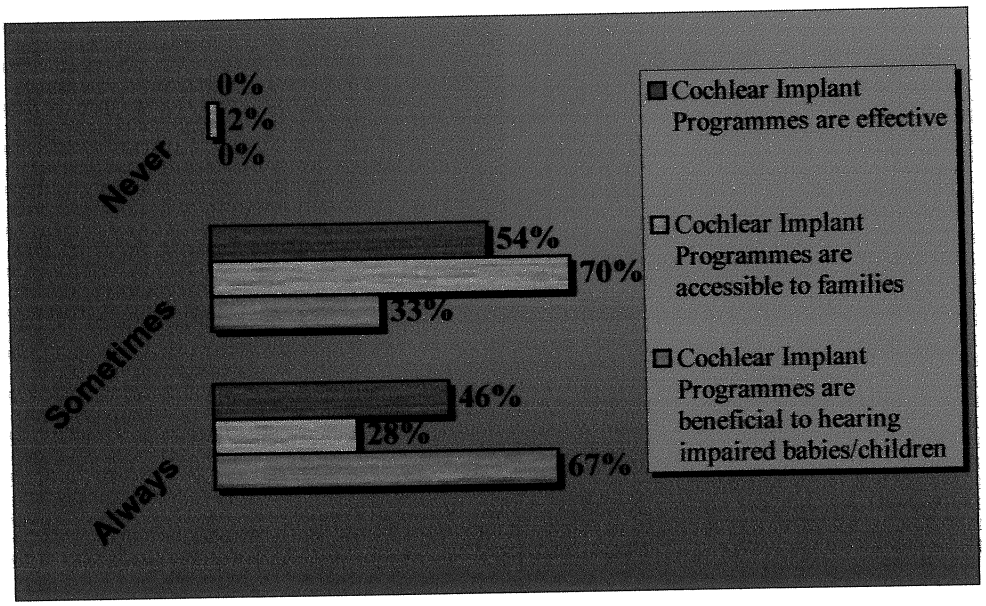


Figure 4.14: Opinions concerning hearing clinics and programmes for children with hearing loss.

Figure 4.14 illustrates that only 46% of the respondents agree that hearing programmes and clinics are effective for children who have sensorineural hearing loss. Only 28% of the respondents believed these programmes and clinics to be accessible to families. These might be seen as the main reasons why the infants and children with sensorineural hearing loss are not referred to audiologists who are involved with hearing programmes or hearing clinics on a regular basis. Another reason is that there might be uncertainty surrounding these programmes and clinics and the role the pediatrician plays in the consultation and referral of clients thereto.

The majority of the respondents (67%) deem these programmes and clinics to be effective for infants and children with a hearing loss. This positive attitude of respondents might be helpful in increasing referrals and making teamwork more efficient.

Yet again, there seems to be uncertainty surrounding the role of the audiologist and relevant hearing programmes. This is concluded from the results found in Figure 4.14 since a large percentage of the respondents replied with the answer '*sometimes*'. The results indicated that 54% of the respondents replied that hearing programmes might be effective, while 70% said that these programmes and clinics might be accessible to

families. Another 33% of the respondents replied that these programmes and clinics might be beneficial to hearing-impaired infants and children. Pediatricians should feel confident that they will receive correct and timely documentation on infants and children tested and that follow-up will take place if needed. Pediatricians need the diagnostic, treatment and support services provided by other healthcare professionals (White, 2002).

4.9 DISCUSSION OF RESPONDENTS' NEED FOR INVOLVEMENT AND CONTINUED EDUCATION

In order to answer the sub-aim formulated in 3.2.2.8 a visual presentation is provided in Figure 4.15. Through this the respondent's needs for involvement are determined.

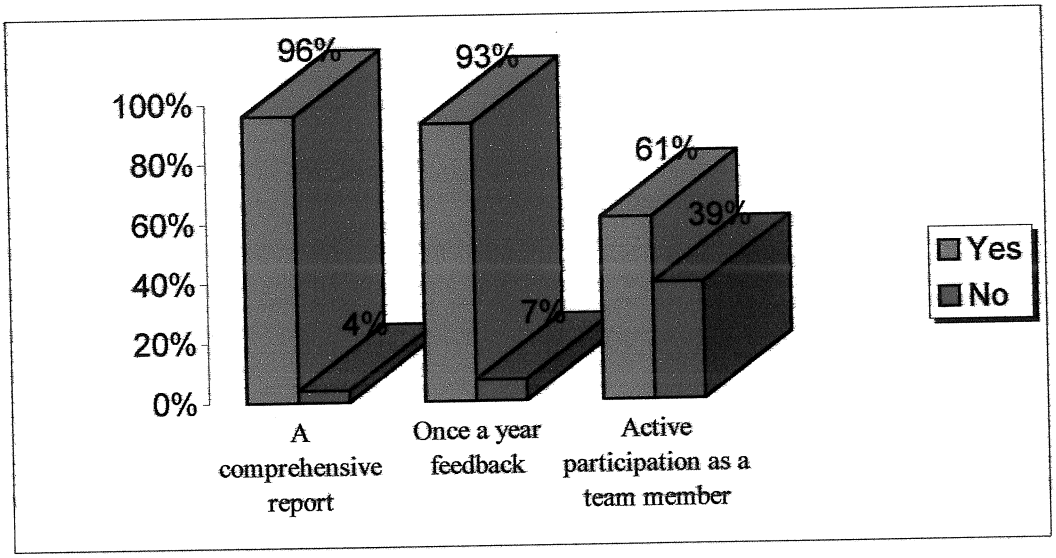


Figure 4.15: Needs of involvement

Before pediatricians can become more involved during the identification and intervention process of infants and children with hearing loss it is important to determine their needs in terms of feedback and involvement. Programme management requires periodic reporting (Finitzo & Crumley, 1999).

Positive feedback was found in terms of the responsiveness and willingness of participants to become more involved in hearing programmes. A positive 96% of the participants said that they would like to receive a comprehensive report of the patient,

while 93% would like to get feedback on the patient's progress once a year. Long-term involvement and dedication on the part of pediatricians, audiologists, speech pathologists, surgeons and family is critical for maximizing the benefit the child receives (Kim, Bothwell & Backous, 2002).

Unfortunately, only 61% said that they would like to be active participants in the intervention process of the infant/child, while the remaining 39% were not interested. Successful hearing screening and intervention programmes require the support and expertise of pediatricians (Hall, 2000).

It is recommended that the interdisciplinary team approach should be accepted in principle with regard to all aspects of the development of the hearing-impaired infant/child, and that the responsible members devise mechanisms to give effect to this team approach.

The respondent's need for further knowledge regarding infants and children with sensorineural hearing loss will be depicted in Figure 4.16.

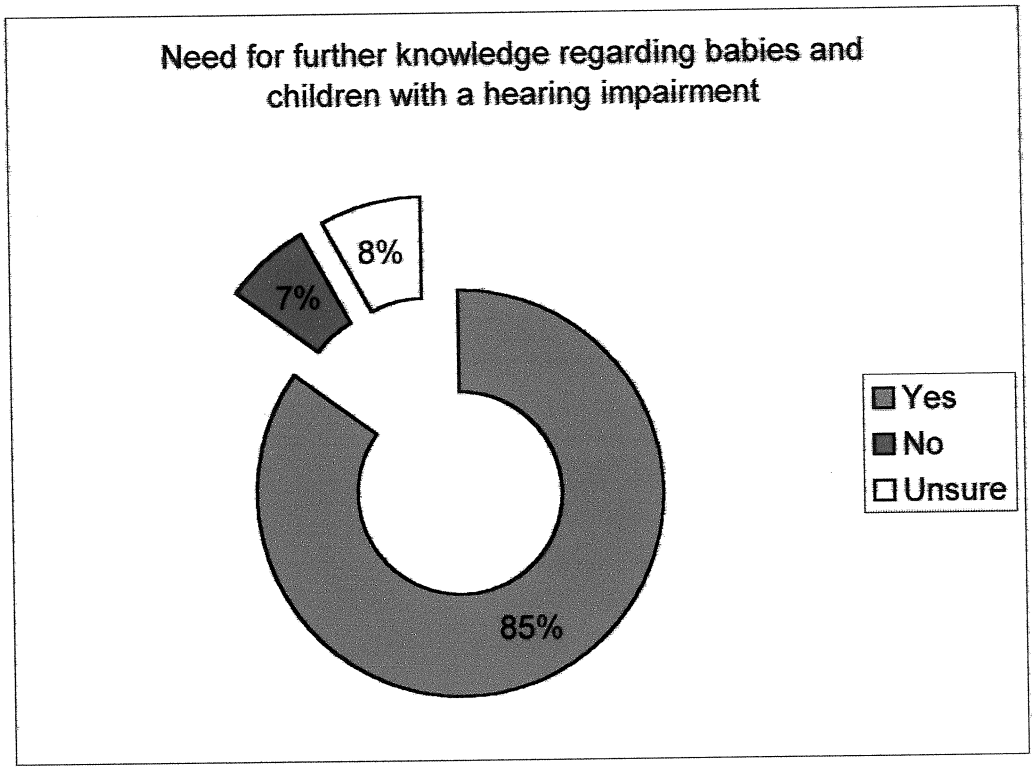


Figure 4.16: Need for further information

The results indicate that most of the respondents (85%) have a need for more information regarding infants and children with sensorineural hearing loss. These results indicate a positive attitude from pediatricians and can lead to the enhancement of cooperation between pediatricians and audiologists.

Throughout the literature (for example Wachtel & Compart, 1996), as well as in the results of this study, it is found that pediatricians have a need for further education and training in the intervention process of infants and children with sensorineural hearing loss. This is based on the results found throughout the study, in terms of a void in certain areas surrounding effective intervention of hearing loss.

4.10 CONCLUSION

The main aim of this study was to investigate the pediatrician's knowledge and attitudes regarding the diagnosis and intervention of infants and children with a sensorineural hearing loss. This has been achieved by means of a questionnaire that was divided according to the sub-aims. The following conclusions were made accordingly:

The training of respondents (undergraduate and postgraduate) appeared to be inadequate in the sense that they are not made aware to consider the consequences of functional restraints while curative and other services are performed.

The respondents showed sufficient knowledge of the possible risk factors that may lead to sensorineural hearing loss, regardless of their '*limited*' information gained during their student years on this subject. It is important to note that hearing loss is not an isolated condition, therefore one must have a greater understanding of related conditions and the individual infant/child's related technology and accessibility needs.

A hearing loss can affect an infant/child in quite a few development areas, as can be seen in Figure 4.4. There is a need to expand in-service educational opportunities, both to establish a better understanding of hearing impairment and its implications and to enable them to assist with the identification of undetected hearing loss.

This ensures greater recognition of the role that an interdisciplinary team plays in the assessment and intervention of the hearing-impaired infant/child in respect to all the problems he/she may experience. Early detection must be followed by proper action, referral, assessment and planning. To secure support for the high-quality audiologic screening and assessment, it is important that professionals from other disciplines should become involved and be made aware of the relatively high prevalence of hearing loss amongst special-needs infants and children.

The pediatric audiology landscape changed dramatically with the advances in screening and diagnostic procedures, amplification possibilities and early

identification outcomes. Working with infants/children with a hearing impairment requires a broad knowledge base (Boswell & Cherow, 1999). Technological developments taking place impact on the optimization of the quality of life of the hearing-impaired infant/child. Such developments include the cochlear implant, digital hearing aids as well as the objective electrophysiological tests available for infants and children.

Medical personnel must continuously provide new ways of increasing efficiency while maintaining a high standard of patient care (Vowles et al, 1997). Team members tend to work independently, providing evaluation services specific to their disciplines. There are shortcomings as well in the training of respondents in the handling of chronic and permanent illnesses.

The goal is to plan an intervention that requires the sharing of professional roles and responsibilities. A unique set of competencies is required to provide optimum pediatric assessment and intervention. Professional members must continue their education to upgrade their knowledge and skills about service delivery to children.

Knowledge of aspects of child development and establishment of an audiologist must be infused into all aspects of audiology care and maintained throughout the infant's/child's life. In order to keep pediatricians better informed information can also be presented during pediatric meetings through personal contact and communication.

4.11 SUMMARY

In order to achieve the main aim of this study, research results were discussed under each of the sub-aims. Research results were depicted in graphical formats. Conclusive remarks were provided in order to achieve the aim of this study: **To investigate the pediatricians' knowledge and attitudes regarding the diagnosis and intervention of infants and children with a sensorineural hearing loss.**

CHAPTER 5
CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The successful handling of the infant/child with of hearing loss of middle ear pathology calls for a high level of interdisciplinary functioning and the cooperation of specialists (Wachtel & Compart, 1996). This assessment team, after making assessments and preliminary diagnosis independently and from their own perspectives, should make a joint diagnosis and decide on the best intervention method in order to increase the infants/child's quality of life. This study aimed to explore the knowledge and attitudes of pediatricians regarding the intervention of infants and children with a sensorineural hearing loss. In this chapter the study will be evaluated in terms of its strengths and limitations. In order to evaluate the value of the results, the results will be summarized together with the clinical and theoretical implications. To conclude the study, recommendations for future research will be given.

5.2 EVALUATION OF THE RESEARCH METHODOLGY

The strengths and limitations of the study must be taken into account if a follow-up or comparative study should be performed. Therefore an evaluation of the research methodology is done in order to provide insight regarding the value of the study.

5.2.1 Strengths of the study

- Results of the study can be considered as valid and reliable on account of the guidelines discussed in Chapter 3.

- The data gathering procedures were effective considering that the questionnaire was limited to the amount of questions, yet relevant questions were asked. The results were therefore complete and this enhances the reliability of the study.

- Since there is limited literature regarding the knowledge and attitudes of pediatricians of the intervention of infants and children with a sensorineural hearing loss, the results of this study can be used as a starting point for similar studies.

- Another strength of this study is that it highlighted the areas of uncertainty of pediatricians regarding the intervention of an infant/child with sensorineural hearing loss. If these areas of uncertainty can be eliminated through continuous education, effective identification and referrals of infants and children with a hearing loss can be obtained.

- This study might lead to the awareness of the importance of continuous education and teamwork. The role of the audiologist is not only to assess hearing and to fit hearing aids, but also for supporting pediatricians as part of a team of professionals in the habilitation of the infant/child with a hearing loss.

- The respondents were also made aware of their own areas of uncertainty regarding their referrals of infants and children with sensorineural hearing loss to professionals. This might create a need to participate in hearing programmes in order to stay up to date with the latest developments in the audiology field.

5.2.2 Limitations of the study

- Firstly, the geographical area of this study was limited to the Gauteng Province. The respondents who participated were thus limited and generalization of the results could not be made.

- Another limitation was the type of questions used in the questionnaire. The majority of the questions were closed-set questions. This question type is time saving and is easily analysed, but the reason for this being a limitation is that the questions are limited, and may not always include all the alternative answers (Leedy & Ormrod, 2001). Consequently the respondents were able to guess the most logical answer.

- The length of the questionnaire has been limited to 18 questions, because of the respondent's busy schedules. A longer questionnaire might have had a lower return rate, but could have provided the researcher with a more comprehensive image regarding the respondent's attitudes and knowledge.

- The size of the pilot study was too small and did not take the whole test population into account.

- The goal of the study is to find the areas where pediatricians lack some knowledge or are in need for continuous in-service education. Therefore the researcher wanted to focus on all pediatricians representing Gauteng (rural and urban areas). Unfortunately no responses were obtained from pediatricians in the rural district. This is a problem since it may be that these pediatricians are not able to be involved with relevant programmes as often as those pediatricians practicing in the city.

5.3 SUMMARY AND CONCLUSIVE DISCUSSION OF FINDINGS OF THE STUDY

The following conclusive results are given according to the results of the study:

- Continuous education, regardless of experience, is to transfer and gain technical knowledge, related skills, values and attitudes in order to develop proficiency and abilities to improve capabilities as a medical member (Masterson et al., 1999). Therefore all pediatricians, those who just started practicing as well as for those who have been in practice for a longer period should be on an equal level regarding their skills and knowledge.

- All pediatricians, regardless of area of practice, need sufficient knowledge regarding infants and children with sensorineural hearing loss.

- The respondents appear to have sufficient knowledge regarding most of the risk factors that might lead to sensorineural hearing loss, despite limited or no formal education surrounding this topic.

  Uncertainty of lesser-known risk factors that may cause a sensorineural hearing loss, such as blood type incompatibility between the mother and child, childhood diseases, diseases of the mother and otitis media, may interfere with the early diagnosis and intervention of an infants/child's life. Limited knowledge has negative implications for the effective identification and referrals of infants and children with sensorineural hearing loss. It is therefore important to emphasize the need for continuous educational programmes for all professionals involved the intervention of these infants and children.

- The majority of the respondents related to the importance of early identification. These results might have a positive outcome regarding early identification, appropriate referrals, amplification and intervention of infants.

- The respondents appear to have a broad knowledge of tests available for testing the hearing of the pediatric population, as well as to when to request for a specific test. If hearing tests can only become a routinepart of an initial examination as well, earlier referrals can be made, problems can be diagnosed earlier, eliminated or treated.

- For adequate intervention to take place all disciplines must be aware of the devices available for intervention of hearing-impaired infants and children. It is also necessary for them to know of the outcomes of available devices, in order to educate and motivate families. The respondents view both the hearing aid and the cochlear implant as effective. As technology develops, so to must education, in order to keep pace with changes as the specially designed adaptive technology will increase and change (Davila, 1994).

- Overall the respondents showed good interdisciplinary skills when it came to the referral of patients and their interaction during teamwork, although some

respondents never consult with hearing programmes or clinics. Co-operation and mutual confidence between these programmes and the involved team members is important in order to improve service delivery to patients and their families.

- The respondents indicated a strong need for more information regarding the early identification and intervention of infants and children with a sensorineural hearing loss. They stipulated that they would like the information to be summarized in the form of a pamphlet. The researcher can make the conclusion that even though the respondents appear to have sufficient knowledge surrounding most of the aspects covered in the questionnaire, there are a few aspects where they show limited knowledge. It is for these 'gray' areas that extra and new information will be provided to them through a pamphlet.

5.3.1 Theoretical and clinical implications of the results

In the following paragraphs the implications of the study's results will be discussed.

By means of the literature study it became evident that education surrounding the identification and intervention of infants and children with sensorineural hearing loss is insufficient. Throughout the study the complexity surrounding a sensorineural hearing loss is emphasized. Sufficient knowledge is therefore of critical importance for all pediatricians if they want to ensure the best intervention methods for these children that suffer from a hearing loss.
An expert on the identification, prevention and intervention of infants and children with sensorineural hearing loss the audiologist is the preferred person to provide information. It is therefore the role of the audiologist to enhance cooperation, knowledge of professionals as well as to provide them with the necessary information regarding the diagnosis and intervention of infants and children with sensorineural hearing loss. The respondents can therefore enhance their knowledge by becoming active members of hearing programmes and to work in coordination with audiologists.

In order to ensure pediatricians' involvement in the early diagnosis and intervention of the hearing-impaired population, Hearing Programmes are needed. These programmes must address the pediatrician's needs and questions surrounding all

aspects of sensorineural hearing loss. The keyword is thus empowerment of all pediatricians as a member of the early intervention team of the hearing-impaired. More research must be conducted in order to make the programmes more curriculum-based and to ensure the programme will be effective in the South African context. This can be done by establishing personal contact with Pediatric Departments of Universities and to involve them in the development of a more effective curriculum-based programme that will enhance the pediatrician's knowledge surrounding sensorineural hearing loss.

It is evident from the results that there is a great need for more information surrounding the diagnosis and intervention of a sensorineural hearing loss. This has positive implications for the elaboration of the pediatrician's knowledge on sensorineural hearing loss. Compiling a pamphlet that will include all the relevant information regarding the topic, sensorineural hearing loss will be send to all the respondents. Another goal is to publish the results of the study in pediatric magazines. Through this a bigger population can be reached.

Effective hearing-impaired intervention relies on teamwork where all disciplines' roles are integrated. Therefore all clinical and theoretical implications as discussed above may lead to a more positive relationship between members of the team and will help with the expansion of knowledge on the field surrounding sensorineural hearing loss.

5.4 RECOMMENDATIONS FOR FUTURE RESEARCH

The researcher is of the opinion that the study proved to be beneficial and valuable since the respondents showed a strong need for further information and knowledge on the intervention of infants and children with sensorineural hearing loss. The study is relevant since there is a growing tendency for earlier identification of infants and children with hearing loss. National research regarding the knowledge and attitudes of pediatricians on infants and children with sensorineural hearing loss is necessary in order to draw conclusions and differences between first and third world countries.

In order for this goal to realize the 'gate keepers' of infants and children, the pediatricians, need to be alert for indications of a hearing loss. The goal of this study was therefore mainly to identify areas of uncertainty, whereas audiologists can provide information to pediatricians to be part of a team. The findings of this study will hopefully motivate more in-depth research studies in the future. Research and more literature surrounding this specific topic, namely pediatric sensorineural hearing loss, can help to minimize the 'gray' areas, can lead to the development of a new and complete curriculum at medical school and may help the fast developing field of pediatric audiology.

Effective diagnosis and intervention of infants and children with sensorineural hearing loss is dependent on the integration of all the relevant disciplines' skills and coordination of services (Guralnick, 1997). This study emphasizes the importance of teamwork and the need for audiologists and pediatricians to exchange their skills and knowledge in order to provide the best possible intervention for this population.

5.5 CONCLUDING REMARKS

The aim of early identification and early intervention is clear: one needs to accommodate disabled infants and children as soon as possible within the mainstream of education (for example a school).

As stated throughout the study, pediatric audiology is a fast developing field and the technology surrounding this field will become more sophisticated and continuously improving. Therefore it is important to note that new research opportunities will arise as technology develops. Only if all team members have thorough knowledge and necessary skills surrounding their roles, will the children with a hearing loss reach their maximum potential. The aim thus is continuous education for all professionals in the team. The future of infants and children with a sensorineural hearing loss appears to be increasing in effectiveness with the help of all relevant team members of Hearing Programmes.

The pediatrician is an important team member of the hearing intervention team. Their involvement is crucial and their referral can be the important stepping-stone for early

identification and intervention. This research emphasized the importance of a pediatrician as part of a team of professionals who interact, to ensure the early diagnosis and intervention of a young child with a sensorineural hearing loss.

The study can be concluded as Charles Gore once said: "***it is not expected of us to do extraordinary things, but to do ordinary things extraordinary well.***"

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APPENDIX A:

APPROVAL OF APPROPRIATE ETHICAL PROCEDURES

Our Ref: Ms P Woest / 9914689
Tel: 012 420 2736
Fax: 012 420 2698
E-mail: petru.woest@up.ac.za

13 December 2004

Ms E Slabbert
PO Box 66178
HIGHVELD PARK
0169

University of Pretoria
Pretoria 0002 Republic of South Africa Tel 012-420-4111
Fax 012-420-2698 *http://www.up.ac.za*

Faculty of Humanities

Dear Ms Slabbert

TITLE REGISTRATION: FIELD OF STUDY – MCOMMUNICATION PATHOLOGY (OPTION 1)

I have pleasure in informing you that the following has been approved:

Title of dissertation/essay:	**The knowledge and attitude of pediatricians regarding the diagnosis and intervention of infants and children with a sensorineural hearing loss**
Director of studies:	**Ms PH Venter**
Co-director of studies:	**Ms L Pottas**

I would like to draw your attention to the following:

1. **ENROLMENT PERIOD**
   (i) You must be enrolled as a student for at least one academic year before submission of your dissertation/essay.
   (ii) Your enrolment as a student must be renewed annually before 31 March, until you have complied with all the requirements for the degree. You will only be able to have supervision if you provide a proof of registration to your supervisor.

2. **APPROVAL FOR SUBMISSION**
   On completion of your dissertation/essay enough copies for each examiner as well as the prescribed examination enrolment form which includes a statement by your director of studies that he/she approves of the submission of your dissertation/essay, as well as a statement, signed by you in the presence of a Commissioner of Oaths, must be submitted to the Faculty Administration.

3. **INSTRUCTIONS REGARDING THE PREPARATION OF THE DISSERTATION/ESSAY AND THE SUMMARY APPEARS ON THE REVERSE SIDE OF THIS LETTER.**

Yours sincerely

for **DEAN: FACULTY OF HUMANITIES**

APPENDIX B

COVER LETTER

University of Pretoria
Pretoria 0002 Republic of South Africa Tel 012-420-2357
/ 012-420-2816 Fax 012-420-3517 http://www.up.ac.za

Department of Communication Pathology
Speech, Voice and Hearing Clinic

November 2003

Dear Doctor

REGARDING: RESEARCH PROJECT

I am currently a master's student in Communication Pathology (Speech- Language and Audiology) at the University of Pretoria. I am conducting a research project regarding the knowledge and attitudes of pediatricians with regard to the diagnosis and intervention process of children with a sensorineural hearing loss.

To complete my research project, I need your participation and co-operation. It would be appreciated if you could complete the questionnaire attached to this letter to make a valuable contribution to my research project.

Due to early contact with babies and young children, you have an important contribution to make during the early identification and referral of babies and young children with a possible hearing loss. Hearing loss causes a detrimental delay in the overall development of babies and children, therefore this study can have far-reaching consequences to the development of the field of early hearing detection and intervention.

All the information obtained during the research project, will be strictly confidential and used for research purposes only.

I do realize that you have a busy schedule and can assure you that the questionnaire only takes 10 minutes to complete. I would appreciate it if you would complete the questionnaire and return it in the enclosed envelope.

If you require any information you can contact me at the following number: 082 873 3690.

Thank you for your co-operation and support.

Erna Slabbert
Student

Mrs. N. Venter
Tutor

For: Prof. B. Louw
Head: Department Communication Pathology

Universiteit van Pretoria

Pretoria 0002 Republiek van Suid-Afrika Tel 012-420-2357
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Departement Kommunikasiepatologie
Spraak- Stem- en Gehoorkliniek

1 Mei 2003

Geagte Dokter

INSAKE: NAVORSINGSPROJEK

Ek is tans 'n magisterstudent in Kommunikasiepatologie (Spraak-Taalterapie en Oudiologie) aan die Universiteit van Pretoria. Ek is besig met 'n navorsingsprojek wat die kennis en houdings van pediaters rakende die diagnose en intervensie van kinders met 'n sensories-neurale gehoorverlies ondersoek.

Ten einde die navorsingsprojek uit te voer, het ek u, as pediater se samewerking en deelname nodig, en word u vriendelik gevra om die vraelys in te vul en aan my terug te stuur.

Weens u vroeë kontak met babas en jong kinders het u 'n belangrike rol om te vervul tydens die vroeë indentifisering en verwysing van babas/jong kinders met 'n moontlike gehoorverlies. Aangesien gehoorverlies 'n algemene ontwikkelingsagterstand by 'n baba/jong kind veroorsaak, kan hierdie studie verreikende voordele inhou.

Al die inligting sal uitsluitlik vir navorsingsdoeleindes gebruik word en konfidensialiteit sal ten alle tye gewaarborg word.

Ek besef dat u 'n besige program het en verseker u dat dit slegs 10 minute neem om die vraelys te voltooi. Ek sal dit hoog op prys stel indien u die vraelys so spoedig moontlik voltooi en aan my kan terug faks by 012-667 1825.

Byvoorbaat dankie vir u samewerking. U deelname word hoog op die prys gestel.

Indien u enige verdere inligting verlang, skakel my asseblief by 082 873 3690.

Vriendelike groete

Slabbert

Erna Slabbert
Student

Mev. N. Venter
Tutor

Namens: Prof. S.R. Hugo
Hoof: Departement Kommunikasiepatologie

APPENDIX C

INSTRUCTION SHEET

Algemene instruksies vir die voltooiing van Afrikaanse vraelyste

1. Voltooi asseblief al die vrae, tensy anders aangedui.
2. Beantwoord die vrae deur die toepaslike blokkie(s) met 'n 'X' af te merk of die antwoord in te vul in die ruimte verskaf.
3. Die uitvoering van die vraelys behoort ongeveer 10 minute te duur.
4. Alle inligting sal as streng vertroulik hanteer word.

Terme en definisies

Sensories-neurale gehoorverlies: Die tipe gehoorverlies wat voorkom in die binne-oor wanneer die haarselle van die koglea of die akoestiese senuwee (KN VIII) beskadig is.

Ernstige gehoorverlies: 71 – 90dB; **totale gehoorverlies**: ≥ 90dB

Babas – geboorte tot een jaar.

Jong kinders – een jaar tot twaalf jaar.

General instructions for completion of English questionnaire

1. Please complete all the questions unless otherwise indicated.
2. Answer the questions by marking the appropriate block(s) with a 'X' or write your answer in the provided space.
3. The completion of the questionnaire should not take longer than 10 minutes.
4. All information will be kept strictly confidential.

Terms and definitions

Sensorineural hearing loss: A hearing loss due to damage in the inner ear (hair cells of the cochlea) or of the auditory nerve (CN VIII).

Severe hearing loss: 71 – 90dB; **Profound hearing loss**: ≥ 90dB

Babies – birth to one year.

Young children – one year to twelve years.

APPENDIX D

QUESTIONNAIRE

Questionnaire

For office use only

Respondent number V1 [ ][ ][ ] 1-3

1. Where did you specialize? At the University of…

Bloemfontein	1
Durban	2
Capetown	3
Pretoria	4
Stellenbosch	5
Witwatersrand	6
If other, please specify.	7

V2 [ ] 4

2. How many years have you been practicing as a registered pediatrician?

..... Years. V3 [ ][ ] 5-6

3. At which of the following instances are you currently at professional capacity?

	Yes	No	
Private practice	1	2	V4 [ ] 7
State -/provincial instance	1	2	V5 [ ] 8
Academic instance	1	2	V6 [ ] 9

4. Did you receive any formal lectures on sensorineural hearing loss in terms of diagnosis and intervention during your post-graduate studies?

Yes, only one lecture.	1
Yes, more than one lecture.	2
No.	3

V7 [ ] 10

5. Are you of the opinion that the following risk factors can lead to a sensorineural hearing loss in infants/children (0-12 years)?

	Always	Sometimes	Never			
Genetic/hereditary	1	2	3	V8		11
An infection of the mother during pregnancy (e.g. German measles, toxi-plasmosis or cytomegalo virus).	1	2	3	V9		12
Complications during delivery (e.g. anoxia, prematurity of the baby).	1	2	3	V10		13
Diseases of the mother (e.g. cardio-vascular diseases, diabetes).	1	2	3	V11		14
Abuse of medicine or similar kinds of drugs abuse during pregnancy.	1	2	3	V12		15
Incompatibility of the mother's and the infants' blood types.	1	2	3	V13		16
An infection of the baby (e.g. meningitis, inflam-mation of the inner ear).	1	2	3	V14		17
Head injuries of the baby.	1	2	3	V15		18
Child diseases (for example measles, whooping cough or mumps of measles at an early age).	1	2	3	V16		19
Medication for babies (e.g. gentamycin and dihydro-streptomycin)	1	2	3	V17		20
Chronic otitis media	1	2	3	V18		21

6. What symptoms/characteristics can you expect with an infant/ child with a possible profound sensorineural hearing loss?

	Always	Sometimes	Never	
Reaction to sound is inconsistent/none.	1	2	3	V19 [ ] 22
Decrease in babbling patterns at seven months.	1	2	3	V20 [ ] 23
A-typical general develop-ment (show significant delays).	1	2	3	V21 [ ] 24
Decrease in social interaction with parents/ other (the baby/ young child becomes quiet, inactive or even aggressive).	1	2	3	V22 [ ] 25

7. What is the earliest age at which an infant's hearing can be tested in order to identify a hearing loss?

0 – 48 hours after birth.	1
1 week after birth.	2
1 to 5 months.	3
6 months and older.	4

V23 [ ] 26

8. I will refer the infant/child to an audiologist for a hearing evaluation…

	Yes	No	
..as part of the routine initial examination.	1	2	V24 [ ] 27
..if some of the risk factors (question 5) is present.	1	2	V25 [ ] 28
..if the parents are worried and suspect a possible hearing loss.	1	2	V26 [ ] 29
..if the baby's/child shows developmental delays.	1	2	V27 [ ] 30
..where chronic otitis media is present.	1	2	V28 [ ] 31

9. If you make a referral to an audiologist for a hearing evaluation, which tests do you request?

	Always	Sometimes	Never	
Otoacoustic emissions	1	2	3	V29 32
Tympanometry	1	2	3	V30 33
Speech audiogram	1	2	3	V31 34
Pure tone testing	1	2	3	V32 35
Auditory brainstem response	1	2	3	V33 36
Auditory evoked potential	1	2	3	V34 37

10. Do you agree with the following amplification options as treatment possibilities for infants/children with a profound sensorineural hearing loss?

	Yes	No	Unsure	
Hearing aids	1	2	3	V35 38
Cochlear Implants	1	2	3	V36 39

11. Do you agree that the infant/child has to comply with the following selection criteria in order to receive a cochlear implant?

	Yes	No	Unsure	
Severe to profound sensorineural hearing loss in both ears.	1	2	3	V37 40
Receive little or no useful benefit from hearing aids.	1	2	3	V38 41
No medical contraindications.	1	2	3	V39 42
Appropriate expectations of the family.	1	2	3	V40 43
No minimum age for referral.	1	2	3	V41 44

12. At what age can a baby be fitted with the appropriate hearing aids?

4 weeks.	1
3 months.	2
6 months.	3
1 year.	4
Older than 1 year.	5

V42 [ ] 45

13. How often do you consult with a Hearing Institutions Program/Cochlear Implant Program regarding infants and children with a possible or diagnosed hearing loss?

Never, but I am fully aware of such programs or clinics.	1
Never, I am unaware of such programs or clinics.	2
At least once a week.	3
At least once a month.	4
At least once a year.	5

V43 [ ] 46

14. Hearing Programmes/Cochlear Implant Programmes for profoundly deaf infants/children…

	Always	**Sometimes**	**Never**
..are beneficial to the babies/children with a hearing loss.	1	2	3
..are accessible/ approachable to families.	1	2	3
..are effective.	1	2	3

V44 [ ] 47
V45 [ ] 48
V46 [ ] 49

15. If you have an infant/child in your practice with a profound sensorineural hearing loss, what do you expect of the people you've referred him/her to?

	Yes	**No**
A comprehensive report.	1	2
Once a year feedback on the progress the baby/child is making.	1	2
Your active participation as a team member of the baby/child's rehabilitation program.	1	2

V47 [ ] 50
V48 [ ] 51
V49 [ ] 52

16. Do you have the need for further knowledge regarding the diagnosis and rehabilitation of infants and children with a profound sensorineural hearing loss?

Yes	1
No	2
Unsure	3

V50 ☐ 53

17. Would you like to receive a summary of the current study's results? If **Yes**, please provide your details in given block.

Yes.	1
No.	2
Personal details for post sending	

V51 ☐ 54

Vraelys

Vir kantoorgebruik

Respondentnommer V1 [ ][ ][ ] 1-3

1. Waar het u gespesialiseer? Universiteit van…

Bloemfontein	1
Durban	2
Kaapstad	3
Pretoria	4
Stellenbosch	5
Witwatersrand	6
Ander. Spesifiseer asb.	7

V2 [ ] 4

2. Hoeveel jaar praktiseer u al as 'n geregistreerde pediater?

..... Jaar.

V3 [ ][ ] 5-6

3. By watter van die volgende instansies is u tans in professionele hoedanigheid betrokke?

	Ja	Nee
Privaat praktyk	1	2
Staats-/provinsiale instansie	1	2
Akademiese instansie	1	2

V4 [ ] 7

V5 [ ] 8

V6 [ ] 9

4. Het u enige formele lesings oor sensories-neurale gehoorverlies in terme van diagnose en intervensie tydens u nagraadse studie ontvang?

Ja, een lesing.	1
Ja, meer as een lesing.	2
Nee.	3

V7 [ ] 10

5. Meen u dat die volgende risikofaktore tot 'n sensories-neurale gehoorverlies by babas/kinders (0-12 jaar) kan lei?

	Altyd	**Soms**	**Nooit**	
Geneties/oorerflik	1	2	3	
'n Infeksie tydens swangerskap by moeder (bv Duitse masels, ototoksiese middels, sitomegalo-virus).	1	2	3	V8 [ ] 11 V9 [ ] 12
Komplikasie tydens geboorte (bv anoksie, prematuriteit by baba).	1	2	3	V10 [ ] 13
Siektes van moeder (bv kardio-vaskulêre siektes, diabetes).	1	2	3	V11 [ ] 14
Misbruik van medikasie of dwelmmiddels deur die moeder.	1	2	3	V12 [ ] 15
Onverenigbaarheid van die moeder en die baba se bloedgroepe.	1	2	3	V13 [ ] 16
'n Infeksie by die baba (bv meningitis, inflammasie van die binne-oor).	1	2	3	V14 [ ] 17
Hoofbeserings by die baba.	1	2	3	V15 [ ] 18
Kindersiektes by die baba (bv masels, kinkhoes, pampoentjies).	1	2	3	V16 [ ] 19
Medikasie by die baba (bv gentamycin en dihydrostreptomycin)	1	2	3	V17 [ ] 20
Chroniese otitis media	1	2	3	V18 [ ] 21

6. Watter simptome/kenmerke kan u verwag om by 'n baba/ kind met 'n moontlike ernstige sensories-neurale gehoorverlies te sien?

	Altyd	Soms	Nooit			
Reageer onkonsekwent/glad nie op klank nie.	1	2	3	V19		22
Afname in babbelpatrone op sewe maande.	1	2	3	V20		23
A-tipiese algemene ontwikkeling (toon agterstande in mylpale).	1	2	3	V21		24
Afname in sosiale interaksie met ouers/ander (baba/kind raak stiller, onaktief, selfs aggressief).	1	2	3	V22		25

7. Wat is die vroegste ouderdom waarop 'n baba se gehoor getoets kan word om 'n gehoorverlies te identifiseer?

0 – 48 uur na geboorte.	1	V23	26
1 week na geboorte.	2		
1 tot 5 maande.	3		
6 maande en ouer.	4		

8. Ek sal 'n baba/kind na 'n oudioloog verwys vir 'n gehoorevaluasie…

	Ja	Nee			
as dit vorm deel van die roetine inisiële ondersoek.	1	2	V24		27
as enige van die bogenoemde risiko faktore (vraag 5) voorkom.	1	2	V25		28
indien die ouers bekommerd is en 'n gehoorverlies vermoed.	1	2	V26		29
as die baba/kind se ontwikkelings mylpale 'n agterstand toon.	1	2	V27		30
indien kroniese otitis media voorkom	1	2	V28		31

9. Indien u 'n kind na 'n oudioloog verwys vir 'n gehoorevaluasie, wat is die toetse wat u aanvra?

	Altyd	Soms	Nooit			
Oto-akoestiese emissies	1	2	3	V29		32
Timpanometrie	1	2	3	V30		33
Spraakoudiogram	1	2	3	V31		34
Suiwertoontoetse	1	2	3	V32		35
Ouditiewe breinstam respons	1	2	3	V33		36
Ouditief ontlokte potensiaal	1	2	3	V34		37

10. Beskou u die volgende versterkingsopsies as behandelingsmoontlikhede vir babas/kinders met 'n ernstige sensories-neurale gehoorverlies?

	Ja	Nee	Onseker			
Gehoorapparate	1	2	3	V35		38
Kogleêre inplantings	1	2	3	V36		39

11. Aan watter van die volgende seleksiekriteria moet die baba/kind voldoen ten einde 'n moontlike kandidaat vir 'n kogleêre inplanting te wees?

	Ja	Nee	Onseker			
Erge-totale sensories- neurale gehoorverlies wat in albei ore voorkom.	1	2	3	V37		40
Min/geen nut met die gebruik van gehoorapparate.	1	2	3	V38		41
Geen mediese kontra-indikasies.	1	2	3	V39		42
Ouers en kind se verwagtinge moet realisties wees.	1	2	3	V40		43
Geen minimum ouderdom vir verwysing nie.	1	2	3	V41		44

12. Hoe vroeg kan 'n baba/kind gepas word met gehoorapparate?

4 weke.	1
3 maande.	2
6 maande.	3
1 jaar.	4
Ouer as 1 jaar.	5

V42 [ ] 45

13. Hoe gereeld konsulteer u met 'n Gehoorinstansieprogram/ Kogleêre Inplantings Program, oor babas/kinders met 'n moontlike of bevestigde gehoorverlies?

Nooit, maar is wel bewus van sodanige programme of dienste.	1
Nooit, is nie bewus van sodanige programme of dienste.	2
Minstens een keer 'n week.	3
Minstens een keer 'n maand.	4
Minstens een keer 'n jaar.	5

V43 [ ] 46

14. Gehoorinstansie programme/Kogleêre Inplantings Programme en dienste…

	Altyd	**Soms**	**Nooit**
…strek tot voordeel van kinders met 'n gehoorverlies.	1	2	3
…is bereikbaar/toeganklik vir families.	1	2	3
…is effektief.	1	2	3

V44 [ ] 47
V45 [ ] 48
V46 [ ] 49

15. Indien u wel 'n kind in u praktyk het met 'n ernstige sensories-neurale gehoorverlies wat verwag u van die persoon na wie u die baba/kind verwys het?

	Ja	**Nee**
'n Volledige verslag.	1	2
Jaarlikse terugvoer oor die baba/kind se vordering.	1	2
U aktiewe deelname as spanlid van die baba/ kind se rehabilitasie program	1	2

V47 [ ] 50
V48 [ ] 51
V49 [ ] 52

16. Het y 'n behoefte aan verdere kennis aangaande die diagnose en rehabilitasie van babas en kinders met 'n ernstige sensories-neurale gehoorverlies?

Ja	1
Nee	2
Onseker	3

V50 ☐ 53

17. Wil u graag 'n opsomming ontvang van die huidige studie se resultate? Indien **Ja,** verskaf asb u besonderhede in gegewe blokkie.

Ja.	1
Nee.	2
Kontakbesonderherde vir posstuk	

V51 ☐ 54