

CHAPTER 7

CONCLUSIONS AND IMPLICATIONS

Aim: To draw general conclusions and derive implications from the research findings, critically evaluate the research, and make recommendations for future research

7.1. INTRODUCTION

Informed clinical practice is guided by applied research endeavours and clinical practice in turn stimulates these research activities (Fouché, 2002a:109). Such a reciprocal relationship is necessary to steer evidence-based practice, and in areas where there is an absence of clinical practice it should only be established based on applied contextual research endeavours.

The initiator of UNHS in the USA, Marion Downs, is confident that the Western world will soon see most newborns enrolled in UNHS programmes and has urged these countries to assist developing countries such as South Africa to follow suit (Downs, 2000:293). Developing audiological services is, however, reliant on research that meets the unique local demands of the South African population and context in a socially and economically justifiable manner (Hugo, 1998:12).

The current investigation of Maternal and Child Health (MCH) clinics being recommended as hearing screening contexts by the year 2002 Hearing Screening Position Statement (HPCSA, 2002:5), aims to address this responsibility by providing research-based recommendations for clinical practice. This exploratory study can therefore serve to initiate further research and guide

future clinical implementation of Early Hearing Detection and Intervention (EHDI) programmes at MCH clinics in a manner that improves hearing healthcare for South African infants in a cost-effective and accountable manner.

The aim of this chapter therefore, is to draw general conclusions and implications from the results of the empirical study, to critically evaluate the research, and to make specific recommendations from the theoretical and empirical research conducted during this study in the format of a proposed infant hearing screening service delivery model in MCH clinics in South Africa.

7.2. CONCLUSIONS

The recommendation by the South African year 2002 HSPS, namely to include MCH clinics as an infant hearing-screening context, was investigated in a developing peri-urban community during the current study. The empirical research was conducted according to five sub-aims, which resulted in the summarised conclusions that follow below.

Sub-aim #1 Description of MCH clinics as screening context

The two MCH clinics investigated in Hammanskraal provided a suitable context to screen infants for hearing loss despite prevailing contextual barriers that are characteristic of primary healthcare clinics in developing contexts of South Africa. A summary of the results and discussion that describe these clinics as screening contexts was provided in Table 6.2.

Sub-aim #2 Description of infants and caregivers attending clinics

Caregivers and infants attending these two MCH clinics demonstrated significant degrees of socio-economic depravity, which places the population at an increased risk for congenital hearing loss, poor participation in the hearing screening/follow-up process, and subsequent poor involvement in a family-focused early intervention process for infants identified with hearing loss. A

summary of the environmental risk factors that were prevalent among the infants and caregivers attending the clinics was provided in Table 6.4.

Sub-aim #3 Description of HRR and test procedure results

A significantly increased incidence of risk indicators for hearing loss was recorded. The immittance and OAE results also indicated similar pass/refer results that are indicative of a close relationship between their measuring specificity for middle-ear transmission and inner-ear integrity. A summary of the discussion of the High Risk Register (HRR) and test procedure results was provided in Table 6.11.

Sub-aim #4 Description of screening protocol performance and efficiency

The screening protocol effectively identified infants, placed them into risk categories for hearing loss and established useful norms for high frequency immittance in infants. The efficiency of the programme was acceptable, considering the short period for which it had been implemented; however, inefficient coverage with the AABR and poor follow-up return rates were obtained at the clinics. A summary of the results and discussion describing the screening protocol performance and efficiency was provided in Table 6.20.

Sub-aim #5 Description of interactional processes involved in implementing and maintaining a screening programme at MCH clinics

Interactional processes between fieldworkers, clinic staff and caregivers revealed that collaborative partnerships fostered by consistent service delivery, maintenance of an open channel of communication and basic courteousness, facilitated an effective initial infant hearing screening at the two clinics. A summary of the results and of the interactional processes involved in implementing and maintaining a screening programme at MCH clinics was provided in Table 6.24.

The two MCH clinics, despite identified barriers, demonstrated promise for such clinics to serve as platforms for widespread hearing screening programmes for infants in South Africa. The descriptions according to the specified sub-aims of

the screening programme implemented during the current study revealed valuable clinical implications and made recommendations for the structure of the screening process and protocols to serve as guide for the future planning of early hearing detection programmes.

7.3. CLINICAL IMPLICATIONS

The most prominent clinical implications that can be derived from the empirical results obtained in this study are presented according to the sub-aims of the research in the following paragraphs.

Sub-aim #1 Description of MCH clinics as screening context

- Primary healthcare contexts such as the MCH clinics have the potential to serve as practical hearing screening contexts that provide comprehensive coverage of infants in South Africa, especially those from disadvantaged communities (Solarsh & Goga, 2004:121). The recommendation by the year 2002 HSPS, namely to include 6-week immunisation clinics at MCH clinics as a major screening context alongside the Neonatal Intensive Care Units (NICUs) and well-baby nurseries (HPCSA, 2002:5) is therefore a practical solution to achieve widespread screening coverage in the South African context.

Sub-aim #2 Description of infants and caregivers attending clinics

- The increased risk of having a congenital hearing loss as a result of the socio-economic depravity (Kubba et al., 2003:125) that characterises this community (which is representative of large parts of the South African population), highlights the urgent need for early hearing detection and intervention (EHDI) services to be made available to these infants (Olusanya et al., 2004:298).
- Due to the poor socio-economic and low educational levels evident in this community (which is representative of many developing contexts), the

implementation of successful EHDI services with actively involved caregivers will require culturally sensitive efforts towards enhancing awareness and educating caregivers about the benefits of early identification compared to lack of timely intervention (Bamford, 2000:365; Louw & Avenant, 2002:147). The fact that early intervention services are based on the premise that a child's success is largely the result of family-focused intervention, emphasises the fact that the first step in the management process must be to actively involve the caregiver (Beckman, 2002:687). An EHDI system at these clinics must therefore include an educational component that conveys information to caregivers about the effect of undetected hearing loss, as well as about the benefits and process of early intervention. Such information must be conveyed in a culturally sensitive manner that empowers families (Beckman, 2002:688). This also ensures that the locus of decision making remains within the family and necessitates their active participation (Popich, 2003:34).

Sub-aim #3 Description of HRR and test procedure results

- Due to limited resources, the year 2002 HSPS recommended the screening of infants according to the HRR as an intermediate step towards controlling the number of necessary screenings (HPCSA, 2002:5). The significantly increased incidence of risk factors reported in this study indicates, however, that screening at-risk infants may result in a significantly larger number of infants requiring screening compared to risk incidence reported in developed countries (Mahoney & Eichwald, 1987:160; Kennedy et al., 1998:1959; Vohr et al., 2000b:380). This reveals an important limitation of HRR screening if it is used for the purposes of limiting resource expenditure on IHS in a developing context such as Hammanskraal. An alternative screening approach is provided in the proposed service delivery model in paragraph 7.6.

- If a HRR is to be implemented, documenting a family history of hearing loss will require a meticulous and conscientious approach since ascertaining an accurate description is difficult (Kountakis et al., 2002:136;

Northern & Downs, 2002:277). In the current study, this risk factor (family history of hearing loss) contributed the majority of risks that have a negative effect on the feasibility of implementing a HRR approach to screening as an intermediate step toward UNHS. This fact indicates the need for a more rigorous approach to recording risks or an alternative approach as suggested in paragraph 7.5.

- In this population the screening of neonates for sensori-neural hearing loss was more effective than the screening of infants, because the high frequency immittance and OAE results demonstrated more referrals for infants than for neonates younger than four weeks. Therefore, if a screening programme targets sensori-neural hearing loss, the screening of neonates and younger infants will result in less confounding influences from MEE than the screening of older infants. Screening neonates or younger infants will therefore be a more successful screening practice at MCH clinics as it will result in earlier identification, thereby allowing earlier initiation of intervention services to the benefit of both infants and families (Yoshinaga-Itano, 2003:200).

- Screening with an Automated Auditory Brainstem Response (AABR) apparatus proved not to be very effective with older neonates and especially with infants, due to the fact that the babies' restlessness increased with age (Palmu et al., 1999:211). An OAE screening is therefore recommended at MCH clinics for infants paying their 6-week immunisation visits. OAE screening also requires less disposable materials, which results in reduced costs and is a simpler procedure to conduct than AABR screening. These are important aspects to consider in the resource poor developing contexts of South Africa and they also underwrite the use of OAE as an initial screening procedure at MCH clinics.

Sub-aim #4 Description of screening protocol performance and efficiency

- Since 1000 Hz immittance results are highly correlated with OAE results in the current study as well as in previous reports, they can serve as a useful tool in classifying neonates and infants into varying degrees of risk for types of hearing loss. Conducting 1000 Hz immittance measurements on infants referring the OAE screen can therefore be used to distinguish sensori-neural hearing loss from middle-ear pathology for infants younger than seven months of age (Kei et al., 2003:21; Purdy & Williams, 2000:9; Margolis et al., 2003:384). In this way the need for the medical management of middle-ear disease, as well as the need for and timing of diagnostic audiological procedures can be determined, all of which can save unnecessary referrals and follow-up appointments (Margolis et al., 2003:384).

- 1000 Hz immittance measurements, although useful in neonates, are more reliable in correctly identifying middle-ear effusion (MEE) in infants older than four weeks of age. The importance of including 1000 Hz immittance measurements for screening infants at MCH clinics can therefore be attributed to the following two facts: 1) Results of this study indicate that approximately 65% of OAE refer results in the population of infants investigated at the MCH clinics are due to transient MEE and/or external ear canal obstruction and 1000 Hz immittance measurements can assist in differential diagnosis between sensori-neural and conductive pathology; 2) The proposed screening at MCH clinics is recommended to be conducted when infants attend their 6-week immunisation visit (HPCSA, 2002:5) which means they are older than four weeks and therefore 1000 Hz immittance measurements will be more reliable than for neonates.

- The normative 1000 Hz tympanometry data obtained in this study demonstrates the importance of using age-specific norms for the infants and neonate population. This is essential as the values change significantly with increasing age due to maturation of the outer-ear and

middle-ear structures (Purdy & Williams, 2000:9; Meyer et al., 1997:194; Holte et al., 1991:21).

- Results indicate that the value of 1000 Hz probe tone acoustic reflexes for infants simply lies in the fact that its presence is usually reassuring of a normal middle ear, as was reported previously (Gates et al., 1994:56; Purdy & Williams, 2000:14). High frequency acoustic reflexes must therefore be used and interpreted in conjunction with 1000 Hz probe tone tympanometry in neonates and infants.
- Considering the South African national healthcare context with its limited resources and healthcare priorities skewed toward more life-threatening diseases, a screening protocol at MCH clinics for identifying bilateral hearing loss may be a more suitable intermediate solution than HRR screening. Limited resources also place a greater emphasis on identifying bilateral hearing loss above the more expensive identification of unilateral hearing loss (Lutman, 2000:368; Davis et al., 1997:73). The proposed screening protocol is discussed in paragraph 7.5.
- Follow-up return rates should improve steadily over time, provided that a consistent and continuous service is rendered and parents are empowered to realise the importance of early identification and intervention (Mehl & Thomson, 2002:1; Beckman, 2002:688). Internationally, this is acknowledged to be the primary challenge for successful hearing screening programmes (White, 2003:85). Clinicians in South Africa should therefore implement safeguards to ensure the provision of continuous and consistent services, as well as awareness and educational programmes that will, in turn, encourage higher follow-up return rates.

Sub-aim #5 Description of interactional processes involved in the implementation and maintenance of a screening programme at MCH clinics

- An important challenge that needs to be addressed is the active involvement of all participants in the screening process. Both the caregivers/parents and the nursing staff at MCH clinics need to be empowered by recognising and building upon the strengths and assets that they exhibit. Culturally sensitive information furthermore needs to be provided to improve their awareness and knowledge of hearing loss and its effects (Beckman, 2002:688). It is essential to establish effective collaborative partnerships where all parties share a common philosophy about the need and consequence of services so as to improve the outcomes of the infant (Moodley et al., 2000:26; Popich, 2003:34).

The clinical results of the empirical research conducted in this study could guide the implementation of future EHDI services at MCH clinics in South Africa. The recommendations that have flowed from this study also have further research implications, which are presented below.

7.4. RESEARCH IMPLICATIONS

A research question answered raises a multitude of new questions to be answered and in this sense the current study was no exception. The results obtained in and conclusions drawn from the current study revealed several significant aspects that require further investigation. These are presented to provide guidelines and suggestions for future research endeavours.

- Large-scale longitudinal studies are necessary at different pilot MCH 6-week immunisation clinics to gather data in a systematic manner (Swanepoel et al., 2004:634). At these pilot sites, nurses and/or lay volunteers should be trained to conduct hearing screening, while experienced audiologists should manage the programme (HPCSA, 2002:4). Pilot studies will provide incidence figures for hearing loss as well

as for the presence of risk factors in South Africa (Mencher & DeVoe, 2001:20). These studies will also serve to establish an integrated programme for immunisations and hearing screening that can serve as a model at all immunisation clinics in the South African context.

- An assessment should be made of the trainability and attitude of nurses and lay volunteers who are to conduct screening programmes. These studies will measure their level of involvement and will provide information towards the adaptation of programmes so as to ensure their active involvement and professional ownership – something which is essential for the success of such programmes (Moodley et al., 2000:37).
- Pilot studies are also necessary for NICUs and well-baby nurseries – the other two screening contexts in South Africa specified by the year 2002 HSPS (HPCSA, 2002:2) – since hardly any research reports regarding hearing screening in these contexts could be traced (Swanepoel et al., 2004:634). The incidence of risk factors and hearing loss must be determined alongside the best practice in screening, tracking and follow-up protocols. These pilot sites could then be developed to become centres of excellence that may serve as examples to other sites in generating relevant research to guide accountable practice in these South African contexts.
- An important and unique aspect that requires investigation is the effect of HIV exposure and infection on the incidence of congenital, delayed onset, and progressive hearing losses (Matkin et al., 1998:152). The high prevalence of HIV-infected mothers in South Africa provides an opportunity to conduct large-scale studies to investigate the effect of the infection on infant hearing (Swanepoel et al., 2004:634). This will establish whether HIV should be added to the list of high risk indicators for hearing loss especially in a country like South Africa.

- Parental anxiety and perceptions regarding hearing screening among the South African population are two other very important aspects that require investigation. Parental anxiety can potentially interfere with maternal infant attachment and cause abnormal parenting behaviour and communication (Watkin, 2003:170). Although international reports indicate this cost to be manageable, no such studies have been conducted in South Africa to date (Watkin, 2003:170). The range of cultures in South Africa needs to be investigated to determine attitudes toward and perceptions of screening for each, in order that culturally appropriate approaches may be followed (Beckman, 2002:688).
- Immittance measurements using both 226 and 1000 Hz probe tones need to be investigated in a large group of infant ears over the first few months and controlled for normal and abnormal middle-ear functioning. This should provide comparative data to validate or reject 1000 Hz probe tone immittance as a valuable tool for ascertaining middle-ear functioning.

The empirical results of the current study have provided direction for future research priorities aimed at developing and promoting EHDI services to infants with hearing loss in the developing contexts of South Africa.

7.5. CRITICAL EVALUATION OF STUDY

A critical evaluation of an empirical research endeavour is important to ensure the appropriate interpretation of results within the framework of the strengths and limitations of the research (Mouton, 2001:125). The current investigation of MCH clinics as a hearing screening context has been the first of its kind to be conducted in South Africa. This is despite the year 2002 HSPS compiled by the Professional Board for Speech, Language and Hearing Professions, which recommended MCH clinics as one of three screening contexts for the widespread implementation of newborn and infant hearing screening programmes (HPCSA, 2002:5). Table 7.1 below provides a critical evaluation of

the empirical study based on the strengths and limitations of the data collection method and procedures, as well as of the research participants.

TABLE 7.1 Critical evaluation of the empirical study

DATA COLLECTION
<p>Strengths:</p> <ul style="list-style-type: none"> - A combined qualitative and quantitative method of triangulation was implemented. This approach of convergence and complementarity provides greater insight into a social reality, which allows for a more comprehensive study (De Vos, 2002a:364; Posavac & Carey, 1989:242). Both quantitative and qualitative data was therefore used to provide a wider description of MCH clinics as hearing screening contexts. <p>Limitations:</p> <ul style="list-style-type: none"> - Since no hearing screening programme was in existence at MCH clinics when the study was conducted, an existing programme could not be investigated. This means that a programme was implemented and conducted over a short period of five months, solely for the purposes of the study. The conclusions drawn are therefore representative of a newly implemented programme and not of any existing programmes. For an aspect such as the follow-up return rate this has important implications, since reports indicate improved follow-up rates with increasing numbers of years in operation (Mehl & Thomson, 2002:1; White, 2003:85). - During the five-month data collection period it was not possible to conduct screening every day. Therefore not all infants who visited the MCH clinic during this period were necessarily screened, whereas in an established programme screening would have been conducted more consistently. Although appointments were made for specific days on which to conduct follow-up screening and diagnostic evaluations, a consistent delivery of screening services offers a more flexible schedule for caregivers to return with their infants. Mehl and Thomson (2002:1) report that on-going services over time result in improved follow-up return rates. The lack of such a consistent service and the use of a system of specific appointments may have increased the number of caregivers who did not return for follow-up evaluations. - The HRR, completed by the fieldworkers, evidenced clear misreporting by caregivers in the congenital infection section. When compared to the national incidence of HIV at antenatal clinics, it was clear that HIV status was not reported accurately. This was most likely due to the stigma of HIV infection, which creates many barriers towards disclosing the diagnosis, but it may also be due to ignorance and unconfirmed diagnoses (Spiegel & Bonwit, 2002:134). Closer collaboration with the nursing staff in completing the HRR and informing caregivers of the importance of correct disclosure may have resulted in more reliable documentation of HIV incidence. It might also have helped if information was provided and requested in a culturally sensitive manner that still respects caregivers' rights not to disclose their HIV status. - The inclusion of 226 Hz probe tone immittance measurements that allow comparison between the results of high and low frequency probe tone immittance measurements would have contributed valuable information about the usefulness of both procedures in the population of infants (Margolis et al., 2003:389).

TABLE 7.1 Continued

RESEARCH PARTICIPANTS
<p>Strengths:</p> <ul style="list-style-type: none"> - All fieldworkers had a bachelor's degree or diploma qualification in the communication sciences and had previous experience with neonatal hearing screening and cross-cultural interviewing. Two fieldworkers were also fluent in two or more African languages, which allowed for the collection of biographical and HRR information in caregivers' native or second language. These strengths facilitate collaborative relationships that contribute to successful EHDI programmes (Beckman, 2002:688). - A large sample of subjects was enrolled during the data collection period, which ensured an improved degree of generalisability and representation of the community investigated (Strydom & Venter, 2002:198). The large number of ears from which high frequency measurements were made also increased the sensitivity of norms compiled from the sample acquired in this study. <p>Limitations:</p> <ul style="list-style-type: none"> - The fieldworkers who conducted the screening were not representative of the screening personnel recommended by the year 2002 HSPS (HPCSA, 2002:5), namely nurses and/or lay volunteers. Using such personnel may influence the results of the screening programme and as such the current study is therefore not representative of the recommended screening practice at MCH clinics (HPCSA, 2002:5). - Since, at the time of the data collection, no formal screening programme existed in conjunction with the immunisation programme, all infants between the age of 0 and 52 weeks were included and not only those attending for their 6-week immunisation visit. This means that although the MCH and immunisation clinics were investigated, the study was not confined to the 6-week immunisation clinics for initial screens as recommended by the year 2002 HSPS (HPCSA, 2002:5). The results therefore do not represent only the 6-week immunisation clinics, but rather the broader population of infants younger than one year of age who attended the particular two MCH clinics.

The study in hand succeeded in investigating an important and appropriate South African hearing screening context for young infants in a manner that provides empirical data that can guide contextually relevant clinical implementation and future research. This contributes a unique body of knowledge toward developing hearing screening services in South Africa and addresses the recent international call for developing and establishing EHDI services in the developing countries of the world (White, 2004:28; Downs, 2000:293).

7.6. SERVICE DELIVERY MODEL FOR INFANT HEARING SCREENING IN MCH CLINICS

The clinical and research implications of the empirical study, together with the critical review of the research, constitute an important foundation for the development of future EHDI services at MCH clinics in South Africa. These empirical implications, combined with a theoretical approach, may be used to construct a broader model of EHDI service delivery at these clinics. The exploratory research conducted at the MCH clinics was based on large numbers of subjects that can be generalised to guide clinical practice in the form of a theoretically-grounded service delivery model. Research informs clinical practice and the empirical evidence compiled during the current study can be used in conjunction with a theoretical foundation to develop a service delivery model that informs the clinical practice of IHS at MCH clinics (Fouché, 2002b:97). Such a theoretical model becomes a representation of formalised perspectives that may guide the development of hypotheses for scientific inquiry and the implementation of services or interventions (De Vos, 2002c:38; Fouché, 2002b:97).

The objective of this model is to serve as a working document to complement the year 2002 HSPS (HPCSA, 2002:1) in the form of contextual, evidence-based recommendations and proposed infrastructures. The clinical implications and recommendations generated by the theoretical and empirical research conducted in this study are therefore compiled and presented in the form of a preliminary service delivery model for infant hearing screening at MCH clinics.

The proposed model is a working construct that integrates contextual empirical research evidence with theoretical perspectives (van Dijk, 2003:321). It is presented on three levels, namely 1) service delivery structure, 2) role players and responsibilities, and 3) screening protocol. Figure 7.1 presents the components of this three-tiered service delivery model.

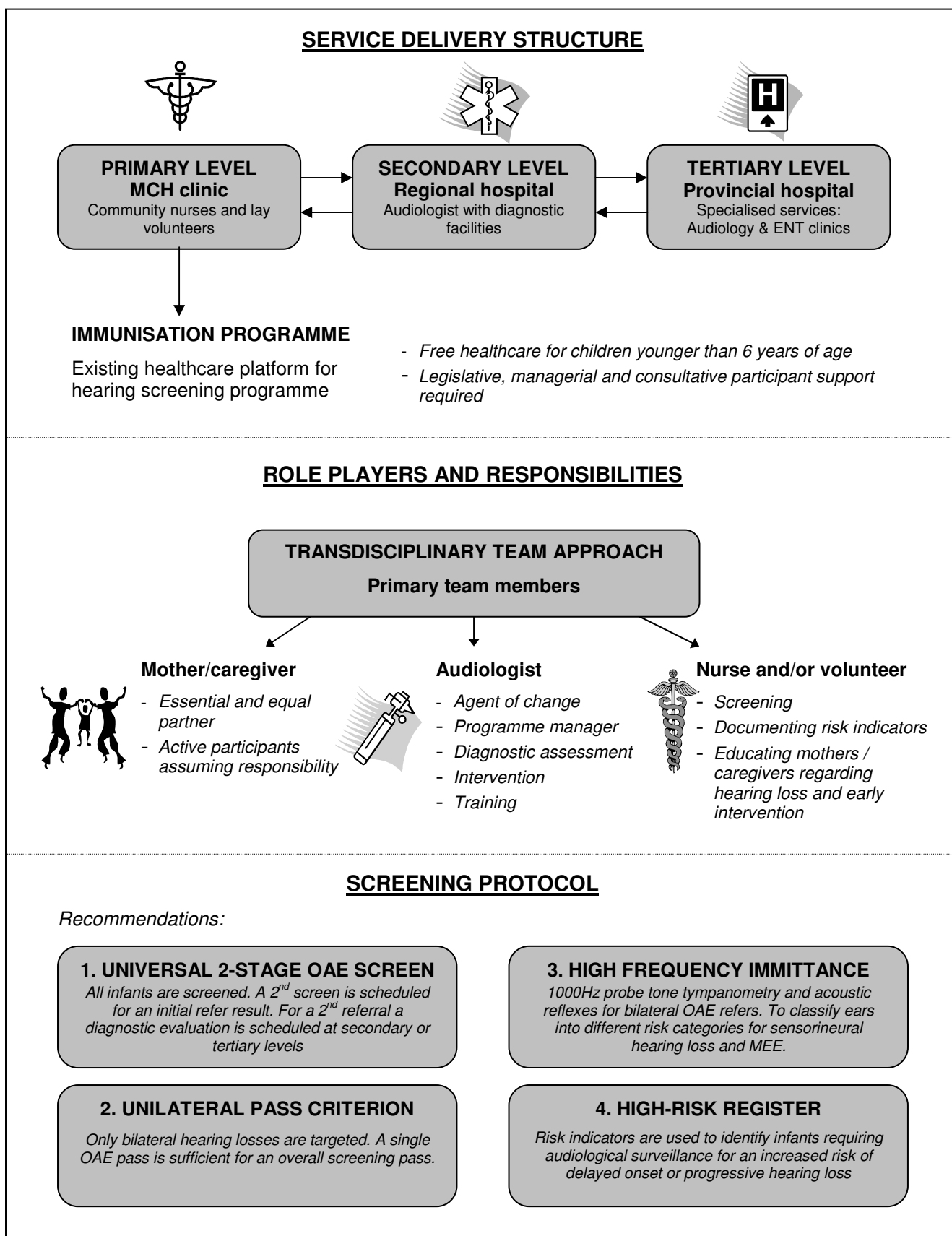


FIGURE 7.1 Service delivery model for infant hearing screening at MCH clinics

7.6.1. Service delivery structure

The Department of Health has tasked MCH clinics to offer free healthcare for children up to six years of age. This package of free services includes immunisation, health surveillance and screening, identification of children with special needs, and basic elements of care and treatment for children with chronic illnesses (Children in 2001, 2000:42). The definition of services at MCH clinics seems to describe a very suitable and natural context for infant hearing screening and **the results of the current study have empirically demonstrated the appropriateness of these clinics as IHS contexts.** The specified services are comprehensive but unfortunately very little developmental screening is performed in actual practice (Baez, 2000:1). To create a workable system for establishing infant hearing screening will require a complete model for the adaptation of, and changes in, service provision at these clinics. This is in agreement with the philosophy of primary healthcare as a continuous process that develops over time and changes to meet new situations (Dennill et al., 1999:56). According to Dennill et al. (1999:56) this “is the only feasible means of meeting the health needs and improving the situation of the people of Southern Africa”. To address this new situation, the following discussion proposes a preliminary service structure as part of the proposed infant hearing screening service delivery model.

The South African government has adopted the primary healthcare approach as the underlying philosophy for the restructuring of its health system. Due to this service delivery approach and the unique characteristics of the South African context, the relevance of early intervention service delivery models from developed contexts is limited (Fair & Louw, 1999:16). As a result, the integration of conventional early intervention models and a community-based model of service delivery as proposed by Fair and Louw (1999:21) is used to guide EHDI service delivery. The individual strengths of the two models are anticipated to be a powerful means of preventing primary, secondary and tertiary communication disorders through community participation (Fair & Louw, 1999:21). **The poor follow-up return rates documented in the current study emphasise the**

need for ensuring community participation through awareness and educational programmes about the effect of hearing loss and the benefits of early intervention.

However, as illustrated in Figure 7.1, the first step toward delivering EHDI services involves legislation and support for early intervention services by the managerial and consultative participants in the community-based intervention process (Fair & Louw, 1999:21). The South African year 2002 HSPS asserts this fact by stating that Provincial Directorates of Finance must accept full responsibility for ensuring that an adequate dedicated allocation of funds is made to enable hearing screening and intervention (HSPS, 2002:4). **Yet, the current study did not observe any hearing screening equipment at any of the clinics studied, despite the recommendation by the HSPS to have equipment available at all MCH clinics by 2005** (HSPS, 2002:5). Lobbying for governmental support is therefore essential to ensure that newborn and infant hearing screening and follow-up services are comprehensive and effective.

This type of support will allow for the implementation of widespread EHDI programmes in South Africa but will require contextual models of service delivery to ensure reliable implementation at all levels of healthcare. As indicated in Figure 7.1, an infant hearing screening service delivery model at MCH clinics will be at a primary healthcare level and should therefore utilise human resources at this level within the community-based intervention model to identify possible hearing losses (Fair & Louw, 1999:17). **Results from the current study indicate that nurses were helpful but disinterested in learning about either hearing loss or the screening process. Creating awareness and providing education programmes for nursing staff should therefore form an important element of introducing EHDI services at MCH clinics.**

Diagnostic services must be available at regional hospitals or health centres. The South African year 2002 HSPS recognises this when it recommends that hearing screening at MCH 6-week immunisation clinics should be integrated within the District Health Services model. The proposed service structure for an infant

hearing screening service delivery model at MCH clinics in South Africa is illustrated in Figure 7.2.

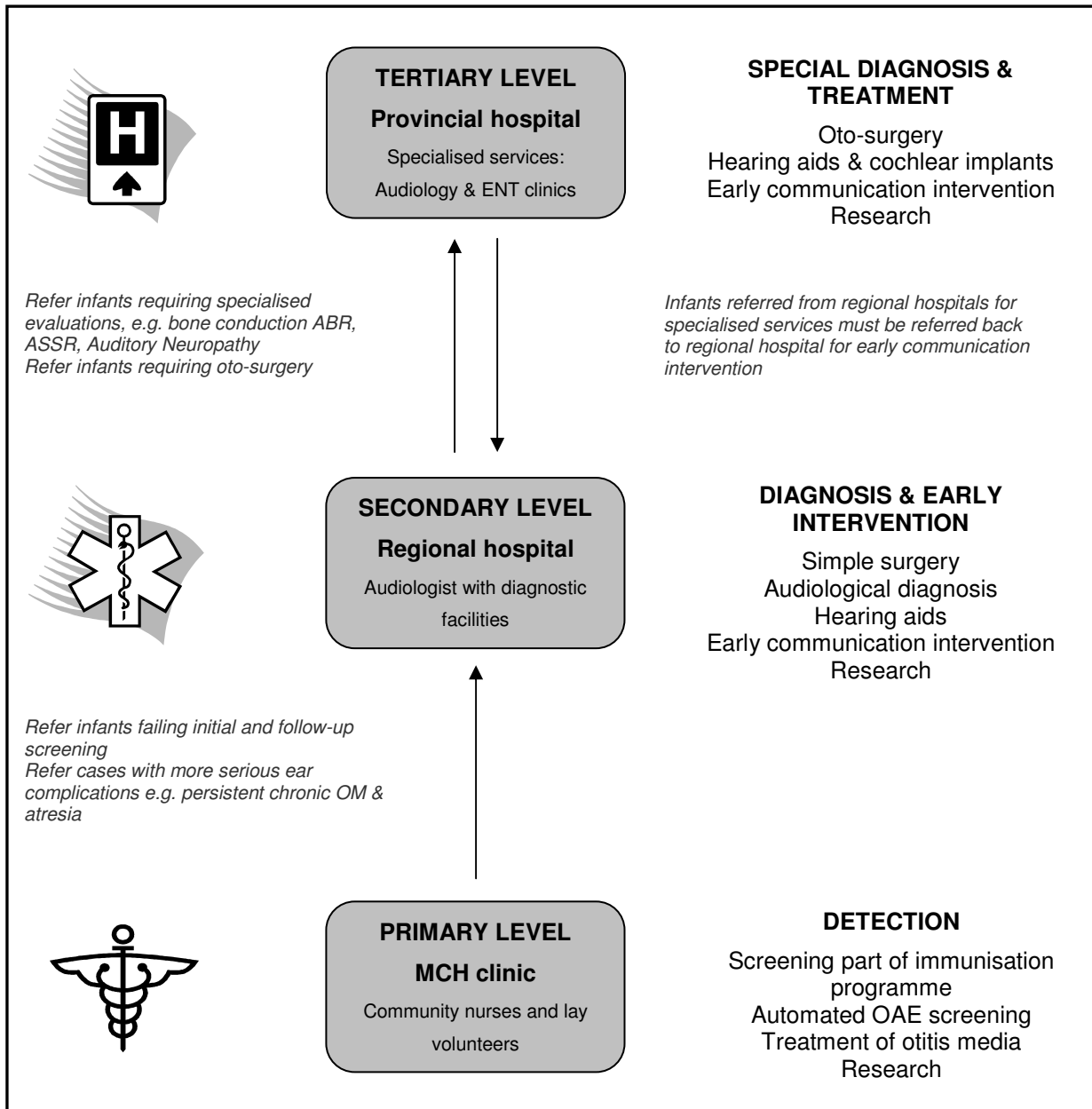


FIGURE 7.2 Service structure for infant hearing screening at MCH clinics

The national programmes of immunisation, as supported by the expanded programme on immunisation (EPI) initiative of UNICEF, can serve as an effective

existing healthcare platform from which a hearing screening service can be initiated (Olusanya et al., 2004:297). Using the immunisation programmes as a platform for hearing screening (as indicated in Figure 7.2) will ensure that a comprehensive coverage of infants is attained, seeing that only 2% of South African children between the ages of 12 and 23 months receive no vaccinations (*Children in 2001*, 2001:75). A recent report indicated that 79% of all infants in South Africa were fully immunised by one year of age (Solarsh & Goga, 2004:121). This percentage could ensure an almost 80% coverage for hearing screening before six months of age, as the first immunisation is recommended at 6 weeks of age. Follow-up screenings may also be scheduled alongside second immunisation visits at 14 weeks of age (3.5 months) to ensure high follow-up return rates (Day et al., 2004:404). **The fact that poor follow-up return rates were recorded during the current study emphasises the importance of arranging follow-up appointments for the 2nd stage OAE screen or a diagnostic evaluation to coincide with follow-up immunisation visits.**

A concern regarding the screening of infants who come for their immunisation visits, however, is that hearing loss may not be identified before the recommended three months of age (HPCSA 2002:5) since some of these infants may only be brought into the clinic for their first immunisation later on during the first year of life (*Children in 2001*, 2001:75). The Department of Health has fortunately put forward a recent strategic plan to ensure that full immunisations are achieved for all infants by one year of age, with an intermediate step of 90% national coverage by 2005 (Solarsh & Goga, 2004:113 & 122; *Children in 2001*, 2001:75).

Another concern is that, even when infants are screened at exactly six weeks of age on their first immunisation visit, it allows limited time for follow-up and confirmation of hearing loss before three months of age (JCIH, 2000:15). For hearing screening in well-baby nurseries and NICUs a cut-off age of three months old may be a reasonable benchmark for South Africa, but at MCH clinics this might prove very difficult to attain. Realistic benchmarks must therefore be

determined for ages at which hearing loss can be identified, that will coincide with immunisation visits to MCH clinics.

Generally the results from the current study indicate that, **despite obvious practical obstacles such as high noise levels, interruptions in electricity and water supply, as well as safety concerns, the MCH clinics provide an adequate platform for conducting hearing screening.** The healthcare system has also recently identified the need to upgrade these primary healthcare facilities, which promises to enhance the suitability of MCH clinics as a hearing screening context in the future (Day et al., 2004:345).

7.6.2. Role players and responsibilities

The implementation of comprehensive services for the early detection of hearing loss must rely on a transdisciplinary team approach that facilitates collaborations and that is essential for community-based early intervention services (Moddley et al., 2000:37). As indicated in Figure 7.1, the three primary role players in the infant hearing screening service delivery model at MCH clinics are identified as caregivers, audiologists, and nurses or volunteers.

- **Caregivers**

Collaborative hearing services that are family friendly are necessary for success. This conviction is based on the premise that any success a child achieves will be through family intervention, and therefore the family must be an essential and equal partner in the hearing management team (Mencher et al., 2001:8). The South African HSPS acknowledges this when it states that the members of the transdisciplinary team includes first of all families, followed by the other professionals (HSPS, 2002:4). **Results from the current study indicate that the majority of caregivers evidenced a willingness to participate actively in the screening process and this is promising for effective collaborative transdisciplinary teamwork where caregivers are the primary role players.**

- **Audiologists**

Audiologists are central to this service delivery model, as indicated in Figure 7.1, and should act as agents of change in the implementation thereof. Due to the advanced technological apparatus associated with the practice of audiology and a general lack of knowledge regarding the profession, it is occasionally wrongly assumed to be an unsuitable profession for PHC services. According to Moodley et al. (2000:37), however, it is imperative that audiologists be proactive in determining appropriate ways of delivering early intervention services at PHC clinics. Audiologists who serve infants and young children with hearing loss and their families must consider themselves to be early interventionists and, therefore, part of an early intervention team (English, 1995:117). The families together with the professionals render the necessary services within a family-focused, transdisciplinary team model (HSPS:2002:4). It is the audiologist, however, who supervises the screening programme in the capacity of programme manager (HSPS, 2002:4).

In the proposed service delivery model illustrated in Figures 7.1 and 7.2, the audiologist provides services from a regional or provincial hospital but also manages, coordinates, and assesses the hearing screening programmes at the MCH clinics. The JCIH Year 2000 position statement (2000:13) specifies the role of the audiologist for the hearing screening component as “development, management, quality assessment, service coordination, and effective transition to evaluation, habilitative and intervention services”. The audiologist must ensure that the services are effective and the referral system is efficient. A database must also be kept as part of a national information infrastructure. The following types of data must be collected: number of infants screened; number of infants referred for follow-up; number of infants referred for diagnostic assessments; number of infants with hearing loss, number of different types of hearing loss; number of infants whose hearing was evaluated before 3 month of age; the mean, median, and minimum age of diagnosis, etc. (HSPS, 2002:7).

For the follow-up component the audiologist's role entails "comprehensive audiologic 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" (JCIH, 2000:13). The poor follow-up return rate of the current study indicates that audiologists will have to be resourceful in finding ways through community participation to ensure that caregivers become active participants in returning their infants for follow-up appointments (Louw & Avenant, 2002:147). For the early intervention component the audiologist should provide "timely fitting and monitoring of amplification (sensory devices and assistive technology) with family consent, family education, counselling and ongoing participation in the infant's service plan" (JCIH, 2000:13).

Timely and efficient confirmation of hearing loss for infants screened during 6-week immunisation visits at MCH clinics will require an integrated multi-disciplinary follow-up system. The audiologist must play a key role in the process of developing a comprehensive integrated system for tracking and follow-up of referred infants and caregivers within the South African national healthcare system as illustrated in Figure 7.1. Poor follow-up rates are characteristic of programmes in the initial phases (Mehl & Thomson, 2002:1) and emphasise the responsibility of audiologists to strive for optimal follow-up rates by sustained effort and dedication as programme managers.

An important role of the audiologist will be to train the nurses and/or volunteers who will be conducting the screening. Interdisciplinary training programmes to empower the nurses and/or volunteers are necessary to ensure that the screening is conducted in an accountable manner (Moodley et al., 2000:36). **Results from the current study indicate that the interactional processes between nurses and audiologists are an essential part of ensuring successful screening programmes.** Training programmes need to address the fact that screening personnel should educate the mothers/caregivers about the importance of returning for follow-up appointments, the effect of late-identified hearing loss, and the benefits of

early identification and intervention. **The current study indicates that poor follow-up rates were a consistent obstacle in the way of successful hearing loss identification and this problem may be addressed by educating mothers and caregivers about the importance of early identification.** Mothers who are better educated are more likely to return for the full set of vaccinations and probably also for follow-up hearing screenings and evaluations (*Children in 2001*, 2001:75). Positive changes will require culturally sensitive efforts towards enhancing public awareness in antenatal clinics and in communities regarding the benefits of early identification and the disadvantages of lack of timely intervention (Bamford, 2000:365; Louw & Avenant, 2002:147).

- **Nurses and/or volunteers**

According to this model it is recommended that community nurses and volunteers perform the initial hearing screening as illustrated in Figure 7.1 (HSPS, 2002:4). Community-based primary healthcare nurses are the frontline health professionals in the early intervention team, since they have direct contact with at-risk infants and are based at primary healthcare clinics that are accessible and affordable to the majority of the South African population (Moodley et al., 2000:26). The primary healthcare clinics therefore constitute the obvious place where infants should receive developmental screening and presents as an ideal context for identifying hearing loss early (Moodley et al., 2000:26). In addition, the community nurses outnumber the audiologists by more than ten times (Moodley et al., 2000:26). Nurses are key team members in identifying infants with hearing loss because almost all babies visit a clinic during their first three years of life (*Children in 2001*, 2001:75). **The current study reports that nurses are a valuable asset in ensuring that risk factors for hearing loss are documented accurately.** Although nurses already have many responsibilities, the gains that can be made by developmental screening (e.g. hearing screening) are so great that sustained efforts should be made to incorporate such screening into a community nurse's day (Baez, 2003:2).

Lay volunteers have also proved to be a valuable human resource in neonatal hearing screening programmes (Downs, 2002: personal communication). This could be of significant value in South Africa where resources are already limited and there is a lack of healthcare professionals who are fluent in African languages. A community volunteer can be any person as long as he/she is motivated, has literary skills and a positive, respectful attitude towards all people (McConkey, 1995:72). The volunteer must receive appropriate training according to SAQA accredited training modules and should be presented by speech-language therapists or audiologists (HSPS, 2002:4). The training must empower the screening personnel to educate mothers and caregivers about the importance of returning for follow-up appointments, the effect of late-identified hearing loss, and the benefits of early identification and intervention **in order to ensure a higher follow-up return rate than the number reported in the current study** (*Children in 2001*, 2001:75). According to McConkey (1995:71) the quality of the training will often determine the quality of the programme.

7.6.3. Screening protocol

A hearing screening protocol, based on the outcomes of both the theoretical and empirical investigations conducted during this study and illustrated in Figure 7.1, is recommended for use in MCH 6-week immunisation clinics. The recommended protocol is a working suggestion for the initial implementation of hearing screening in MCH 6-week immunisation clinics in response to the recommendations by the year 2002 HSPS (HPCSA, 2002:2). As illustrated in Figure 7.1, the protocol recommends the following: 1) universal 2-stage OAE screen, 2) a unilateral pass criterion, 3) high frequency immittance measures to classify degrees of risk, 4) High-Risk Register (HRR) for audiological surveillance. The rationale for these recommendations as compared to the year 2002 HSPS recommendations and evidenced in the current study is discussed in the following paragraphs.

Instead of screening only the high risk infants who attend clinics, as recommended by the year 2002 HSPS (HPCSA, 2002:5), a universal screening using a unilateral pass criterion is recommended. In the past, targeted screening was recommended as a way of screening a small percentage (~10%) of infants to obtain a significant (~50%) yield of present hearing losses in a birth cohort. **Although excellent coverage (99%) based on the HRR was obtained during the current study, there are serious concerns about such a targeted infant hearing screening programme at the MCH clinics in South Africa.**

The current study suggests that the prevalence of risk factors in primary healthcare clinics in South Africa may be twice as high as in developed countries (Kennedy et al., 1998:1959; Mahoney & Eichwald, 1987:161; Vohr et al., 2000b:380). If HIV status is considered as an additional risk factor for hearing loss, this figure will rise even more significantly. This increased prevalence of risk factors implies that a large number of infants will require thorough bilateral screening, which calls for more human and economic resources. **The current study shows that if only high risk infants were screened, 77% of infants with bilateral OAE refer results would have been missed.** This means that two-thirds of the infants at highest risk for bilateral hearing loss would not have been identified by the risk factors. Furthermore, infants identified through targeted NHS have a significantly higher incidence of secondary disabilities than infants without risk indicators. This means that the children presenting with hearing loss only, in other words those who have the highest potential for success, are most likely to be missed (Yoshinaga-Itano, 2004:462).

Since it is recommended that the OAE equipment be made available at the MCH clinics to conduct targeted screening (HPCSA, 2002:5), it may well prove more productive to screen all infants who attend the clinics by using an efficient unilateral OAE pass criterion. This will ensure that existing resources are used (OAE equipment recommended for targeted screening by the year 2002 HSPS) to identify bilateral hearing loss, which impacts most significantly on a child's development, for the entire population. A unilateral pass criterion implies a much-reduced screening time, since only one ear is required to pass and therefore in

the majority of cases only one ear will require a screen. In addition to this, by applying a unilateral OAE pass criterion, the monetary and human resource requirements for conducting follow-up evaluations would be reduced significantly. **In the current study the referral rate dropped from 14% to 3% when a unilateral pass criterion instead of a bilateral pass criterion was applied** – which is within the specified benchmark of the JCIH (2000:15) and the South African HSPS of a <5% referral rate (HPCSA, 2002:3).

The fact that a screening protocol for bilateral hearing losses will curb resource expenditure must however be evaluated against the cost of not identifying a group of infants with unilateral hearing loss. Although research shows that unilateral hearing loss does in fact influence developmental and emotional outcomes in children (Bess et al., 1998:339), limited resources and a lack of research to demonstrate the effectiveness of early intervention for unilateral hearing loss inevitably accord a higher priority to the identification of bilateral hearing loss over the more expensive identification of unilateral hearing loss (Lutman, 2000:368; Davis et al., 1997:73). Considering the South African national health context with its limited resources and health priorities skewed toward more life-threatening diseases such as HIV and tuberculosis, a screening protocol for bilateral hearing loss only may be a suitable initial option. More comprehensive services may subsequently be built upon such initial programmes and there is still a place for the HRR to identify infants who are at risk for delayed-onset and progressive hearing loss (JCIH, 2000:21).

Based on the results of the current study, the recommended screening equipment to be used at MCH clinics is OAE rather than AABR instrumentation. The screening protocols that were implemented revealed the inadequacy of AABR screening at these clinics in contrast with the efficiency of OAE screening. Conducting an AABR screening on infants past neonatal age becomes increasingly difficult since the babies are more restless and irritable and they become less trusting of unfamiliar personnel as they grow older (Palmu et al., 1999:211). Since the AABR requires more preparation in the form of placing the electrodes and ensuring sufficient impedance, it becomes more

difficult to test the infants, whereas a simple OAE procedure requires only a probe placement, which results in a shorter average test time. Although the AABR may provide a lower refer rate in newborns (Hall et al., 2004:423), **the AABR procedure could only be performed successfully on 26% of the ears that required an assessment in the current study. This fact demonstrates the AABR's inefficiency in respect of older infants to be screened at MCH clinics.**

As illustrated in Figure 7.1, a two-stage OAE screening is recommended. This implies that all infants are screened with OAE and those requiring follow-up appointments are screened for a second time using the same procedure. An OAE refer result for a second-time screen will lead to the scheduling of a diagnostic evaluation at a secondary or tertiary hospital. In addition to OAE, **the use of high frequency immittance measurements may be useful in classifying ears into different risk categories for sensori-neural hearing loss and MEE.** Based on this information it will be possible to determine the need for medical management, as well as the need for and timing of follow-up hearing assessment procedures that will also require initial referrals to either otorhinolaryngologists or audiologists (Margolis et al., 2003:384). Although additional research is required, preliminary risk categories according to 1000 Hz probe tone results of the current study are as follows:

- If a peaked tympanogram is obtained and an acoustic reflex is present, normal middle-ear functioning is strongly indicated.
- If the tympanometry indicates a flat tympanogram and an absent acoustic reflex threshold, it will be strongly indicative of a middle-ear conduction problem such as MEE.
- A mixed result indicating an OAE refer, tympanogram peak and absent reflex will be a high-risk combination for sensori-neural hearing loss.
- An absent OAE and a flat tympanogram with a present reflex are rare and more difficult to interpret. Such a result may be due to a mild conductive MEE that could lead to an OAE refer and a flat tympanogram, but that presents with a present reflex at maximum intensities.

Reliance on a single infant hearing screening technology makes it virtually impossible to identify dysfunction secondary to middle-ear disorders (Hall et al., 2004:423). Although the inclusion of an AABR can help to make this distinction, this procedure has not proved effective in the population of infants attending MCH clinics. Reliance on a faster and more efficient technique such as high frequency immittance will be more valuable at these clinics.

The above infant hearing screening service delivery model is proposed in response to the recommendations by the Year 2002 HSPS (HPCSA, 2002:5) as a feasible step toward providing more comprehensive infant hearing screening programmes for the majority of South African infants to the benefit of those infants with hearing loss, their families and society in general.

7.7. FINAL COMMENTS

The basic rationale behind newborn and infant hearing screening is that “early detection followed by early intervention maximises the benefits the child, family, and society will receive” (Diefendorf, 2002:469). Ensuring these benefits remains a challenge, especially in a resource-poor country like South Africa where a non life-threatening yet debilitating condition such as hearing loss does not receive the institutional support, research funding and political advocacy that it deserves (Swanepoel et al., 2004:634).

It is the responsibility of the audiological community in South Africa to meet the challenge of developing early hearing detection programmes for the entire population in order to ensure that infants with hearing loss may develop to their maximum potential. This must be achieved primarily through contextual research that reveals the extent and impact of hearing loss alongside the standard and scope of otological and audiological services in South Africa. These endeavours are required to gain governmental support and will ensure a contextually relevant course of action towards implementing widespread newborn and infant screening

programmes that are incorporated into primary and secondary healthcare, thus becoming an integral part of a national health and education system.

In the pursuit of comprehensive First World hearing healthcare for South African infants, the audiological community must be content to start with small-scale infant hearing screening (IHS) services against the backdrop of a country with no formalised public healthcare screening programmes to identify infants with hearing loss. This must, however, be accompanied by a relentless quest for continued growth and improvement in IHS services delivery over time. Initial steps toward comprehensive services need to start with pilot screening programmes that take the lead in providing feasible and accountable services, which can serve as examples for future programme implementation on a wider scale. These pilot sites will provide an infrastructure that can serve as a platform for contextual research and further improvements in service provision suited to each context. In line with these ideals, the current exploratory study provides data that indicates the usefulness of MCH clinics as an IHS context and suggests working recommendations for the future direction of early identification and intervention services for infants with hearing loss in South Africa.

The ultimate goal is to have “screening programmes that improve hearing healthcare for all infants in a cost-effective and accountable manner” (Swanepoel et al., 2004:635). EHDI programmes have proved that “hearing loss need not impede typical development, place an individual at a functional disadvantage, or alter ultimate outcome” (Herer et al., 2002:224). It is time that the hearing loss barrier be minimised for children in South Africa, and that the benefits and improvement of quality of life associated with early identification and intervention become a reality for the infants who suffer hearing loss in South Africa. Children with hearing loss are as much part of the future of the country as those with normal hearing and it is through effective EHDI services that the active participation of these children will be secured among their hearing peers to change, influence and direct the future of South Africa.

“The problems of deafness are deeper and much 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 thought astir, and keeps us in the intellectual company of man.”

Helen Keller (Keller, 1910)