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AUDIOLOGICAL PRACTICE AND SERVICE DELIVERY IN SOUTH AFRICA

A MASTERS RESEARCH REPORT PRESENTED TO

THE DISCIPLINE OF SPEECH PATHOLOGY AND AUDIOLOGY

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TIRUSHA NAIDOO

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ABSTRACT

The Audiology profession in South Africa appears to be lacking direction. Many challenges to Audiology service delivery are said to exist. However, no official national investigation regarding the range of audiological services provided has been conducted. The *purpose* of this study was to investigate at a national level, the demographics of Audiologists in SA, to conduct an audit of service delivery, and to identify issues impacting on audiology service delivery. Respondents were requested to indicate reasons for non-provision of audiology services. Research participants included all South African qualified Speech-Language and Hearing Therapists, Audiologists, Speech Therapist and community service graduates currently registered with the Health Professional Council of South Africa. A cross-sectional ex post facto, descriptive survey research design within the quantitative paradigm was selected. Descriptive statistics were utilised to analyse the data and were presented to display service delivery provided by respondents employed in the private and public sectors. *Result*s: A significant difference in professional registration and practice was evident. The audit of service delivery revealed that the provision of advanced diagnostic audiology procedures, paediatric audiology services as well as rehabilitation services was significantly lacking. Audiology service delivery in both the public and private sector were analogous. The lack of equipment was a central reason for the non-provision of services amongst all respondents. Key issues influencing service delivery included the lack of knowledge by associated professionals and the public, delayed referrals, limited budgets, lack of staffing, and restrictions regarding advertisements. *Conclusion:* The profession of audiology in SA is under transition. The scope of audiology service delivery is slowing moving towards the implementation of advanced diagnostic audiology services however support from associated professionals is lacking. To this end the Audiology profession in SA must focus on advertisement and marketing regarding the range and clinical relevance of audiological services available. Future directions for the profession include the development of unified test protocols and norms, forming data bases, equipping audiology departments, and hosting a forum to discuss a vision of audiology services in SA.

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INTRODUCTION

1. Rationale

“Despite their many insights, the founders of audiology could have not envisioned ways in which this profession would evolve to meet the needs of the children and adults with hearing impairments. Breakthroughs continually come in the areas related to the study of audiology that include the principle of human hearing and the diagnosis and remediation of hearing loss. This profession is more exciting today than ever before” (Martin, 1997: p xi)

Within the South African (SA) context the vision of the audiology profession, and scope of audiology practice, appears to be the topic of much discussion amongst professionals. The remarkable and rapid expansion in the range of audiological tests and (re)habilitation services available today, as encapsulated in the above quotation, has been the direct result of technological advances. Audiologists are expected to include these new clinical tools and expanded range of services into their everyday practice but literature continues to highlight that although the provision of updated, quality services to all persons is imperative, factors such as large case loads, cost of purchasing new equipment, manpower and socio-economic imbalances are reportedly impacting on service delivery (Lubinski and Frattali, 2001, Swanepoel 2004). Thus, the objective of this study was to obtain a ‘snap-shot’ of audiology practice in the country and to identify key reasons impacting on each area of practice by conducting a national audit of audiological services provided by audiologists qualified and practicing in South Africa. The study also aimed to explore the possible contributing variables impacting on service delivery in the private and public sectors.

Further, research regarding movement and changes in the profession appear to be necessary. International literature has noted that the Audiology profession seems to be rapidly diversifying, and at times it seems difficult to recognise the affinity between audiology services performed in one context versus another, or to acknowledge that the audiologists performing the various services are part and parcel of the same discipline. It has become difficult to stay abreast with where and how audiologists work because of the rapid shifts in audiologists' professional alliances and workplace settings (Hosford-Dunn, Roeser and Valenate, 2000). Such demographic information has not been collected in this country on a national scale, nor has the trend in audiology practice in different workplace settings and sectors been documented. Therefore collection of demographic information and an audit of services were included as specific aims of this present study.

Further, the literature reviewed clearly indicated that this study was not only necessary but is also important towards understanding audiology service provision and contributing factors influencing delivery. In addition this study was relevant, as the current *White Paper on the Transformation of the Health System in South Africa* emphasizes the need for quality service provision which involves meeting clients' expectations and providing health professionals with adequate resources to carry out their job effectively (Department of Health, 1997:p5-6, Nzanira, 2002). Thus the information gathered in this study would serve to inform government and heath service providers about the position of audiology practice in SA and issues that needed to be addressed. Also, the SA Department of Health has recently ratified the proposed Certificate of Need for healthcare services, including Audiology (National Health Act, No. 61 of 2003). However without information regarding the demographics of Audiologists, the service demands and service needs in various geographical areas, such decisions may be reached inappropriately.

As a first attempt to investigate the above areas at a national level, this research is not only relevant to assessing audiological service provision, but would also serve to inform the profession concerning standards of practice and would hopefully raise service delivery issues that should be timeously addressed. According to Bamford et al. (2001) consensus statements, guidelines, audits and protocols are now concepts that should be familiar to health care service providers as these serve to ensure quality service provision. In addition, the performance of quality assurance measures is necessitated not only to improve the quality of services provided, but also to reduce practice variability and inequity of service provision (Bamford, Beresford, Mencher, De Voe, Owen and Davis, 2001, p 213)

To this end, this research proposes an audit of audiological services in South Africa. To the best of the researcher's knowledge no such audit has been carried out in recent years. As a result: a) Existing Scope of Practise guidelines may not accurately reflect the practice of Audiology in the South African context b) the demographics of Audiologists is unknown, thus Audiology posts/services may not be appropriately aligned with the population to be served and c) common primary issues concerning audiological service delivery nationally have not been formally documented through research.

2. Literature Review

Innovation in audiology practice has lead to more accurate assessment and treatment of clients. Although technological improvements brought the promise of superior testing and intervention options, there are many additional factors that contribute to the efficacy and quality of service provision. The literature review to be presented will provide a brief over view of the profession to highlight the complexity of audiology and the role of an audiologist, followed by discussions concerning factors influencing audiology service delivery locally and

internationally and professional matters impacting on the audiology profession in South Africa.

2.1 Overview: The Audiology Profession

The word *audiology* literally means the science of hearing (Martin, 1994). Thus the central focus of the profession of Audiology is concerned with all auditory impairments, and their relationship to disorders of communication. The essential goal of audiology services is to optimise and enhance an individual's hearing ability, as well as to improve the efficacy of his/her everyday communication. All professional activities related to this central focus fall within the purview of Audiology (American Speech and Hearing Association (ASHA) 2004; Academy of Audiology (AAA), 2000).

As a profession that emerged after World War II to address the rehabilitation needs of hearing impaired war veterans, Audiology now stands as a fully fledged autonomous health profession, with services extending to diagnostics, amplification, re(habilitation), screening and counselling (Katz, 2002, Martin, 1997). Audiology today includes a number of subspecialties including Diagnostic Audiology, Paediatric Audiology, Industrial Audiology, Educational Audiology and Aural Rehabilitation (Martin, 1997).

Service delivery settings extend across hospitals; community health clinics; rehabilitation clinics to schools; tertiary institutions; the military; industry and hearing aid companies. Audiological services are provided to individuals across the age span, from new born babies through to geriatric clients; across ethnic, cultural language and socio-economic backgrounds and to individuals who have multiple disabilities (Lubinski and Frattali, 2001). The development of more effective instruments for specialized testing and management procedures has resulted in more accurate assessment and management of all age groups,

an important development being the array of evoked bioelectric responses referred to as auditory evoked potentials (AEPs) (Stach, 2002).

Professional competencies and acceptable standards of clinical and ethical practice are compiled in, what has been termed 'Audiology Scope of Practice' statements. The two main international organizations that have developed the scope of practice statements for audiology are the American Speech and Hearing Association (ASHA) and Academy of Audiology (AAA) (Hosford-Dunn, Roeser and Valenate, 2000). In South Africa, the Professional Board for Speech Language and Hearing professions of the Health Professionals Council of South Africa (HPCSA), in conjunction with the South African Speech-language Hearing Association (SASLHA) and the South African Audiologist Association (SAAA), are responsible for overseeing the scope of practice statements for the audiology profession. These Scope of Practice statements are based on what the profession is, and relate to what the profession does.

Common audiological service areas in Scope of Practice documents include: prevention, identification, assessment, diagnosis and non-medical management of disorders of the auditory system i.e. amplification, rehabilitation and counselling. The following discussion will serve to highlight the complexity and multifaceted nature of the conventional practice of audiology and why audiology is truly a specialized field. According to Scope of Audiology Practice documents (ASHA, 2004, HPCSA, 2004), each of the areas of audiological service delivery is unique in aims and outcomes, with the roles of the Audiologist being specific to each area as follows:

Identification involves the development and overseeing of hearing screening programmes. The purpose of screening is to provide a quick method of identifying whether or not a hearing

problem exists and making appropriate referrals to further investigate the problem. The most recent development in this area has been (Universal) Newborn Hearing Screening (UNHS) which has been declared a mandatory service globally, towards the goal of early intervention (WHO, 1990). The driving notion behind UNHS was that the earlier the hearing loss was identified, the sooner the process of diagnosis would begin and management options could be explored and implemented.

The process of making a ***diagnosis*** for hearing or balance disorders includes the administration and interpretation of behavioural and electrophysiological measures of the auditory and vestibular systems respectively. Diagnosis is accomplished by using standardized testing procedures and appropriately calibrated instrumentation, together with the audiologist's interpretation of these measures, case history taking and the use of the audiologist's clinical judgement.

Neurophysiologic monitoring involves the administering and interpretation of electrophysiological measurements of neural functioning including sensory and motor evoked potentials, tests of nerve conduction and electromyography. These measures are important for differential diagnosis, pre and postoperative evaluation of neural function, and neurophysiologic monitoring of the central nervous system.

Treatment or otherwise termed **"**management" options for hearing loss include, but are not limited to, hearing aids; cochlear implantation; aural rehabilitation and manual communication skills (e.g. sign language, assistive listening devices; tinnitus management as well as vestibular and balance rehabilitation therapy). The (re)habilitation process involves exploring and deciding upon the best management option for the client, according to the clients' communication needs, age, cultural beliefs and environment

Hearing Loss Prevention and Awareness Programmes: Hearing loss can be congenital or acquired postnatally, or later on in life. Whilst acquisition of hearing loss through some avenues may be preventable, others are a direct consequence of disease such as rubella (German measles), human immunodeficiency virus (HIV), acquired immune deficiency syndrome (AIDS) and cytomegalovirus (CMV). (Martin, 1997), thus emphasising the dire need for public awareness programmes that address the causation of hearing loss and treatment. In the area of prevention, audiologists are responsible for the designing, implementation and coordination of community, industrial and recreational hearing loss prevention programmes. Such programmes are a vital service that could result in lower incidence of hearing loss.

Research: The advancement of the profession, as any other, is reliant on research.
Clinical research is especially important for assessing and improving the validity and reliability of test measures and treatment tools, devising new testing procedures and treatment options (Katz, 2001) and is central to evidence based practice (Wolf, 2001: 340). Additionally, natural evolutions are occurring simultaneously in areas outside of audiology. These external changes stem from technological advances through to consumer demands. With these changes, arise areas of research such as service provision, client needs and assessment of services and practice management (Hosford-Dunn, Roeser and Valenate, 2000).

Despite the dire need for the service offered by audiologists, the profession of Audiology has and continues to experience various obstacles to service delivery, and seems to be rather undervalued globally. In the following discussion, the researcher will present a review of factors influencing audiology service delivery

2.2 Factors Impacting on Audiology Service Delivery: International and Local Issues

In the researcher's experience, through hearsay and informal discussions amongst South African audiologists employed in various settings, challenges impacting on service delivery such as lack of equipment, lack of training, lack of staff, budget cuts etc. have surfaced. However a proper investigation documenting these workplace related issues has not to date been conducted. South African Audiologist, Hugo (1998) stated that "Conservatively estimated, the population of persons with a communication disorder forms approximately 10% of the total population of 44.8 million people. It remains inconceivable that despite this high occurrence, and with the exceptional emphasis placed on the importance of communication today, the role of communication pathology (including hearing disorders) is still not significantly recognised".

In the international arena, surveys conducted in 'wealthy' developed countries such as England and Europe highlighted similar issues impacting on audiological service. In September 2002, The Royal National Institute of Deaf People (RNID) reported findings of a survey conducted on 111 audiology departments within the National Health Service (NHS) clinics across the United Kingdom. In this report the plight of audiology was depicted as follows: "Within most National Health Service (NHS) Trusts there is a service, far too often to be found in a cramped, inhospitable corner that could transform the lives of literally millions of patients each year at less cost per capita than an overnight stay in hospital. This is Audiology".

In May of 1999, The Royal National Institute for the Deaf (RNID) concluded an investigation on equipment resources and waiting periods in public audiology clinics across England and Whales. This report acknowledged the long waiting times for basic services and hearing aid fitting as key indicators of service performance stating that "*long waiting times are*

symptomatic of services that are not appropriately structured or staffed to meet demand". Other key findings included: a) Long waiting times were a symptom of stress on the service, whereby people were waiting a year to have hearing tested and 5 months to a year to be fitted with hearing aids, b) Inadequate investment and funding as audiology faced continuous budget cuts, c) Inadequate staff to meet demand or give enough time to meet with patients to provide counselling for rehabilitation and, d) Crumbling infrastructure indicted by inadequate accommodation and lack of modern equipment and facilities, as a major concern and priority for change.

In the 1990's, the ASHA Ad Hoc Committee on Hospital and Health Services also focused on developing and implementing strategies to address major issues affecting delivery of speech-language and audiology services in US hospital settings. Some of these issues included: a) Limited upward mobility for many speech-language pathologists and audiologists in hospitals; b) While physicians and other health care professionals are the basis for referrals in a hospital setting, they remain largely unaware of the scope of the profession; c) It was difficult to fill hospital vacancies; d) Alternative staffing models (e.g. "speech aids", multi-skilled health care providers) may decrease recognition and level of professional autonomy of the speech-language pathologist and audiologist, and can potentially reduce access to and quality of services, and e) Medical coverage policies specify exclusions and restrictions that effect delivery of speech pathology and audiology services and remain uninformed about costs/benefit and length of treatment (ASHA, 1990: 193-98).

Developed countries continue to address these imbalances and challenges that face audiology services. Reports evaluating service delivery and trends in practice compiled by organizations such as the RNID and ASHA serve an important purpose of officially presenting areas of concern and deliberation. In South Africa such reports and surveys have not been

compiled by professional bodies. These documents have a crucial role of raising common issues impacting on service delivery and proposing strategies to address such matters.

Each work context has issues that influence the type and quality of services offered (Lubinski and Frattali, 2001). Stakeholders need to be made aware of the detrimental impact these factors would have on audiology service delivery, if they remain unresolved and change is not implemented soon. Audiologists seem to be presented with a challenge of providing quality, appropriate and updated services in the most cost effective and time efficient manner (White 2002: pg738).

In the broader context of a country additional factors such as the 'over all' well being of a country's population; health care infrastructure; economy; and social factors contribute to delivery of health services This certainly applies to South Africa as highlighted by South African Audiologist, Swanepoel, (2004:11) who noted, "As a third world country, South Africa presents with a significant challenge in service delivery in terms of population characteristics, socio-economic circumstances, educational status, and health care priorities. The children of South Africa face multiple barriers and the HIV pandemic has become an increasingly important variable that is affecting all aspects of life in South Africa". These factors will be reviewed below to highlight the irrefutable complexity of the South African context and implied challenges facing audiology service delivery.

2.3 Audiology in the South African Context: Service Delivery Needs and Challenges

The South African context expands this already challenging Audiology profession, to include a more innovative, and perhaps more demanding way of practice. Contextual factors that challenge service delivery include client demand, socio-economic positioning, availability of

support services and the perceived importance of and need for the professional service by the public and professionals (Swanepoel, 2004; McKenzie, 1992)

2.3.1 The Prevalence of Hearing Loss in South Africa: Demand for Audiology Services

The national Census of 2001 indicated that of the approximate 44.8 million people residing in South Africa, 2,3 million were reported as disabled, with hearing impairment being the third highest disability accounting for 313 600 (0,7%) of the disabled population. Hearing impairment in infants (0-4 years) and children (5-13 years) constituted approximately 15 000 (21.1%) and 52 000 (21.9%) of the disabled population in each category respectively. Of the approximately 620 000 disabled individuals in the 14-34year age category 92 000 (14.8%) were reported to have hearing impairments, with this figure increasing to approximately 98 000 (10, 6%) of the 928 000 adult population, within the age range 35-64 years.

The disability figures for hearing and communication disabilities across age groups as reported in the 2001 census are depicted in Table 1 below.

Table 1: Census 2001: Percentage disability across age groups in South Africa

Age Group	Total Population	Disabled Population	Hearing Disability	Communication Disability (excluding hearing loss)
Infants (0-4)	4 449 819	71 000 (1.6%)	15 000 (21.1%)	4000 (5.3%)
Children (5-13)	8 938 626	239 000 (2.7%)	52 000 (21.9%)	13 000 (5.3%)
Youth/Young Adults (14-34)	17 528 929	620 000 (3.5%)	92 000 (14.8%)	25 000 (4.0%)
Mature Adults (35-64)	11 687 195	928 000 (7.0%)	98 000 (10.6%)	26 000 (2.8%)

It is an obvious fact that socio-economic factors are central to the general standard of living, accessibility to health care, level of education and often dictate the level of well being of persons. Unfortunately however, the extensive divide in this area in SA has resulted in a

minority of the population representing ‘First world’ development, with the majority of the population entrenched in ‘Third world’ living. As a result of low levels of education, most rural communities have little knowledge and awareness of illness and disease causation, prevention and disability (Swanepoel, 2004).

According to Jordaan (2003), children with disabilities constitute approximately 10 % of the total population who present with disabilities, and although provincial figures differ, children (0-10years) from rural areas are twice as likely to have disabilities as compared to urban children, with approximately 22% of disabilities being hearing impairments (Children in 2001, 2000). This emphasises the dire need for increasing community awareness and knowledge about disability and caring for the disabled. Audiologists servicing these areas need to find ways of extending their services to the people, who can least afford it.

To meet the health needs of the South African context, there has been a strong move from the traditional Medical Model of Health Care to the Primary Health Care (PHC) model of service delivery, which encompasses Community-Based Rehabilitation (CBR).

2.3.2 Primary Health Care (PHC) and Community Based Rehabilitation (CBR*)*

The PHC approach was formulated at the Alma-Ata in 1978, at a joint World Health Organization (WHO) and United Nations Children’s Fund (UNICEF) conference. PHC goes beyond conventional treatment and prevention of disease, to include a state of mental, physical and social well-being of the community, with guiding principles including equitable distribution of health care resources and adequate care for all, a focus on preventative and promotive services, active community participation, use of appropriate technology and redressing the socio-economic inequalities (McKenzie & Mazibuko, 1989). Community based rehabilitation (CBR) was thereafter introduced, which aimed to deliver rehabilitation which

builds on the resources of the community and emphasises the need for socialization of persons with disability.

Both PHC and CBR service delivery approaches place large emphasis on community development through education, sustainable community involvement projects, with the focus of taking health care to the people. Successful implementation of these approaches however does rely on adequate infrastructure, human resources, a good sustainable economy and community involvement. Further, the various health disciplines were required to practically adapt their practice in accordance to PHC and CBR principles and service delivery areas.

One area of audiology that is clearly positioned under the principle of PHC is hearing screening. Durst and Moon cited in McCormick (2004, chp7:304), defined screening as “a procedure that effectively identifies a subset of the population with a high probability of having a condition, that the screen is designed to identify. The identification of the subset of the population avoids the prohibitive cost of applying diagnostic screening to the entire population”. Screening addresses prevention and promotive health care and can be implemented though community outreach programmes. This is a quick, cost effective way of identifying persons with possible hearing impairments in community settings. Hearing screening would also enable one to identify contributing factors to the prevalence of this impairment and serve as a platform to educate the public on ear care and audiology services.

One such project was undertaken by staff from Tinswalo Hospital, based in Limpopo Province. Screening of hearing at crèches and preschools was attempted, but not all schools were covered due to lack of staff. The more feasible alternative was then taken, which involved teacher education about hearing loss, so as so encourage more appropriate

referrals. This programme was reportedly unsuccessful for the following reasons (McKenzie (1992) :

1. SLHT team was acting in isolation from PHC team resulting in misunderstanding of SLHT goals and follow up medical treatment, 2.Referrals were not followed through by parents due to lack of money and lack of community awareness of hearing loss and 3.Teachers did not feel confident to motivate parents as their own knowledge in this area was poor. In addition, the following obstacles to the implementation of the principles of PHC and CBR were highlighted: inadequate infrastructure resulting in poor client attendance, inappropriate training of SLHT's to meet the demands of the rural setting, lack of appropriate technology, lack of community awareness on the services of SLHTs and difficulty in balancing hospital and community services (Aron, 1991; McKenzie, 1992).

In response to the need for services in rural areas and limited human resources across work settings, the Minister of Health, Dr Tshabalala Msimang, implemented community service amongst seven health professionals including Speech Therapists and Audiologists in 2003. Through this programme speech-language therapists and audiologists would have the opportunity to "demonstrate their invaluable role in the rehabilitative team as this is not always recognised by health professionals. Further, more permanent speech-language therapy and audiology posts may be created" (Buttress, 2002:2).

2.3.3 Social Factors

2.3.3.1 HIV/AIDS Pandemic

According to the 2004 Report on the Global AIDS Pandemic compiled by the Joint United Nations Programme on HIV/AID (UNAIDS), at the end of 2003 more than a third of people living with HIV/AIDS in the world, were living in Southern Africa (O` Grady 2004). This amounts to approximately 14. 4 million people of the global total of 39.8 million living with HIV/AIDS as estimated by the UNAIDS (2004). Further, by the end of 2003, over 10% of the

global total (5.3 million) was residing in South Africa. Of the 5.3 million living with HIV/AIDS in this country, 2.9 million were women aged 15-49 years, 230, 000 children under the age of 15, and 1,1 million aids orphans (UNAIDS 2004 190-191 cited in O` Grady, 2004:1-2)

Living with HIV has been said to be possible provided nutrition and appropriate medical management is obtained. The current role out of antiretroviral treatment brings hope for many, but unfortunately persons infected with the virus continue to suffer from secondary medical conditions. Ear, nose and throat manifestations include: middle ear pathologies, neurological abnormalities, conductive and sensori-neural hearing loss, viral and fungal infections in the ear, nose, throat and mouth, lymphomas and tumours that impact speech and hearing and hypopharyngeal and laryngeal problems due to infections and tumours (Larsen, 1998; Strauss, 1997).

Additionally, HIV/Aids research has indicated that infants living with HIV/Aids are susceptible to other infections and neurological complications that can compromise auditory function (Matkin, Deifendorf & Erenberg, 1998). Infants born to HIV positive mothers are at risk for a congenital hearing loss or developing hearing loss after birth (Druck & Ross, 2002 cited in Swanepoel, 2004), whilst ototoxic medication taken prenatally for treatment of HIV related diseases may cross the placenta and damage foetal ear structure development (Banaitis, Christensen, Murphy & Morehouse, 1998).

The increase in infants and young children living with HIV will have a profound effect on the prevalence of hearing disorders across the population. With the hope of living a healthy life with HIV, the quality of life must been addressed as well. One initiative would be to begin wide spread implementation of hearing screening and awareness programmes, however testing infrastructure to support persons identified during screening must also be developed.

2.3.3.2 Linguistic and Cultural Considerations

Persons from diverse cultures have a variety of concepts and definitions of communication disorders, of impairments, and of intervention, all of which will influence service delivery.

As a multilingual society with 11 different official languages, providing professional services in all languages remains a challenge. This is especially important for the profession of Speech-Language Therapy and Audiology, given that the scope of practice is essentially central to maximising language and communication abilities. Most tests used have been developed by international audiologists and speech-language pathologists. As pointed out by Kayser (2001: 393), “test instruments are most likely to reflect the culture of the test developer and present stimuli thought to be familiar to all individuals”. Further, linguistically based assessment tools are often standardized tests developed internationally, with normative data “developed from a population that is primarily middle class, English speaking and of European background” (Kayser, 2001: 393). The evaluation of clients who do not fit this “norm” is therefore highly compromised not only by linguistic differences but by cultural diversity as well. SA audiologists therefore have the task of modifying and adapting instruments so that they become more culturally and linguistically appropriate and sensitive. This however loses the standardization of the test and reduces test reliability and validity. Thus norms for the SA population need to be developed. Linguistic diversity also greatly impacts on intervention.

From the above literature reviewed it is clear that audiology services are essential, although the spectrum of service delivery differs greatly in SA. On one extreme audiologists practice first world technological advanced testing and treatment procedures to those who can afford private care. On the opposite extreme, basic tests are restricted by under resourced public health systems serving the poor socio-economic majority of the country. Further medical, socio-economic, cultural and linguistic difference pose challenges to conventional audiology practice.

Despite the difficulties and diversities, audiology practice must ensure that quality; appropriate, updated services are provided. Not only do SA Audiologists need to be competent in conventional audiology practice, but need to be equipped with knowledge and skills specifically required in South Africa. Academic training and reform is central to service delivery however consensus on the model of training in SA has still to be reached. Further, audiologists by the nature of their training are the most qualified to assess and treat hearing loss. However, the highly complex and multifaceted scope of audiology practice appears to be threatened by associated professionals. These professional matters will influence the professional and public view of the audiology profession, and impact on the quality of service provision. In view of the contextual factors facing the audiologist, issues regarding training and professional autonomy serve to further complicate service delivery. The following discussion will present the concerns regarding professional autonomy and audiology training in South Africa.

2.4 Current Professional Matters Confronting Audiologists in South Africa.

2.4.1 Professional Autonomy

The training of audiologists encompasses specialized knowledge and skill regarding all aspects of hearing i.e. medical and non-medical diagnosis and treatment of individuals with hearing loss and due to the number of sub-specialities, often further studies and professional development workshops are explored to gain expertise. However, professional autonomy in audiology appears to be threatened. American audiologist, Jacobson (2002) noted, “We have problems that we must confront. There are those outside of our profession who minimize our value and would, if they could, define for us who we are and what we can and cannot do.

However, we are an autonomous profession with noble bloodlines. We alone in our home organizations will chart the course that defines our future."

The above quotation raises a specific and urgent problem facing the profession of Audiology. The ASHA Ad Hoc Committee on Hospital and Health Services 1990 report identified professional autonomy as a major issue impacting on service delivery and stated that "The boundaries of overlapping areas of clinical practice are not well defined. As a result, encroachments of the practice of speech-language pathology and audiology and violations of licensing laws have occurred" and recommended the "development of guidelines for actively reviewing and monitoring the bylaws, licensure laws and scope of practice statements of related professions for any encroachment on the professional autonomy or scope of practice of speech-language pathologists and audiologists" (ASHA 1990: 196).

In SA, several professionals are currently registered with the professional board for Speech Language and Hearing Professions, including speech therapists and/ or audiologists, speech and hearing community workers, speech and hearing correctionists, audiometricians and hearing aid acousticians. While these professionals share the same Scope of Profession, each Scope of Practice varies depending on training and experience. The American Academy of Audiology acknowledges that "Periodic updating of any scope of practice statement is necessary as technologies and perspective change" (2003). Given that there are different categories of Speech and Hearing Professionals, it is in the public's best interest that the scope of Practice for each professional is clearly defined.

In South Africa, the situation is a little more complex as there are many more stakeholders. However, it is our responsibity as professionals and educators to ensure that the professional

body is truly representative of the profession and thus in a position of shielding the public and steering the professions (Andanda, Bonaretti & Wemmer, 2004).

2.4.2 Audiology Practice and Training

Despite the fact that Audiology as a profession is still in its infancy, the demands made on the field by significant theoretical, clinical and technological advances are extensive (Aron, 1991; Van Vliet, Berkey, Marion and Robinson, 1992; Burkard, 2002; Kidd, Cox and Matthies, 2003). With increased sophistication in testing tools and advancement in the scope of practice, gaps in the preparation of newly graduated Audiologists becomes more apparent when seeking well-qualified entry-level Audiologists (Van Vliet, Berkey, Marion and Robinson, 1992).

Insufficient training would directly impact on service delivery and allows for associated professionals to infringe on the scope of practice if service needs and expectations are not met. Education is thus central to the future of Audiology. In SA the 'dual" qualification in Speech and Hearing Therapy focused on training speech therapist with a foundation in basic Audiology, training on the technical aspects of Audiology were covered with less rigour. One such area is hearing aids. As a result Hearing aid acousticians were trained as technicians to fill this void in service delivery. However, since 1999 the Universities of Cape Town, Pretoria and Kwazulu-Natal (previously known as University of Durban Westville) are now offering what is referred to as the "Split-Curriculum", where students are able to choose to study either Speech Language Pathology of Audiology and thus register with the HPCSA on a single qualification register. This single registration follows that of Audiology and Speech Language training programmes throughout the international arena. "In most countries, the disciplines of Speech-Language Pathology and Audiology are considered to be separate professions" (Soer, 2003).

The emergence of the “specialist” Audiologist has changed the face of Audiology in our country, as sufficient training in areas such as hearing aid technology and electrophysiology is possible. It therefore seems that the scope of practice of Audiology (and by implication Speech-Language Therapy) will need to be redefined, as up to this point Audiology has not had a clear professional identity in South Africa. Overlap between the Scope of Practice of Audiologist and other “associate professionals” such as Hearing aid acousticians and ENT specialists needs to be clearly defined in terms of current practice and proposed training.

Educational reform is pivotal to the future of the profession, as training programmes that are aligned with the needs of the country would result in a clearer identity and increased autonomy of the profession. Again, in order to design a curriculum for the South African context, it is necessary to have information regarding the services offered by Audiologists as this would identify possible gaps and limitations in practice. To this end this research proposes an audit of audiological services in South Africa that also identifies clinical areas that may not be practised on account of a lack of training

3. <u>Purpose of the of the Study</u>

The results of this study will provide a ‘snapshot’ of the scope of practice of Audiology in South Africa by presenting insight to the types of audiological services offered in various work settings and additional areas included in the scope of practice. In addition, it will accentuate primary reasons for non-practice of certain clinical areas, present challenging issues influencing practice in the pubic and private sectors and hopefully provide some formal insight to the diverse needs of the country. This information is important in evaluating professional practice in our country and will serve to inform: (1) areas in which audiologists require CPD activities or clinical additional training (2) the need for the development of a

comprehensive service delivery model for the South African context, (3) areas in which service delivery protocols and standards need to be developed and or redefined, (4) policy development and budgetary allocations on the basis of the statistics obtained from the survey and (5) curriculum design and future clinical training of audiologists.

4. Research Questions

1. What is the geographical distribution of audiologists, speech language hearing therapist in South Africa?
2. Which audiological services are being offered across various work settings?
3. What are the trends in audiological practice in South Africa?
4. What are the primary reasons of not providing specific audiological specific services?
5. Is there a difference in audiological service delivery between the public and private sectors?
6. What are the factors influencing service delivery?
7. What are the additional demands on service delivery across the varied work settings?
8. Are service delivery issues that have been reported internationally also occurring in SA?
9. What are the factors to be considered for the future training of audiologists in South Africa?
10. What is the future of Audiology in SA?

METHODOLOGY

Objective of the Study

To conduct an audit of audiological services rendered in South Africa and to identify issues that impact on service delivery.

Study Aims

1. To collate demographics of Audiologists in SA
2. To conduct an audit of audiological services rendered in SA
3. To explore reasons for possible non-practice of services
4. To identify contributing factors impacting on service delivery in the public and private sectors.

Research Design

To meet the aims of the study, a cross-sectional ex post facto, descriptive survey research design within the quantitative paradigm was selected. Quantitative research uses numerical data and involves collection methods such as surveys (Schiavetti & Metz, 2002 & Rosnow and Rosenthal, 1996). This paradigm was thought to best suit the study as the researcher sought to provide statistical data on demographics of respondents and to quantify the extent to which audiology services were provided. Also, a survey method was supported by Babbie (2001) as the one of the best methods available for collecting original data for describing a population too large to observe directly.

As this was a national study, a good geographical representation and a large sample of South African Audiologists were essential within the time and resource constraints of the researcher. A survey was the most feasible method of reaching participants and best

enabled the acquisition of a reliable representative sample (Stein and Cutler, 1996). Data was obtained using a self-developed structured closed-ended questionnaire as other methods such as interviews necessitate trained interviewers as well as travel expenses. This method of data collection also allowed for anonymity and reduced interviewer bias (Babbie, 2003 & Rosnow and Rosenthal, 1996). According to Bowling (2002) structured standardized sample surveys are often used to determine the description of a population, people's opinions as well as efficacy of programmes as it has the advantage of obtaining a "snapshot" of the population investigated. Also, the standardized data produced are amenable to quantitative computer based statistical analysis.

Bowling (2002: 197) supported an Ex post facto design as "an economical method in relation to time and resources, as large numbers of people can be surveyed relatively quickly, and standardized data are easily coded". Further, this design was appropriate for this research, as possible relationships between variables could be established. Such findings could be further investigated in forthcoming research. The strengths of this design were its flexibility, relative inexpensiveness as it does not rely on randomisation or manipulation of variables and correlations enabled a broad scope of problems to be addressed. The weakness was that no causal relationship can be reached with a degree of certainty (Schiavetti & Metz, 2002).

The objective of including qualitative data was to provide the researcher with a greater understanding of participants' responses and their opinions of the content of the study. It also served to allow participants with a platform to clarify and expand on key aspects that were not included in the quantitative method. Thus this method would allow the researcher to obtain a better insight into participants' behaviours and responses and uncover essential as well as

rich information that will enhance the information obtained using the quantitative paradigm (Walliman, 2001; Hult, 1996).

This research was conducted in parallel with a study probing how well Audiologists and Speech and Hearing Therapists felt that their undergraduate degree prepared them for service provision and what the structure of a new audiology curriculum should encompass in terms of undergraduate and postgraduate training (Wemmer, 2003). Since practice dictates training and vice versa these studies provide complementary information and therefore a combined questionnaire was used allowing for direct comparisons and correlations of findings (Refer to Appendix 2).

Research Participants

Selection Criteria

To qualify as a participant in the research, participants were required to be registered with the HPCSA as an Audiologist, Speech-Language Therapist or a Speech-Language and Hearing Therapist, including graduates completing community service, and Community Speech and Hearing Workers. Speech-Language Therapists were included as participants for the purpose of obtaining a geographical distribution of service provision. This information would serve to inform placement of Audiologists, or when creating audiology positions or practices in areas serviced by a Speech–language Therapist. As this was a national study aimed at obtaining demographics and an overview of service delivery, no exclusions were made in terms of geographical location, work settings, year of graduation and level of experience and or qualification.

Sampling

A purposive sampling procedure was used. As per selection criteria, questionnaires were posted to all Audiologists, Speech-Language Therapists or Speech-Language Therapists and

audiologists registered with the HPCSA in 2005. This constituted approximately 1500 participants. The postal addresses of participants were located by obtaining the latest register from the Health Professionals Council of South Africa (HPCSA), South African Speech Language and Hearing Association (SASLHA) and South African Association of Audiologists (SAAA).

Research Instrumentation

As this was a parallel study the questionnaire included areas investigated according to the aims of both studies. Due to the overlap in demographic information required for both studies as well as the inter-dependence of the data from the studies (e.g. the audit results of audiological service "always and never" practiced were correlated with the level of preparedness in the parallel study; non-practice of areas that were associated with training were correlated with level of preparedness) a combined structured, self administered questionnaire was developed to allow for direct correlations between data sets as well as to save time and costs.

Questionnaire Format

The questionnaire was comprised of 4 sections: (Refer to Appendix B)

1. Section A: Biographical Information.
2. Section B: Audit of Audiological Services.
3. Section C: Adequacy of Undergraduate Training
4. Section D: Future Curriculum Design
5. Section E: Additional Comment/Other

Sections A and B investigate the aims of this study, whilst sections C and D applied to the parallel study by K. Wemmer. Section E was to be analysed as per relevance of comments to each or both of the studies.

Close-ended questions were used in sections A and B. Closed-ended response categories were used for the following reasons (Babbie, 2002; Schiavetti & Metz, 2002):

1. This format allowed for a faster time of completion, 2) It provided uniformity of responses as a fixed list of alternatives was provided and 3) Responses could be transferred directly into computer format. The disadvantages of this response type are that responses cannot be further investigated and would need to be researched in a follow-up study.

According to Babbie (2003: p234) the construction of close-ended questionnaires must ensure the response categories are “exhaustive and exclusive” (exclusive meaning that respondents should not feel compelled to select more than one option, and exhaustive, to include all possible reasons).The sections were structured to ensure that responses were mutually exclusive i.e. where applicable; questions were supported by instructions requesting that the respondents select “the primary reason or select only one”, (refer to instruction stated in Section B as an example). Where reasons and or categories were provided, an “Other” option was included (Babbie, 2003) for example Section A, to ensure that responses were exhaustive. The questionnaire response format included boxes spaced apart (refer to Section A) and matrix questions (i.e. several answers that have the same reference of answer categories for example in Section B “always, sometimes, never” are options to the range of audiological services provided). According to Babbie (2001:p240), box formats are best when respondents need to select one response from a series of alternatives while the advantages of matrix questions included better use of space; faster completion time and increased comparability of responses (pg 242).

Section A: Biographical Information

This section was comprised of 20 biographical questions that were to be answered by all respondents. These questions ranged from information regarding degree qualification (i.e.

name of degree, year of graduation, tertiary institution attended and HPCSA registered qualification) to questions related to service provision (i.e. province and sector employed in, primary workplace, sector of employment client waiting periods for basic hearing testing, hearing aid fitting and ENT appointments).

Section B: Audit of Service Delivery

Section B focused on the provision of Audiology services and the primary reason for not providing a service. Possible work related factors that would impact on service delivery were also investigated. The completion of this section was restricted to participants' currently practicing audiology or those who have had work experience in audiology.

Section B was divided into 8 subsections, labelled A-H. The content and layout of each subsection was as follows:

Subsections A-F

Subsections A-F included all areas of audiology services that should be provided as outlined by the Scope of Audiology Practice Guidelines (2005) as developed by the HPCSA and Standards Generating Body (SGB), as well as international Scope of Practice documents compiled by organizations such as the American Speech-Language- Hearing Association (ASHA, 2004). Literature on the audiology profession and areas of service delivery was also reviewed and contributed to informing the content of the questionnaire. The 7 subsections were divided as per category of practice viz. basic test battery, diagnostic audiology, paediatric audiology, amplification, hearing prevention and conservation and rehabilitation. Each subsection included a listing of clinical procedures. (Refer to Table 2 and Appendix 2).

Table 2: Example of layout of Section B

Subsection	Examples of clinical areas included per subsection
A. Basic Testing	Pure tone Audiometry, Speech Reception Testing, Tympanometry
B. Diagnostic & Electrophysiological Tests	Behavioural Site of Lesion, Behavioural Auditory Processing, Otoacoustic Emissions, P300, Auditory Steady State Response
C. Paediatric Audiology	Visual Reinforcement Audiometry, Play Audiometry, Multifrequency Tympanometry
D. Amplification	Real Ear Measures, Hearing Aid Selection, Fitting and Validation, Cochlear Implant Mapping, Assistive Listening Devices
E. Hearing Conservation & Prevention	Implementation of a Neonatal Screening Programme, Ototoxic Monitoring, Industrial Audiology
F. Habilitation & Rehabilitation	Auditory Training, Manual Communication, Cochlear Implant Habilitation and Rehabilitation, Tinnitus Management

Participants were asked to indicate how frequently they provided a service by shading the circle under the appropriate category i.e. “always, never, sometimes”. For each never response selected, participants were instructed to indicate one primary reason for this non-practice from the range of reasons provided. The exclusive category of reasons listed includes the following options: *no equipment, no caseload, insufficient training, time constraints, language barrier and other*. These reasons were identified through informal discussions with Audiologists practicing in South Africa, by reviewing international reports on service delivery (ASHA 2002; RNID, 2001) and literature pertaining to service delivery in speech pathology and audiology (Lubinski and Fratalli 2004).

Subsection G: (Miscellaneous)

This subsection investigated whether respondents participated in community work, supervision of students/junior audiologist/community service graduates, conducting clinical research and the audiology management of HIV- Infected /Aids patients. This subsection was included in the audit for the purpose of correlation with Section C of the parallel study. The

parallel study intended to correlate “always and never” responses obtained from the audit to the study results on perception of adequacy of undergraduate training.

Subsection H: Service Delivery Issues

Various contributing factors influencing service delivery have been found to exist within the public and private health sectors. Subsection H investigated whether or not service delivery issues listed in this question were experienced in the respondents’ work context. Participants were requested to indicate either a “yes/ no” response for each item. The purpose of this question was to broadly identify common issues occurring in each sector. This information would serve as an indication of factors that need further in-depth investigation. The content of this question was compiled by reflecting on key issues impacting on audiology service delivery and the profession that were broached during local governing body meetings and informal discussions with audiologists and by reviewing international reports addressing service delivery as mentioned in the literature review (ASHA, 2002; RNID, 2001). The identification of commonly occurring issues would serve to identify those factors that should be investigated in more depth in future research.

Section E: Addition Comment/ Other

This section was included, as the closed ended nature of the questionnaire could have omitted relevant information and other possible alternatives. Thus, participants were given an opportunity to provide additional comments, express opinions, highlight key issues or raise further concerns etc. This would also improve content validity and provide some rich ‘real’ insight on audiology practice and training in South Africa.

Data Collection

Pilot Study

A pre-test of the questionnaire was conducted to determine the efficacy and practicality of questionnaire (Bowling, 2001). The questionnaire was piloted on 10 participants employed at tertiary institutions, private practice and government hospitals. The pilot was conducted across work settings to ensure content validity (i.e. the full content of the subject area or definition was represented and measured) as well as to obtain representative and unbiased feedback (Rosnow and Rosenthal, 1996). Respondents were asked to provide feedback on the checklist provided (refer to Appendix 3) regarding the clarity of the instructions, ease of completion , the appropriateness and accuracy of the content, ambiguity, editorial errors, length of questionnaire and any other changes or modifications needed (Bowling, 2002). Respondents indicated that the questionnaire was comprehensive and appeared to cover all pertinent areas of audiology practice. Instructions were unambiguous, and the construction of the questionnaire allowed for easy completion. Minor editorial errors were noted, and the time allocation was reportedly adequate for completion.

Due to the size of the sample, data capturing using an electronic scanning format was the most time efficient and minimized the risk of human error through manual capturing. On finalizing the questionnaire, the researchers approached a Gauteng based company specializing in formulating questionnaires that allowed for electronic scanning. This company was experienced in developing academic research instrumentation and were also able to scan the data as required by the statistical analysis programme that was used. A design template was then developed and on approval of the sample questionnaire, printing commenced. The benefits of developing the questionnaire using this format were efficient, timely data capturing and analysis. Further, since the templates could be stored, this exact

study could be replicated in future at minimal cost. The researchers were informed that minor changes could be made to the template.

Being a national survey, a postal distribution was used as it was the most cost effective and timely method for reaching participants. It also provided respondents with an adequate time for completion. An information sheet was included with the postal questionnaire explaining the aim of study, how participants' details were obtained, ensuring confidentially and stipulating approximate time for competition of the questionnaire. A self–addressed return envelope was included with the questionnaire to encourage a timely response. The questionnaire was designed to allow the participants to respond without revealing any personally identifiable information in order for confidentiality to be maintained. Initially a reminder was sent, with a copy of the questionnaire sent thereafter as requested. (Refer to Appendix 1 and 2 for a copy of the covering letter and questionnaire respectively).

External validity was established by ensuring that participants were representative in terms of employment settings and geographical location. Questionnaires were distributed to all HPCSA listed practitioners in speech pathology and audiology. Work place setting included public hospitals, specialized schools, private practices, hearing aid companies, tertiary training institutions across all provinces. In addition to the postal distribution, questionnaires were distributed at Provincial Professional Forums and Private Practitioner Organizations such as SASHLA and SAAA. The information sheet was posted on the SASHLA and SAAA website to create an awareness of the study (refer to Appendix 1).

A triangulation of methods should ideally be used to ensure construct validity (Bowling, 2002). However given the national scale of the survey, the use of an ethnographic research design was beyond the scope of the research as it was neither time nor cost effective and

therefore not feasible. Also, recognising the diversity of work settings in South Africa, it was felt that both observations and interviews would provide biased information regarding the range of services provided as these may be contextually driven by extraneous variables. Further a limited observation time would not be sufficient for the scale of the audit. The quantitative survey was considered best to meet the aims of the study and gather data that could be used as a pilot investigation. An ethnographic research design could be used in the second phase of the study to further investigate and clarify more specific issues, concerns and uncertainties highlighted by this study.

Data Analysis

The results of the questionnaire was analysed separately by the researchers. Sections A and B were analysed using descriptive statistics. According to Bailey (1997), descriptive statistics describe the basic features of the data in a study by providing a simple summary about the sample and the measure. Thus information was organized and described in a manner that easily highlighted trends in data. Results from the statistics were represented as percentages and represented using tabular and graphical (histograms and pie charts) displays.

***Section A*: Demographics**: All respondents qualified to answer this section. Descriptive statistics was obtained for each question. In order to create an overall description of the location and distribution of respondents, two and three way analyses were performed i.e. 1. '*workplace setting' against 'practicing as'* and 2. *'sector employed in'* against *'practicing as'* against '*province of* employment' respectively.

***Section B*: Audit of Audiology Service Delivery:** Respondents who were currently practicing audiology or had previous work experience in audiology qualified to answer this section.

Raw data of the audit was analyzed using descriptive statistics. The frequency of response for each item per category “always, never, sometimes” was calculated. Responses obtained for ‘primary reason for never providing services’ were analysed similarly. The initial management of the data involved cross tabulating audit results against work place setting and province (e.g. how frequently respondents employed in private practice, state hospital etc. performed each service). Three way analyses such as province employed in against workplace setting against each item of service delivery were performed. The researcher then identified trends across the various analyses in order to establish the most feasible way of containing and collating the data, without compromising or distorting trends. One such decision involved the analysis of data per workplace setting or per sector of employment.

As audit results were extensive the reporting of the frequency of service provided across each work setting made for an exceptionally lengthy discussion that was beyond the scope of this report. Upon comparison of the two-way analyses viz. services provided against workplace setting and against sector of employment, the researcher observed that the trends in descriptive statistics i.e. the frequency distribution of each service provided against workplace was similarly represented in the analysis of frequency distribution of each service against sector of employment. Thus the more feasible option of analysing audit results per employment sector was favoured. Further, due to workplace variables, it was thought best to review this analysis in the second phase of the study, whereby each workplace setting could be investigated in more detail. It was observed that the trend in results when analyzed by sector groupings (private/ public sector) were similar to that of the workplace analysis. Also,

due to the skewed provincial distribution of respondents (refer to discussion of results), a province analysis was abandoned.

Final Management of Data: Cross tabulation of Question 11: “sector employed” in was run against audit results and “primary reasons for never providing services”. This allowed results to be sorted by sector of employment as indicated by respondents. This analysis of data proved more manageable, while still maintaining the trends in results observed in the initial analysis. Thus results were divided into two categories: public sector, and private sector. The analysis and presentation of results according to the sector of employment better suited this report and allowed for a comparison of audiology service delivery between sectors. This was important and relevant as much speculation exists regarding differences in service provision between the public and private sector employed practitioners. In addition, it provided a comprehensive ‘backdrop snapshot’ of audiology service delivery nationally that sufficiently fulfilled the purpose of the study and provided adequate information as a first phase/pilot study.

Ethical Considerations

1. Ethical Clearance to conduct the research was obtained from the Medical Ethics Committee of the University of the Witwatersrand (Refer number: R14/49). A copy of the certificate has been included as Appendix 4.
2. Ethical principles and codes of behaviour as delineated by the Medical Research Council (MRC) of South Africa and literature on ethics in research were upheld as follows:

Each questionnaire distributed had attached an information sheet disclosing the nature, scope, purpose of the project and the researchers’ interest in the study (Jones, 2002). This demonstrated the integrity of the researchers (MRC, 2001) and participants could make an

informed decision regarding participation. The benefit of the study to the profession was expressed in the information sheet as well i.e. “serve to inform the profession...” (Refer to Appendix 1). Participants were assured of anonymity and confidentiality, as they did not need to disclose their name or personal identifying information on the questionnaire (MRC, 2001; Jones, 2002 & Beauchamp and Childress, 1994). However they were informed that the results would be made available to the Discipline of Speech and Hearing Therapy at the University of the Witwatersrand as the study was conducted at this institution, and to relevant professional bodies including the HPCSA, SASHLA, and SAAA. Participants were informed that participation was voluntary and as such could choose not to participate or to withdraw from the study at any given time without any consequences. Thus the ethical principles and codes of informed consent, beneficence, disclosure, honesty and integrity were upheld (MRC, 2001; Jones, 2002 & Beauchamp and Childress, 1994).

RESULTS & DISCUSSION

1. Description of Sample

As per selection criteria, participants included HPCSA registered Audiologists, Speech-Language Therapists or a Speech-Language Therapist and Audiologists including graduates completing community service, and Community Speech and Hearing Workers qualified and practicing in South Africa. This amounted to 1500 participants. Questionnaires were posted, followed by reminders sent through professional bodies and meetings. 300 questionnaires were returned corresponding to a response rate of 20%. However, poor completion of questionnaires resulted in 283 usable questionnaires corresponding to response rate of 18.93%.

Although the responses rate may seem low, this calculation is unlikely a true reflection of the

response rate when considering the following factors: 1. although a significant number of individuals may maintain their registration with the HPCSA, many are not practicing the professions, 2. a number of graduates are practicing overseas, 3. the researcher relied on residential/postal addresses supplied by the HPCSA 2005 register as this seemed to be the most feasible method of locating participants. However, it was likely that participants have changed their contact details and have not updated this information with the HPCSA. Therefore the response rate could possibly be considered relatively high, in relation to actual number of individuals practicing the profession in South Africa. Also, as the questionnaire served to obtain information for the parallel study, it was comprehensive and lengthy and thus may have deterred participants from completing it as required. This was evident in the number of incomplete or poorly completed questionnaires returned and may be considered a limitation of the study.

2. SECTION A: *Demographics*

2.1 Gender Distribution

Results: Question 1 investigated gender distribution. The sample distribution of genders was as follows: Female: n=275 (97.17%); Male: n=8 (02.83 %). As the profession is female dominated, this was an expected statistic and appears to be reflective of the gender imbalance present in the field. This imbalance has been attributed to the 'dual' nature of the previous training programmes in South Africa, whereby Speech Therapy and Audiology were trained within the same curriculum. Audiology appears to attract more male students than speech therapy, as it is technologically based, and allows one to venture into 'business like' areas such as hearing aids and industrial audiology. Internationally, Speech Therapy and Audiology are trained as individual professions (Hosford-Dunn, Roeser and Valente, 2000). According to international survey reports (ASHA, 2004), while the profession remains female

dominated, the percentage of male professionals is much larger than in the South African constituent. With the current split-curriculum implemented at 3 institutions in South Africa, it is anticipated that more males will enter into the profession.

2.2 Academic Qualification

Questions 2 to 6 investigated academic qualifications. Respondents were required to indicate the year of graduation, the analysis of which would highlight possible trends in practice and training. 267 questionnaires were properly completed for the question on the year of graduation. Respondents appeared to have difficulty completing the numeric sequence layout. This however was not problematic in the pilot study, but could have been made clear by the use of an example. This information would have been useful in identifying if curriculum changes have influenced practice. Please refer to the finding reported in the report by Kathleen Wemmer regarding correlation between year of graduation and level of training. A total of 275 participants responded to question 2 which identified the highest level of academic qualification obtained in Audiology. The distribution of respondents according to qualification is displayed in Figure 1 below.

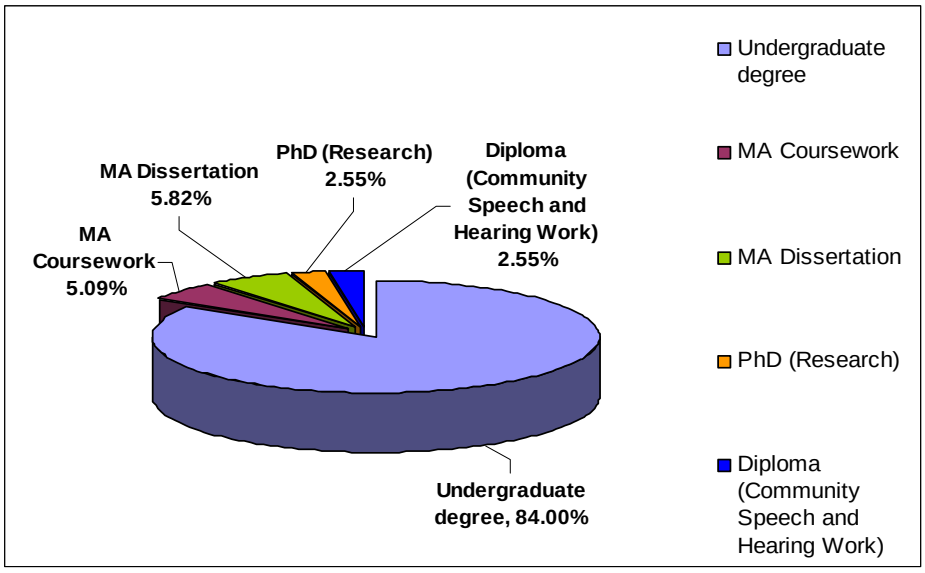

Figure 2: Highest Qualification in Audiology

Academic qualifications ranged from a PHD (research) to a diploma qualifying as a Community Speech and Hearing Worker. The majority of the participants, 84% (n=234) indicated an undergraduate degree as the highest level of qualification obtained, followed by 30 participants holding a masters degree of which 5.82% (n=16) was obtained by dissertation and 5.02% (n=14) by course work and research report. Of the remaining participants, 2.55% (n=7) held a PHD and 2.55% (n=7) held a diploma in speech and hearing therapy. The distribution of undergraduate and postgraduate training received across the various tertiary institutions is displayed in Figure 2 below.

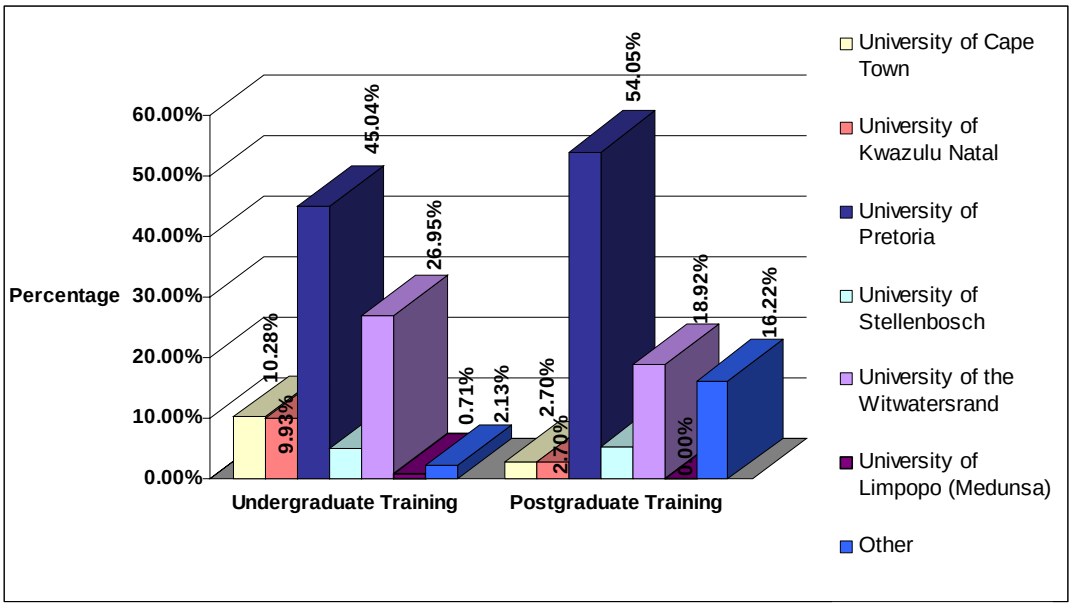

Figure 3: Sample distribution of training across tertiary institutions

Undergraduate Training (n=275)

The majority of the respondents (127) were graduates from the University of Pretoria, followed by 76 graduates from the University of the Witwatersrand. Results indicated a close distribution of graduates from the University of Cape Town and University of Kwazulu Natal i.e. 29 and 28 graduates respectively. The remaining respondents obtained undergraduate

degrees from the University of Stellenbosch (n=14) and University of Limpopo (Medunsa) (n=2), with 6 graduates from other universities abroad.

The distribution of respondents could possibly be attributed to the size of the departments at the various universities, as student quotas differed significantly as well as the duration for which programmes have been running. To the researchers knowledge the University of Pretoria and University of the Witwatersrand were the first to offer a degree in Speech and Hearing Therapy, and appear to have larger intake of first year students, (approximately 30-40 students), while the University of KZN, previous the University of Durban Westville have a smaller intake of students, (approximately 15 students) and therefore produced fewer graduates. Medunsa on the other hand has a fairly new department that has a vested interest in upgrading the previously trained community speech and hearing worker.

Postgraduate Training

Postgraduate degrees were held by 37 respondents. From the sample obtained, the University of Pretoria appears to the leading university in postgraduate training, with 14.57% (n=20) respondents obtaining their degree from the University of Pretoria. Approximately 3.5% (n=7) graduates obtained qualifications from the University of the Witwatersrand and 3% (n=6) from other universities outside of SA. The remaining 4 postgraduate degrees were distributed among the University of Stellenbosch, 1.01% (n=2); University of Cape Town, 0.5% (n=1) and University of Kwazulu Natal, 0.5% (n=1).

The reasons supporting the department at University of Pretoria is unknown to the researcher, but does afford investigation. Plausible reasons could be broader rangers of course work topics and greater availability of supervisors. Currently, international tertiary institutes are debating models of postgraduate training. American universities are now offering a clinical doctorate in Audiology (D. Aud), with debate regarding the need for a

master's degree. As will be presented in the following discussion on the Audit results, research in almost all areas of audiology is necessary in SA and current practice appears to be limited by training in most areas. SA tertiary institutes should therefore re-look at the model of postgraduate training in Audiology and ways to encourage research and or data collection in different work settings.

2.3 Professional Registration and Practice

Prior to 1998, 5 tertiary institutions in South Africa offered an undergraduate degree in Speech and Hearing Therapy. The name of the degree however differed as well as the faculty in which the department was located. Currently 2 tertiary institutions i.e. University of Kwazulu Natal and University Cape Town have changed their curriculum and now offer an undergraduate degree in Audiology or Speech Pathology, while the University of Pretoria offers all three streams. The University of the Witwatersrand continues to offer a degree in B.A Speech and Hearing Therapy only, with the University of Stellenbosh dedicated to only training Speech Therapists. This remodeling of training has had implications on registration and practice.

According to the HPSCA, all graduates are registered on a single register. A Speech and Hearing Therapists had historically and continues to be registered as Speech Therapist and Audiologist, i.e. the name of this professional is recorded under the listing of both professions. Registration of 'split' graduates is in accordance with their qualification i.e. the name of this professional is indicated under one profession viz. Audiologist only or Speech Therapist only. Table 3 illustrates the distribution of respondents as registered with the Health Professionals Council of South Africa (HPCSA).

Table 3: HPCSA Registration (n=250)

Registered with the HPCSA as:	Count	Percentage
Audiologist only	20	8.00%
Speech Therapist only	29	11.60%
*Speech Therapist & Audiologist **	185	75.00%
Community Service Graduates	10	10.00%
Community Service Graduates	10	10.00%
Community Speech & Hearing Worker	6	2.40%

** Qualification = Speech &Hearing Therapist*

Results displayed in Table 3 above indicate that the majority of respondents (75%, n=185) were registered with the HPCSA as Speech Therapists and Audiologists, with 8% (n=20) and 11.60% (n=29) registered as Audiologists and Speech Therapists respectively. The minority of respondents (2.4%, 6) were registered as Community Speech and Hearing Heath Workers. These results can be said to be reflective of the history of the degree and in proportion with current changes in degree structures offered. However, registration for the three streams of qualification offered appears to confusing. Rightfully, since three different professional qualifications are offered, separate registration for each of these professionals should be in effect. However currently, all qualifications are registered on a single register. For example at the University of the Witwatersrand, a person qualifying with the Degree in B.A Speech and Hearing Therapy is registered as a Speech Therapist and Audiologist (HPSCA). The present method of registration implies that the Speech and Hearing Therapist is the equivalent of a Speech Therapist and Audiologists. This is untrue by virtue of the difference in training for each qualification. Thus registration should be dealt with urgently to avoid further confusion.

Further, the analysis of results regarding area of practice vs. registration revealed significant discrepancies between these variable. The sample distribution of registered and practicing

clinicians is displayed in Table 4 below (i.e. practicing as Audiologist, Speech Therapist, Speech and Hearing Therapist, Community Health Worker, Community Service Graduate or none of the above)

Table 4: Sample Distribution of Registered and Practicing Clinicians

	Audiologist Only	Speech Therapist Only	*Speech & Hearing Therapist	Community Speech & Hearing Worker	Community Service Graduates	None of the above
(Q 7) Registered as	***20***	***29***	***185***	6	10	0
(Q 8) Practicing as	***55***	***114***	***82***	9	0	15

***** *Speech and Hearing Therapist are registered as Speech Therapists and Audiologists*

The distribution of respondents consisted of 41.45% (n=114) Speech Therapists, 29.82% (n=82) Speech and Hearing Therapists, 20.00% (n=55) Audiologists and 3.27% (n=9) Community Speech and Hearing Workers. The remaining 5.45% (n=15) respondents selected the 'none of the above' option, which could be interpreted as no longer practicing in the profession. Upon comparing professional registration (Q7) with the current area of practice (Q8), a discrepancy exists largely between the number of registered Speech and Hearing Therapists *(HPCSA registration= Speech Therapist and Audiologist*) and respondents actually practicing as both Speech Therapists and Audiologists. (Refer to Table 4). Of the 185 respondents who maintain the registration as Speech and Hearing Therapists, only 85 indicated practicing in this capacity. The number of practicing Speech Therapists on the other hand had risen to 114; whilst only 29 respondents were registered as only Speech Language Therapists. Similarly, although 20 respondents were registered as Audiologists, 55 respondents were practicing in this capacity.

The above results revealed that many respondents appear to be practicing as Speech Therapists only and to a lesser extent as Audiologists only. The study results highlight that majority of the qualified Speech and Hearing Therapists are practicing as predominately

Speech Therapists and to a lesser extent, Audiologists. Few appear to be practicing in both Speech Therapy and Audiology. This questions whether tertiary training institutes should continue the training Speech and Hearing Therapist, and the purpose of qualifying a person as a Speech and Hearing Therapist.

The difference in professional registration and actual practice does call for concern regarding future training as well as the registration. One of the perceived advantages of obtaining a degree in Speech and Hearing Therapy is the possible flexibility of practicing within both professions. However, with the rapid advancements occurring in the field of Audiology especially, the transition back into Audiology and working as a competent Audiologist is becoming increasing challenging. Thus it is imperative that continued professional development activities are monitored and formally investigated to ensure transition between each profession.

The significant difference between the number of practicing Speech Therapists and Audiologists could be attributed to the scope of practice that extends to working in large institutes such as schools, rehabilitation centres and hospitals. Also importantly, it is financially more feasible to set up a private practice in Speech-Language Therapy as it is not reliant on expensive equipment and clientele seen is not necessarily dependant on referrals from other health professionals. The job locations of Audiologists are predominately in hospital settings and private practice, with employment of a much lesser extent in special schools and in the hearing aid industry. Although a private audiology practice could be lucrative, it does involve equipment costs including maintenance and upgrades, and sustainability is dependent on a good client referral base.

2.4 Geographical Distribution of Participants

Questions 5, 6 and 7 gathered geographical information of respondents i.e. province employed in, workplace setting and sector of employment. A discussion of these results will be presented.

2.4.1 Provincial and Employment Sector Distribution

In order to obtain a snapshot of the distribution of clinicians across the country, a three way analysis of province, sector and domain of practice (*i.e. Audiologist, Speech therapist, Speech and Hearing Therapist, Community Speech and Hearing Therapist and None of the above*) was constructed as displayed in Table 5. Respondents who completed all questions pertaining to this three-way geographical construct were collated, giving a total of 261 usable questionnaires. (Note: The number of respondents (n) per question was as follows: Q 5 Province employed in: *n=273***,** Q 12 Sector employed in: *n=261* and Q 10 Currently practicing as: *n = 275*. Thus collectively, 261 questionnaires were used for the geographical summary. A display of the distribution of the total number of respondents per province *n=273*, is included in Table 5. On comparison of distributions between *n=261* and *n=273*, it is evident that although approximately 15 respondents were not accounted for, the trend in distributions observed in Table 5 remains consistent).

Therapists located in the Gauteng Province constituted the majority of the respondents' i.e. 56.32% (n=147) respondents, most of whom were practicing in Pretoria. Kwazulu-Natal and Western Cape had the second highest number of respondents, equalling a distribution of 10.34% (n=27) respondents per province. Therapist from the North West, Mpumalanga and Eastern Cape each contributed to approximately 5% of the respondents, followed by 3.45% (n=9) respondents from Limpopo Province with the minority of therapist i.e. 0.77% (n=2) from the Northern Cape.

The total distribution of respondents as per professional domain of practice and sector of practice were as follows: The majority of the respondents were practicing as *Speech Therapists* (111), with an almost even distribution of employment of therapist in the public and private sectors of 54 and 57 respectively. A total of 52 respondents were practicing as *Audiologists,* 11 of whom were employed in the public sector and 41 in the private sector. The majority of the private sector Audiologists were from the Gauteng Province i.e. 61% (n=25). Practicing *Speech and Hearing Therapists* totalled to 82, the majority of whom were employed in the public sector, 58.55% (n=48) with 41.46% (n=34) working in the private sector. The greater number of Speech Therapists and Speech and Hearing Therapists were again from Gauteng. A total of 9 respondents were practicing as *Community Speech and Hearing Workers*, 9 of whom were working in the public sector. Of the 261 respondents, 7 respondents indicated that they were not practicing in any of the above domains. Non-practice could be interpreted as either not actively practicing i.e. retired or possibly employed in full time post within a professional organization such as SASLHA or SAAA, or in representative/ consultant/ administrative position thus not actively practicing.

2.5 Distribution across Workplace Settings

A summary of the distribution of practicing Audiologists, Speech Therapists, Speech and Hearing Therapists, Community Speech and Hearing Therapists in each work place setting is provided in Table 6. Workplace setting options included: autonomous private practice, district health area/clinic, Hearing Aid Company, private hospital, private practice owned/co-owned by ENT specialist, specialized school, state hospital, tertiary education institution, the military and other.

A total of 270 respondents completed this question. The majority of respondents (104) were employed in an autonomous private practice, followed by 55 at state hospitals and 46 at

specialized schools. Autonomous private practice dominated as place of employment for both Audiologists and Speech-Language Therapists. Audiologists were primarily working privately, i.e. 50% (n=27) in autonomous private practice and a further 11.12% (n=6) in private practice owned/co-owned by an ENT specialist, with 18.52% (n=10) at state hospitals and 9.26% (n=5) employed in hearing aid companies. Of the 111 Speech- Language Therapists, 49.95% (n=51) working in autonomous private practice, 26.13% (n=29) at specialized schools and 14.41% (n=16) at state hospitals. Employment of Speech and Hearing Therapists was predominately at state hospitals (32.10%, n=26) and in autonomous private practice (30.86%, n=25) and (17.28%, n=14) were employed at specialized schools. Community Speech and Hearing Therapists were positioned at district health clinics, state hospitals and specialized schools. Across all respondents, minimal places of employment were the military; district health clinics and 'other' which could possibly refer to professional organizations or consultant /managerial positions within companies or the health sector.

3. SECTION B: Audit of Service Delivery

The following aims were investigated in Section B:

Aim 2: To conduct an audit of audiology services provided in South Africa

Aim 3: To explore reasons for possible non-delivery of audiology services

Aim 4: To identify possible contributing factors impacting on service delivery

The audit of audiological services was performed by obtaining information regarding how frequently each test or service was provided as well as identifying the primary reason for never providing a test or service. *(Please refer to Section B of the questionnaire).* This audit of service delivery was considered necessary to identify the trends in practice and key variables that were influencing practice. It also allowed for comparisons to be made regarding audiological services provided between professionals employed in the private and public

sectors. This was an important area of investigation, as much speculation exists amongst professionals as well as the public, regarding differences in service delivery provided in private and public sector settings.

3.1 Description Distribution of Respondents

Those participants who had previously practiced audiology or were currently in practice qualified to complete this section of the questionnaire. A total of 148 respondents answered this section. As mentioned during the discussion of the response rate, this number of respondents is fairly high, in view of the possible number of actively practicing audiologists. Further, prior to the "split curriculum" introduced in 1998 all graduates qualified as Speech and Hearing Therapist and were registered on a single register for Speech-Language Therapists and Audiologists. However to the researcher's knowledge as well as the results regarding area of practice to be discussed, most Speech and Hearing Therapists usually choose to practice either in Audiology or Speech Therapy. Therefore it was not possible to identify the precise number of professionals practicing Audiology. It is however common knowledge by professionals working in the field, that there are a significantly fewer number of Audiologists practicing in South Africa than Speech-Language Pathologists.

An almost even distribution of the number of respondents from each sector was obtained, with an average of 70 and 71 respondents per item from the private and public sector respectively. This distribution facilitated clear comparisons of service delivery and variables impacting on service delivery. It must be noted that some items were unanswered, thus the sample size (n) for each item does differ as indicated in the analysis of data. Descriptive statistics were calculated using the (n) value for each item. It appears likely that this section was completed mainly by those respondents who indicated practicing as audiologists and speech and hearing therapists (135 collectively) as reported in the results of section A.

Upon reviewing the demographics of employment of audiologist and speech and hearing therapist in the entire sample as discussed above, it was observed that each sector of employment was dominated by a particular workplace setting. Audiologists and SLHT working in autonomous private practice constituted the majority of the private sector, whilst the majority of public sector audiologist and SLHTs were employed in state hospitals. (Refer to Tables 2 & 3). Thus one could infer that the trends in practice displayed by the private sector were largely representative of practice trends among therapist employed in autonomous private practice. Similarly, practice trends in public sector analysis are mainly representative of service delivery in state hospitals.

3.2 Results of the Audit of Audiological Services provided by clinicians employed in Private and Public Sectors

The presentation and discussion of the results to follow have been reported in accordance to the structure of the questionnaire i.e. audit results from each subsection of audiology has been discussed viz. Basic Test Battery, Diagnostic Audiology, Paediatric Audiology, Amplification, Hearing Prevention and Conservation, (Re) Habilitation. (Refer to Appendix 2).

The audit results for each area of service delivery together with a discussion of the primary reasons given for “never” providing each service will be presented. The researcher will orientate this evaluation of these results by discussing the clinical value of each test and its importance to a comprehensive test battery approach, as well as necessity and relevance for each service. The implications of these findings per service area and recommendations will be included in the discussion. *Please note that discussions into training implications will not be explored in this study as this is the focus of the parallel study by Kathleen Wemmer.*

3.2.1 Subsection A: The Basic Test Battery

Basic test battery is a series of subjective and objective tests that are performed to assess auditory function of adults and children 6 years and older (Martin, 1994). Subjective tests include: pure tone air and bone conduction audiometry and speech audiometry (i.e. speech reception threshold and speech discrimination testing), with tympanometry and acoustic reflex measures constituting the objective component. Using normative data, each test result can be analysed accordingly, however, the eventual diagnosis of the loss is dependant on the correlation of all tests results (Martin, 1994). Once the basic test battery is completed, a diagnosis can be made in terms of the type, degree and configuration of hearing loss, and recommendations for management of the loss (Katz and Lezynski, 2000; Martin, 1994).

Results: The results of the audit as displayed in Table 7 below indicated that the basic test battery was practiced by most respondents, with "no equipment" being the primary reason for those who "never" provided the test. A discussion of the results of each test will be presented.

Table 7: Audit results of basic test battery procedures conducted

BASIC TEST BATTERY	SECTOR	ALWAYS Count	NEVER Count	SOMETIMES Count	TOTAL *(n)*
Pure tone Audiometry (Air & Bone Condition	Public Sector	67	3	5	75
	Private Sector	68	4	2	74
Tympanometry	Public Sector	58	**9**	7	74
	Private Sector	42	**12**	20	74
Acoustic Reflex	Public Sector	38	14	22	74
	Private Sector	25	14	35	74
Speech Discrimination Testing	Public Sector	**28**	**16**	**28**	72
	Private Sector	**55**	**7**	**12**	74
Speech Reception Testing	Public Sector	**25**	**20**	**27**	72
	Private Sector	**52**	**7**	**15**	74
Cerumen Management	Public Sector	17	**32**	22	71
	Private Sector	8	**45**	20	73

Pure Tone Air and Bone Conduction Testing

Results: The results displayed in Table 7 indicate that approximately 95% of respondents provide pure tone audiometry. The primary reason for non-practice provided was a "lack of equipment". (Refer to Table 8). It is possible that these respondents are employed in settings that do not provide clinical services in audiology.

This result is expected and reflective of audiological practice as pure tone audiometry is the primary test procedure necessary to evaluate the client's hearing sensitivity (Martin, 1994). Air conduction testing assesses the entire auditory pathway while bone conduction testing serves to assess inner ear functioning specifically. Both sets of results are necessary in order for one to comment on the degree, type and configuration of the loss and to ascertain whether the deficit is a product of the conductive mechanism, sensori-neural mechanism or both (Martin, 1994). Thus any audiological assessment protocol used to determine hearing sensitivity of children with normal development and adults must include pure tone audiometry.

Tympanometry

Tympanometry evaluates the integrity and functioning of the middle ear system by objectively determining the compliance of the tympanic membrane in the presence of air pressure (Martin, 1994).

Results: Tympanometry was performed routinely by 78.38% (n=58) and 56.76% (n=42) respondents from the public and private sectors respectively. Of the remaining respondents employed in the public sector 9.46% (n=7) indicated conducting this procedure "sometimes", while 37.5% (n=9) "never" used this test. Similarly, in the private sector, tympanometry was used occasionally by 27.03% (n=20) and "never" practiced by 16.22% (n=12) respondents.

(Refer to Table 7 above). The primary reason provided for “never” conducting this procedure was “no equipment” as indicated by 100% (n=9) of the respondents from the public sector and 81.81% (n=9) of private sector respondents. (Refer to Table 8).

This result is concerning as tympanometry is a valuable component of a diagnostic audiological evaluation and serves as an important motivation for referral (Martin, 1994). Clinical value and implications of tympanometry include: 1) identifying possible middle ear pathologies that may not be deduced from the otoscopic examination and or case history information; 2) valuable in the cross check principle as it verifies pure tone results for example conductive hearing loss should be accompanied by abnormal tympanometry results and 3) assists clinicians in determining test protocols for example, in the presence of a middle ear pathology when otoacoustic emission testing can not be performed, bone conduction testing should be performed to establish the impact of the middle ear pathology on hearing by determining air–bone gaps (Flower & Shacks, 2002; Martin, 1994). From the above review of clinical applications it is clear that the tympanometer is an integral piece of equipment that should be available in all audiology practice settings. It is acknowledged that this procedure could be used “sometimes”, as it is specifically important for detecting middle ear pathologies. Thus in patients that do not present with relevant case history factors, or when otoscopy is unremarkable, tympanometry may be omitted from the test battery.

However, the study results indicating the absolute non-practice of this procedure due to a “lack of equipment”, is exceptionally concerning. Tympanometry can often detect middle ear pathologies especially otitis media, often before it is visibly evident during otoscopy, and pure tone audiometry. Type A tympanograms with positive middle ear pressure (> 50dapa) have been reported as an indicator of the onset of acute otitis media. Further, a deviation in equivalent ear canal volume from the norm serves as an indicator of a perforation, which may

not be viewed during the otoscopic examination. Measures of ear canal volume has also proven valuable in monitoring the course of middle ear infections after the insertion of grommets, and correlates highly with incidences of severity of the disease/infection and with reoccurring otitis media (Hunter and Margolis, 2000:p397).

The lack of resources in the public sector especially in rural clinic settings have been informally raised by gradates who have completed community service. It is important that a strong motivation for basic equipment be followed through. Tympanometry is also a useful, quick test for screening middle ear infection. In rural settings, where outreach screening programmes are possibly the first line of audiological intervention, tympanometry would prove invaluable in identifying and monitoring children with otitis media.

Acoustic Immittance Testing

Acoustic Reflex measures are used clinically to assess the 1) integrity of the brainstem neural pathways associated with the reflex arch, 2) detect functional hearing loss and 3) used in the Metz test to determine recruitment (Martin, 2004; Wiley & Stoppenbach in Katz, 2002)

Results: Acoustic immittance testing was reportedly performed by the majority of the respondents (approximately 81%) per sector, with 18.92% (n=14) respondents from each sector “never” conducting the test. (Refer to Table 7). The majority of respondents provided a “lack of equipment” as a primary reason for non-practice. (Refer to Table 8).

As with all other test components of the basic test battery, acoustic reflex measures should be used with clinical discretion and certainly provides important information regarding the functioning of the auditory nerve pathway within the brainstem. All diagnostic tympanometers have the option of reflex measures. Therefore it is possible that those respondents who indicated not performing tympanometry also indicated a “never” response for this measure.

Availability of this equipment is clinically vital and once again complete non-practice would imply that valuable information could be overlooked during the assessment.

Speech Audiometry

The hearing impairment established by pure tone testing can by no means depict the impact of the loss on speech communication. Tests for speech-processing are included in the audiological examination to determine the extent to which depressed hearing thresholds limit the perception of speech sounds (Thibodeau, 2000:p282).

Results: Speech discrimination (SD) testing was used as a clinical tool by 77.78% (n=56) of respondents working in the private sector (i.e. “always” 34.72% (n=28) and “sometimes” 38.88%, (n=28)) with 27.77% (n=20) respondents “never” conducting this procedure. Respondents employed in the public sector indicated that 93.06% (n=67) performed the test (i.e. 74.32%, (n=55) “always”, and 16.22%, (n=12) “sometimes”) while 22.22% (n=16) respondents “never” used this test. A similar trend in result was observed for speech reception testing (SRT). (Refer to Table 7). The primary reason provided by the majority of respondents for “never” conducting speech audiometry was a “lack of equipment” (> 60%). (Refer to Table 8).

The percentage of “never” responses raises questions concerning audiological evaluations for hearing aid fittings. As mentioned, speech audiometry is essential to making a differential diagnosis. The clinical significance of speech (word) discrimination scores include: 1) they provide information regarding the site of lesion i.e. cochlear or retro cochlear 2) in some pathologies such as Menieres Disease patterns in speech audiometry and pure tone results serve as a classic indicator of pathology and 3) importantly indicates the clients ability to discriminate speech with amplification which depicts the prognosis for hearing aid use.

Speech Reception Thresholds (SRTs) are used to validate pure tone results (Brunt, 2002; Thibodeau, 2000; Martin, 1994). Therefore, by not performing speech testing, a true description of the impact of hearing loss on the auditory system would not be established. Further, the primary reason for non–practice being a “lack of equipment” is concerning as speech audiometry is standard selection on all diagnostic audiometers. Thus “no equipment” can be interpreted as a) this function was not in use or b) screening audiometers which could be used to obtain pure tone audiograms were being used for diagnostic testing. It is acknowledged that a test may sometimes be omitted from the audiological evaluation (as is evident in the response “sometimes”) but this decision is assumed to be within clinical reason.

It is acknowledged that depending on the focus of their practice, some audiologists may not see a caseload requiring speech testing. However audiology practices/departments offering diagnostic and rehabilitation services should be appropriately equipped. Non-performance of speech audiometry due to a “lack of equipment” implies that incomplete audiological examinations are routinely performed by these respondents. Further, one needs to question how management decisions regarding hearing aid fittings and verification, or the need for ENT intervention especially in the case of a retrocochlear pathology are being reached. No clinician should be placed in the position of performing inadequate basic services. In the least, all audiologists must be able to conduct the complete basic test battery.

In sum, the basic test battery was performed by most respondents. However the complete omission of tests due to a lack of equipment is concerning as these test components constitute the initial comprehensive diagnostic audiological evaluation and thus should be carried out during the assessment. Also, the basic test battery emphasises the need for the cross check principle in which all test measures are integrated and compared to verify results

(Martin, 1994). As noted by Roeser, Valente and Hosford-Dunn (2000:p14), “when selecting a test battery, because of time and reimbursement constraints, that which is ideal may not be that which is real. The question arises as to which tests are preferred in clinical practice; the answer has to do with efficiency”. Thus, it is acknowledged that time constraints could impact on the test protocol, at which stage clinical discretion would dictate the optimal testing protocol. However, not having access to equipment does not provide one with the option of conducting the test and thus does fair poorly towards obtaining a comprehensive reliable, valid diagnosis.

Cerumen Management (CM)

Impacted cerumen can cause a variety of symptoms including itching, pain, hearing loss, tinnitus, dizziness and increased infection risk and if left untreated can lead to “hearing loss, social withdrawal, poor work function and even mild paranoia” (Guest, Greener, Robinson and Smith, 2004:p477). Often patients attempt to remove the wax, most often with an ear bud and in doing so force the wax deeper into the canal resulting in a tympanic membrane perforation which can lead to a perilymph fistula which can cause nystagmus, sensori-neural hearing loss and if cerumen is severely impacted against the eardrum and then is suddenly released, tinnitus could occur (Guest, Greener, Robinson and Smith, 2004).

Further, impacted cerumen may prevent, or render invalid certain audiological procedures including otoscopy, immittance measures, caloric irrigations, otoacoustic emissions (OAEs), real ear measures, ear canal impressions, as well as conventional pure tone and speech audiometry (Skordas & Primus, 1997). Hence cerumen removal is often necessary in the course of the audiological evaluation.

Results: The results indicated that cerumen management was not practiced by most audiologists. In the private sector 61.64% (n=45) of the respondents indicated "never" performing cerumen management, 27.40% (n=20) "sometimes" and 10.96% (n=8) "always". 45.07%, (n=32) public sector respondents "never" provided this service, 31% (n=22) occasionally, and 23.94% (n=17) "always". (Refer to Table 7). The primary reason provided by all respondents for "never" practicing cerumen management was due to "insufficient training". Of the 45 private sector respondents "never" offering cerumen management, (66.67%, n=30) indicated "insufficient training" as the main reason for non-practice, (17.78%, n=8) a "lack of equipment" and (15.56%, n=7) "other". Similarly, of the 32 "never" responses obtained from public sector employees, (68.75%, n=22) selected "insufficient training" as primary reason for not offering this service, (3.13%, n=1) "no equipment" and (25%, n=8) selected "other". (Refer to Table 8).

The goal in performing cerumen management (CM) is to remove the earwax and debris that blocks the ear canal without exacerbating pathologic conditions which should be evaluated and treated by physicians. Traditionally CM was conducted by a physician. Currently, it can be performed by a trained audiologist if supported by the scope of audiology practice. However the role of the audiologist in cerumen management continues to be debated (Guest, Greener, Robinson and Smith, 2004). The impact of these issues on the results obtained will be included in the discussion to follow.

The majority of "never" responses obtained was expected and is essentially due to the training programmes provided in SA, as indicated by respondents. In countries such as the US, audiologists obtain clinical training in CM including syringing and irrigation, as it is included in their Scope of Audiology Practice (ASHA, 2004). In South Africa, audiologists currently do not receive clinical training during the undergraduate programme on the removal

of cerumen and often management is limited to suggesting pharmacological treatment products such as Cerumol, Waxsol, Exterol, Earex and Xerumenex, coupled with a medical referral. Audiologists who have been trained and or supervised by an Ear Nose and Throat Specialists (ENTs) may perform wax irrigation and syringing, however this practice seems to be context driven.

The results of this study suggest that CM is conducted more by public sector employees (31% (n=22) occasionally, and 23.94% (n=17) “always”). (Refer to Table 7). Audiological CM in these settings could have been facilitated by the presence of on-site medical personnel. Also, it is also possible that some respondents could have interpreted cerumen management in a limited context to mean, suggesting pharmacological treatment and making referrals.

According to Roeser and Crandell (cited in Skordas and Primus, 1997), every practicing audiologist should learn cerumen management techniques and develop expertise in this area to more efficiently, thoroughly and safely treat their patients. However, the managing of cerumen in audiology practices has been opposed by professionals in related fields as it requires basic medical knowledge and substantial proficiency. Literature has also noted that factors such the clinical skill required and professional risks such as physical injury to the patient and liability attached to patient injury may deter audiologists from practicing cerumen management (Guest, Greener, Robinson and Smith, 2004).

The limited Scope of Audiology Practice in the area of cerumen management available to SA Audiologists proves problematic to timely assessment of clients. Patients may need to visit a physician before completing the audiological evaluation, resulting in delays and inconvenience and further expenses for the patient (Skordas & Primus, 1997), especially when testing clients in environments that do not have immediate access to physicians or

ENTs. Further, the inability to perform wax removal during screening programmes impacts on the programme in that patients are expected to follow up on the referral and further testing would not be possible until the wax removal is performed. Immediate management on the other hand would imply that the identified problem would be addressed, no further cost would be incurred by the patient, and follow-up testing could be performed in a timelier manner.

The need for training in the area of cerumen management appears necessary for best audiological practice outcomes. As indicated by the results, clinical training in CM is completely lacking in the graduate training programmes in SA with a limited number of audiologists obtaining training possibly from medical persons such as ENTs. In countries such as the US where CM is within the scope of Audiology practice , debate still exists regarding the adequacy of training, and the appropriateness of audiologists to perform CM. Results of a survey conducted of 500 US audiologists investigating the practice of cerumen management and perceptions surrounding this service indicated that whilst most audiologists supported CM, predominant reasons for limited practice in this area included concerns regarding the lack of training, appropriateness for audiological practice and professional risks (Skordas and Primus, 1997). A similar survey could be conducted in SA, which would serve to direct the course of CM training and practice necessitated in the SA context.

3.2.2 <u>Subsection B:</u> Diagnostic Audiology

At the completion of the basic test battery, clients may be referred for alternate or additional audiological evaluation. These clients are usually (a) young children or a client whose developmental levels preclude use of a complete basic assessment or (b) clients for who symptoms and findings from the basic audiological evaluation suggest the site of the loss to be related to cochlea and /or auditory nerve and /or central auditory nervous system (i.e.

retrocochlear pathologies) (Robinette & Cevette in Katz, 2002: p144, Martin, 1994). These advanced procedures are designed to more precisely assess and distinguish these components, as an accurate differential diagnosis allows for the selection of the most appropriate management strategy (Martin, 1994).

Clinical measurements classified as advanced diagnostic procedures include: a) A group of subjective tests referred to clinically as Behavioural Site of Lesion (SOL) tests, which are applicable for the adult population and b) objective tests specific to assessing cochlea and retrocochlear function. Objective tests for cochlear functioning include Electrocochleography (ECochG) and Otoacoustic Emissions (OAEs). Electrophysiological tests constitute the objective assessment procedures which essentially involve the use of Auditory Evoked Potentials (AEPs) i.e. an electrical manifestation of the brain's response to an external auditory stimulus. Such tests include the Acoustic Brainstem Response (ABR), Middle Latency Response (MMR), Late Latency Response (LLR), Auditory Steady State Response (ASSR) and P300 (Burkurd & Secor, 2002 ; Roeser, Valente & Hosford-Dunn, 2000).

RESULTS: A summary of the audit results of diagnostic audiology services provided in both sectors are displayed in Table 9 below, accompanied by graphic displays (Figures 3(a) and 3 (b)) illustrating the distribution of primary reasons selected for never providing a service in the public and private sector respectively.

Overall, audit results indicated an overwhelming "never" response for all tests investigated in this area. On average, over 55% of respondents across both sectors, never provide Behavioral Site of Lesion (SOL), Auditory Behavioral Response (ABR), Behavioral Auditory Processing (APD) testing, whilst more than 90% of "never" responses were obtained for Electrocochleography(ECochG), Late Latency Response (LLR), Electronystagmography

ENG), Middle Latency Response (MLR), Mismatch Negativity (MMN), Neurological Intra-Operative Monitoring and P300. Results for Otoacoustic Emissions (OAEs) testing appears slightly more positive, with 41.09 % respondents working in the private sector performing the test “sometimes”, 20.54% “always”, and 38.35% indicated “never” conducting the test. Public sector use of OAEs differed, with OAEs never conducted by 54.28% of respondents, whilst 30.00% reported always performing the test, and 15.71% sometimes.

While some of these tests are relatively ‘new’ tools such as the ASSR, other tests such as the ABR have been in use for approximately 30years. Results clearly indicate that AEPS and advanced diagnostic audiology tests are not being performed in audiology practices across sectors. The results of each test will now be presented and discussed in more detail.

To lead the discussion on the implication of this finding, the researcher considered the following as important questions to be addressed*: a) What is the clinical relevance of each test? b) What are the implications on diagnosis and intervention should (a) test(s) not be performed? c) Is it possible to obtain the same information using a different test? (d) Are the clinical uses of the tests context driven i.e. is it applicable in the SA context? and e) What do these results imply with regard to the quality of audiological service provision in the area of screening, diagnosis and intervention?*

To attempt to answer the first question the researcher will begin by presenting a discussion on the clinical applications of each test, in order to evaluate the clinical significance or lack there of in testing protocols. Also, possible feasible measures to address the equipment shortage as evident from the results shall be discussed.

Table 9: Audit of Diagnostic Audiology Services provided in Private and Public Sectors

DIAGNOSTIC AUDIOLOGY	SECTOR	*N*	ALWAYS	NEVER	SOMETIMES
Auditory Brainstem Response (ABR)	Public Sector	***72***	13.88%	***70.83%***	15.27%
	Private Sector	***71***	7.04%	***78.87%***	14.08%
Auditory Steady State Response (ASSR)	Public Sector	***70***	2.85%	***90.00%***	7.14%
	Private Sector	***71***	5.63%	***94.36%***	0.00%
Behavioral Auditory Processing Test	Public Sector	***70***	1.42%	***72.85%***	25.71%
	Private Sector	***70***	8.57%	***58.57%***	32.85%
Behavioral Site of Lesion Tests	Public Sector	***70***	11.42%	***52.85%***	35.71%
	Private Sector	***72***	11.11%	***59.72%***	29.16%
Electrocochleography (ECochG)	Public Sector	***69***	0.00%	***100.00%***	0.00%
	Private Sector	***70***	1.42%	***91.42%***	7.14%
Electronystagmography ENG)	Public Sector	***69***	2.89%	***95.65%***	1.44%
	Private Sector	***70***	7.14%	***80.00%***	12.85%
Late Latency Response (LLR)	Public Sector	***69***	0.00%	***98.55%***	1.44%
	Private Sector	***70***	1.42%	***98.57%***	0.00%
Middle Latency Response (MLR)	Public Sector	***69***	1.44%	***94.20%***	4.34%
	Private Sector	***70***	1.42%	***97.14%***	1.42%
Mismatch Negativity (MMN)	Public Sector	***69***	0.00%	***98.52%***	1.47%
	Private Sector	***70***	1.42%	***98.57%***	0.00%
Neurological Intra-Operative Monitoring	Public Sector	***69***	1.44%	***98.55%***	0.00%
	Private Sector	***70***	1.42%	***92.85%***	5.71%
Otoacoustic Emissions (OAEs)	Public Sector	***70***	15.71%	***54.28%***	***30.00%***
	Private Sector	***73***	20.54%	***38.35%***	***41.09%***
P300	Public Sector	***69***	0.00%	***98.55%***	1.44%
	Private Sector	***70***	0.00%	***97.14%***	1.42%

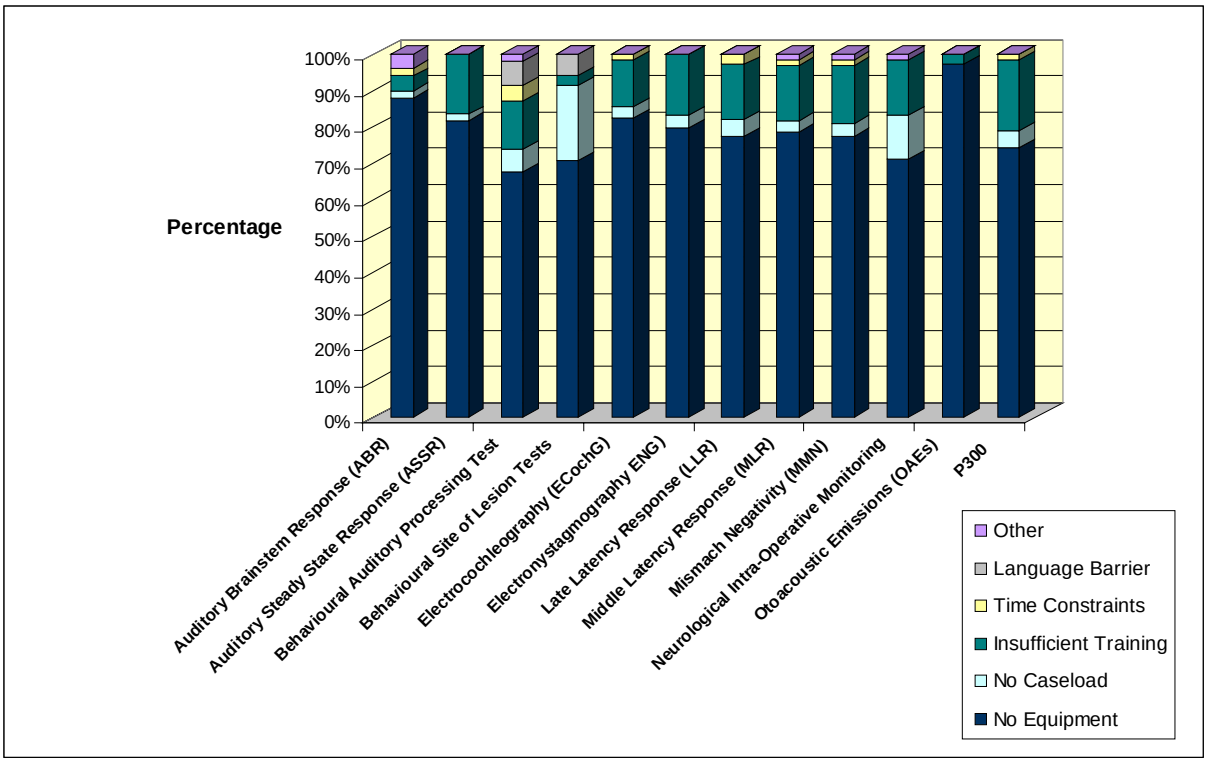

Figure 3 (a): Public Sector: Primary Reason for "Never" Providing Advanced Diagnostics Tests (n=72)

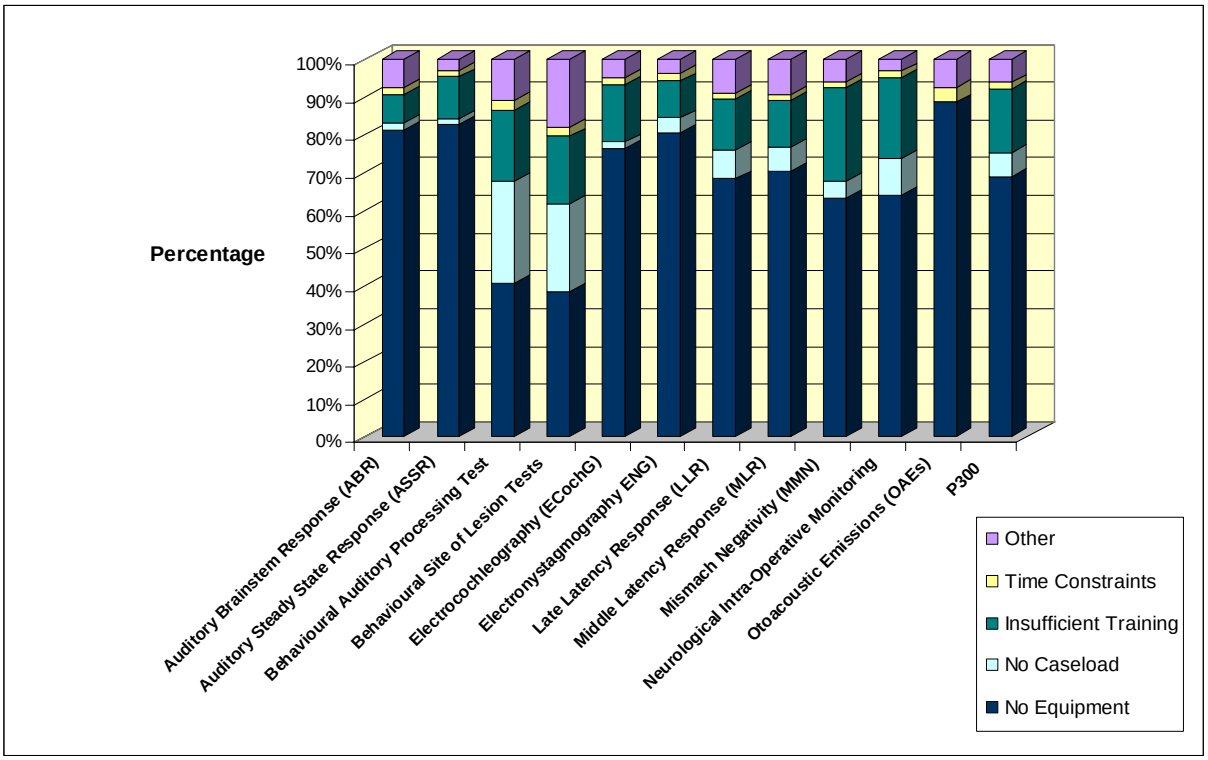

Figure 3(b): Private Sector Primary Reason for "Never" Providing Advanced Diagnostics Tests (n=71)

Auditory Evoked Potentials

Auditory Brain Stem Response (ABR)

The ABR test evaluates the neural synchrony of the auditory nerve and brainstem pathway. Although this test is not a test of hearing sensitivity, it has earned a clinical reputation as useful tool to evaluate the auditory pathway extending from the ear canal to the lower brainstem pathway (Stach, 2002; Arnold, 2000) and should be used as part of a test battery.

Results: A total of 72 respondents from the public sector and 71 respondents from the private sector completed this question. The majority of respondents from both private (78.87%, n=56) and public sector (70.83%, n=56) indicated "never" performing the test, with approximately 15% (~10) of the respondents per sector providing the test occasionally. ABRs were performed routinely by 13.88% (n=10) respondents employed in the public sector and 7.04% (n=5) private practitioners. (Refer to Table 9). Of the public sector respondents "never" providing the test, 87.75% (n=43) indicated the "lack of equipment" as the underlying reason for non-practice, with reasons of "time constraints", "insufficient training" , "no case load" and 'other' contributing minimally to this result. Similar results were obtained from private sector respondents, i.e. the reason of "no equipment" was selected by 81.13% (n=43) of respondents, with insufficient training and other each contributing to a much lesser extent (approximately 5%). (Refer to Figures 3(a) & 3(b)).

The results reveal that ABR testing is not performed by most practitioners, irrespective of sector of employment. The key reason for non-practice among the majority of respondents being a "lack of equipment" needs to be addressed. One obvious factor that impacts on the use of a test is the cost of the equipment. Also, investment in equipment is influenced by the case load serviced and budget restrictions in private hospitals often dictate procedures used.

Similarly, the profitability of a private practice will determine the ability to purchase newer equipment.

Further, performing and interpreting an ABR does require good clinical skill and knowledge. As indicated by respondents “insufficient training” does impact on the use of a test. Clinical skill is developed with practice. Due to the nature and duration of the previous audiology training programmes in SA, it is possible that insufficient time was available to establish clinical skill in all areas of audiology such as ABR. Also, tests such as ABR have evolved, thus it is likely that some practitioners may have obtained limited training in this procedure as it was a developing clinical tool at the time of their training. Therefore, CPD activities reviewing ABR theory and providing clinical training should be implemented. (Please note that issues concerning training will be addressed in detail in the parallel study by Kathleen Wemmer and therefore will not be discussed in this report).

In order to determine whether or not audiologists need to invest in an ABR and if further training in this area is essential, the questions that need to be addressed are: Is an ABR machine an essential piece of equipment in daily practice? What possible measures could be taken to encourage use of this test? In order to answer the question on clinical importance, the researcher will discuss the clinical value of ABR testing highlighted in literature, as well as the advantages and disadvantages of the ABR. Also, with emerging clinical tools, one needs to ascertain which test equipment is the better and more valuable investment, and what is the difference in clinical relevance of each test. Currently, audiologists are questioning if the recently emerged Auditory Steady State Response (ASSR) Test should replace the ABR (Stach, 2002). This is an important question, especially in view of the study results which indicate that SA audiologists need to consider updating their audiological service delivery. With regards to use of the procedure Hosford-Dunn, Dunn & Hartford (1995:p22) emphasized

that an electrophysiology test such as ABR will not be supported in a community, regardless of need if physicians and ENTs are not educated or biased against these tests. This issue will be presented at the conclusion of the discussion.

Literature has highlighted that the clinical value and application of the ABR includes (Mason in McCormick, 2004; Don & Kwong in Katz, 2002; Hall and Mueller, 1998): 1. Ehstimation of auditory thresholds for pseudohypocusic patients, infants and difficult to test children where inadequate or unreliable results are obtained, 2. Neurodiagnosis of auditory nerve or brainstem pathologies/dysfunction across age groups, 3. Monitoring auditory nerve and brainstem status intraoperatively, during posterior fossa surgery and 4. Newborn hearing screening. The ABR is reportedly the most popular AEP for hearing screening, followed by OAEs According to Cone-Wesson (2005), ABR tests have excellent validity and studies have indicated hearing level estimates within approximately 10-15dB of actual pure tone threshold in the high frequency range.

The extent of the clinical utility of ABR in detecting eighth nerve tumours has been questioned, since factors other than eighth never tumours were noted to produce abnormal ABRs (Bauch et al., 1982; 1983 cited in Katz, 2002). Since then, the MRI-G has been considered as the gold standard of detection for eighth nerve tumours and one may now question the role of the audiologist and ABR in making the differential diagnosis (Don & Kwong, 2002). In SA, the detection of tumours using the MRI over the ABR has been observed by the researcher to be common practice. Martin and Cevette (2002:p146) addressed this concern by applying “clinical decision analysis (CAD) techniques” (“a systematic approach to making clinical decisions under conditions of uncertainly”) to differential diagnosis of eighth nerve tumours. The results highlighted the ABR as an efficient and cost-effective tool in detecting eighth nerve tumours. Further, ABR and ECochG are also

used in intraoperative neurophysiologic monitoring (Moeller, 2000). (For more information refer to discussion on intraoperative monitoring).

Although the ABR has proven to be a valuable clinical tool, it does present with limitations. Firstly, ABRs are usually elicited using a click stimulus which is not frequency specific and generally allows estimation over a broad range of high frequencies. Tone-burst elicited ABRs provide more frequency specific information, however it can be difficult to record close to threshold especially at low frequencies. Thus the precision across frequencies is less than optimal (Stach, 2002; Hall and Mueller, 1998). Secondly, for rising, sloping or unusual configurations, the ABR may over -or under- predict the information (Johnson and Winter, 2005). In addition, according to Stach (2002), absent wave forms may be obtained for individuals with losses exceeding 70dBHL i.e. the same absent ABR will be elicited for a loss of 70dB, 80dB, 90dB etc. This prediction is over a broad range of loss, especially if being used to fit a hearing aid. Lastly, an experienced examiner must be able to 'read' the ABR wave forms. The precision with which they can do this is not easily quantified and thus the interpretation is subjective and prone to observer bias (Cone-Wesson, 2005: p266)

Despite the limitations of the ABR test as a single tool, the clinical information obtained is undoubtedly valuable. According to Stach (2002) the ABR has proven to be an essential clinical tool used extensively globally. Further, the literature reviewed clearly highlighted the ABR as a significant test that should be accessible in clinical practice. Literature clearly states that the ABR should not be used in isolation, and in the discussion to follow clinical evidence has suggested that the use of additional objective tests does serve to address the limitations noted in the ABR. One such test is the Auditory Steady State Response (ASSR) test.

From the above discussion it is clear that ABR testing is an essential, valuable clinical tool. However the cost of equipment is significant. As it services all ages and its clinical use extends from neurodiagnosis to auditory threshold predictability, it is valuable in any diagnostic audiology practice. To the researcher's knowledge, public hospitals use a referral system, whereby patients are referred to the nearest state hospitals that have the necessary equipment. The efficacy and efficiency of referral systems needs to be evaluated. In view of the large case loads serviced in public hospitals, the delay in assessment and treatment of patients is concerning. Also, the inconvenience caused to the client must be acknowledged. It is important that audiologists employed in state hospitals discuss referral statistics, and together evaluate systems in place so that an informed decision on resources can be made.

Study results revealed that approximately 15 of the 73 respondents in private practice perform ABRs. This result could imply that 1. the case load requiring ABR testing is manageable through referrals to other equipped practices 2. in the case of neurodiagnosis, an MRI is being conducted over an ABR, and 3. limited testing of paediatric (infant) and difficult to test clients is being conducted. Thus service delivery in private practice needs to be further investigated to establish clientele serviced and issues impacting on extending audiology services.

Auditory Steady-State Evoked Response (ASSR)

The Auditory Steady-State Evoked Response (ASSR) is an auditory evoked potential, elicited with modulated tones. The response itself is the brain potential that closely follows the course of the modulation. The presence of the ASSR at the modulated frequency is critically dependant on the status of the cochlea and the auditory nerve (Stach, 2002; Cone-Wesson, 2005).

Results: 70 respondents from the public sector and 71 respondents from the private sector responded to this question. ASSR was not in clinical use by 90% of public sector and 94.36% of private sector respondents. Respondents across sectors revealed “lack of equipment (approximately 80%) and “insufficient training” (approximately 20%) as primary reasons surrounding this result. (Refer to Table 9 and Figures 3(a) and 3(b) above).

ASSR is a relatively new technology that has been incorporated into clinical practice. Thus, the above results are expected, and appear to be reflective of the early establishment of this test. It is likely that clinical training using ASSR is being phased into the audiology curriculum, and again, CPD would serve as an avenue to inform and train audiologists on ASSR testing. As with other AEPs, the cost of equipment is a significant factor that will dictate use of this tool although it appears to be a very promising test as will be highlighted in the discussion to follow.

As mentioned during the discussion on ABR, the clinical need for a test should be established in order to evaluate the impact of non-practice on audiology assessment and management. The researcher will therefore discuss the clinical use and value of the ASSR and highlight future developments in this area.

The primary clinical application of the ASSR is to obtain frequency specific auditory threshold estimations for infants referred from the new born hearing screening programme (Grason-Stadler, 2001). Unlike the ABR, the ASSR is evaluated using an automatic, objective, statistical method which determines the presence of a response. Numerous studies have concurred that ASSRs are particularly useful for estimating the audiogram and residual hearing(Rance et al.,1998 cited in Sininger and Con-Wesson, 2002:p315) in infants and young children with moderate-severe to profound hearing losses, with poorer accuracy of predictions for mild to moderate losses (Cone-Wesson, 2005; Stach, 2002). Clinically, the

estimated audiogram would be useful in directing intervention strategies e.g. recommendation for a hearing aid or consideration of a cochlea implant (Sininger & Cone-Wesson, 2002; Grason-Stadler, 2001; Stach, 2002).

The above application has raised the question '*does the ASSR replace the ABR*?' This is a critical question not only in terms of best practice, but also when purchasing equipment in emerging or developing practices. The cost of equipment is a governing factor for all practices. Hence, when investing in a clinical tool the range of clinical applications and value that the tool provides against other similar tools should be evaluated.

Currently, insufficient data is available to provide an evidence based guideline for using one method instead of the other to estimate thresholds (Cone-Wesson, 2005:p272). However, it appears that should ABR waves be absent for tone bursts, then ASSR may provide information about residual hearing that may not be available on the ABR (Kosmider, 1997 & Rance et al 1995, cited in Sininger & Cone-Wesson, 2002:p316). This would be especially valuable when evaluating infants and children for possible cochlear implantation.

In addition, possible future applications of ASSR include: *1. ASSR and Speech Perception*: Recent studies have suggested that steady-state recordings to multiple frequency modulated pure tones could provide an objective measurement of suprathreshold hearing (Stach, 2002). *2. ASSR in hearing aid fitting:* ASSR may be able to provide estimates of both the audibility and discriminatory ability. This could be applied in the fitting process, in that thresholds could be estimated using the ASSR, hearing aids could be selected based on electroacoustic information, and the ASSR could be used to verify if the sound is being received and discriminated by the high cortical areas of the brain (Picton, Dimitrijevic, van Roon, John, Reed and Finkelstein, 2001)

The ASSR is a promising clinical tool especially for infant assessment and hearing aid fitting. Although results have indicated that this procedure is currently practice by very few audiologists working mainly in the public sector (refer to Table 9), the positive is that this test is available. Audiologists should seek to invest in this test in the near future. As with all newly released technology, this equipment is indeed very costly and feasible procedures and measures for equipping hospitals and private practices will need to be considered.

Neurological Intra-Operative Monitoring

Neurological intraoperative monitoring using auditory evoked potentials namely the ABR was introduced in the late 1970s, as surgical procedures involving access to the cerebellopontine angle (CPA) resulted in damage to the auditory nerve, cochlear or at higher levels along the auditory pathway (Moeller, 2000) Other procedures that place the auditory nerve at risk include resection of vestibular schwannoma; vestibular nerve section; microvascular decompression of cranial nerves V, VII, VIII, and IX; resection of other CPA and fourth ventricle tumours; repair of CPA arteriovenous malformations; and aneurysm repair (Martin and Mishler, 2002:p323).

Results: 69 respondents from the public sector and 70 respondents from the private sector completed this question. A majority of 98.55% (n=68) and 92.85% (n=65) of respondents from the public and private sectors respectively indicated “never” performing neurological intraoperative monitoring. Intraoperative monitoring was shown to be conducted routinely by 1 respondent from each sector, while 4 respondents from the private sector performed this service occasionally. (Refer to Table 9). In the public sector, 68 of the “never” respondents revealed the following primary reasons for non-practice: 70.59% (n=48) respondents indicated “no equipment”, 17.64% (n=12) selected “insufficient training” and 11.76% (n=8) “no

case load". Similarly private sector respondents indicated "no equipment" (74.62%, n=42), "insufficient training" (21.53%, n=14) and "no case load" (9.83%, n=6) as the main reasons for not performing the monitoring. (Refer to Figures 3(a) and 3(b)).

Results indicate that intraoperative monitoring appears to be uncommon practice amongst audiologists in South Africa. This was mainly a result of a lack of equipment and to a lesser extent to insufficient clinical training and expertise and no case load.

Clinically, Electrocochleography (ECochG) and ABR are used for intraoperative monitoring. Electrocochleography (ECochG) is used to provide information regarding the distal portion of the auditory nerve and cochlea blood supply, and the direct recording of the auditory nerve compound action potential (AN-CAP) now provides almost instantaneous measures of the auditory nerve function (Ferror & Durrant, 2002). The ABR is used to provide an overview of the functioning along the entire auditory pathway extending from the distal end of the auditory nerve, to the mid brain. The use of facial nerve monitoring is also increasing, and is necessary during the resection of vestibular schwannomas, the removal of parotid gland tumours and cochlear implantation.

From the study results discussed previously, it was apparent that auditory evoked potential equipment is clearly under resourced in both the private and public sector, and training in these procedures needs to be revised through CPD activities. Also, the number of patients undergoing surgery requiring such monitoring is a factor that will impact on the use of monitoring. In view of the current equipment shortage, and budget constraints experienced in the health sector, it reduces the likelihood that intraoperative monitoring would be a feasible option currently in SA. As highlighted by Martin and Mishler (2002:p324) "The present emphasis in health care is to reduce cost. Techniques are considered new or experimental by

insurance providers, are not covered. As a result, hospitals wrestle with the administrative decisions about supporting monitoring programmes. Hospitals looking at cost cutting measures may forgo monitoring, to support other revenue generating programmes". This certainly applies to the SA health care system as well.

Under the current transformation of health service delivery in our country, provision of basic medical care to all persons is priority (White Paper on Transformation). The majority of the country is reliant on the public health system budget allocation, which is more likely to support 'wider needed' services. In addition, medical care in SA appears to more orientated and focussed on addressing life threatening conditions. Thus it is possible that the investment required for and the implementation of intraoperative monitoring is not currently feasible in view of other more pressing basic health services.

In sum, intraoperative monitoring is one of the means of reducing the likelihood of mistakes during surgery that could lead to the injury and permanent deficits (Moeller, 2000). This is certainly valuable; however the cost of such a programme appears to be a deterrent to implementation. In addition, the recognised value of monitoring by surgeons is said to differ, and this seems to be a product of their training (Martin & Mishler, 2002:p325). However, the preservation of sensory function is vital to the quality of life and every measure should be taken to preserve the functioning of a patient.

Middle-Latency Response (MLR)

Results: 68 respondents from the public sector and 70 respondents from the private sector completed this question. Audit results revealed that approximately 94% and 97% of the respondents from the public and private sector did not conduct middle latency response

recordings. (Refer to Table 9). This was attributed predominantly to a “lack of equipment”, and to a lesser extent to “insufficient training”. (Refer to Figures 3(a) and 3(b)).

These results are not alarming as the clinical use of MLR is still not completely understood and therefore “not considered a mainstream electrophysiological test in routine audiology practice” (McPherson & Ballachanda, 2000:p496). MLR, otherwise termed middle latency auditory evoked potential (MLAEP), appears to be useful in detecting peripheral hearing loss and central auditory processing problems (McPherson & Ballachanda, 2000). Since MLRs are less dependent on neural synchrony than the ABR, it appears to be useful for threshold estimation in the low frequency range (< 1000Hz). This is particularly important when testing patients with neurological damage, as threshold estimation with other brainstem AEPs is not possible (Kraus and McGee, 1990; 1996 cited in Cacace & McFarland, 2002:367).

Recent studies have suggested that MLR could provide valuable information for the evaluation of central auditory processing disorders (CAPD) and cochlear implant candidates. Abnormal MLR recordings were noted in patients with learning disabilities (Jerger and Musiek, 2002). In contrast, studies conducted in children with cognitive, neurological and language disorders found normal MLRs (Manson and Mellor, 1984 and Kraus et al., 1985 cited in Cacace & McFarland, 2002). Thus more research is needed in this area.

Late Latency Response (LLR) and P300

Results: This question was completed by 69 public sector and 70 private sector respondents. The majority of respondents (98%per sector) did not perform late latency evoked potentials. One respondent from each sector indicated performing this procedure. The primary reasons given for non-practice included “no equipment” (78.33%, n=47), insufficient training (15.00%, n=9) and “no case load” (3.33%, n=2). Similar results were obtained for P300, with 98.55% and 97.14%of respondents per sector “never” conducting this

test, due to “no equipment “ (74.24%, n=49), “insufficient training” (19.69%, n=13) and “no case load” (4.54%, n=3). (Refer to Table 9 and Figures 3(a) and 3 (b)).

As with middle latencies, the clinical use of late latencies and P300 is not part of mainstream diagnostics procedures. Therefore these results are reflective of the use of these tests in routine audiology practice. The uncertainty of the cortical origin and cognitive events underlying LLR and P300 makes the clinical utility of these measures quite limited (Stapells, 2002). P300 latency has been reported to be delayed in children with CAPD, and changes in P300 reflected behavioural changes with therapy.

Behavioural Assessment of Auditory Processing Disorders ((C) APD)

Auditory processing ability is the capacity with which the central auditory nervous system transfers information from the auditory nerve to the auditory cortex for the processing of information that is specific to the auditory modality (Stach, 2000; Jerger and Musiek, 2000). Central auditory processing disorders (CAPD) appear to be associated with difficulties in understanding speech, poor language development, learning and listening especially with background noise (Jerger and Musiek, 2000:p468) and is present in adults and children (Stach, 2000).

Results: This question was completed by 70 respondents per sector. The results suggest that (C) APD assessments are generally not performed by respondents, however more so in the public sector. Of the respondents working in the public sector, CAPD was “never” practice by 72.85% (n=51) and practiced “sometimes” by 25.71% (n=18). The majority of private sector respondents, 58.57% (n=41) “never” conduct CAPD assessments, 32.85% (n=23) occasionally, and 8.57% (n=6) routinely. (Refer to Table 9). Private sector respondents identified key reasons for not providing CAPD assessments as “no equipment”

(41.46%, n=17), “no case load” (26.83%, n=11), “insufficient training” (19.51%, n= 8) and “language barrier” (7.84%, n=4). Public sector respondents indicated similar reasons, i.e. “no equipment” (66.67%, n=34), “insufficient training” (13.72%, n=7) and “language barrier” (10.81%, n=4). (Refer to figures 3(a) and 3(b))

The results obtained are expected in view of the lack of equipment noted thus far, as well as the uncertainty of CAPD assessment procedures, and the lack of suitable, culturally appropriate testing materials in the SA context. Also, testing of non -English speaking clients is problematic in the absence of electrophysiology testing equipment.

CAPD is an important relatively recent area that has been included in audiology practice that needs to be established in SA. Therefore, as indicated by respondents, it is likely that audiologists may have not received theoretical and clinical training in this area (refer to Figures 3(a) and 3(b). Also as this is a developing area, the amount time and training given to APD would differ in accordance with the developments in CAPD at the time of training. Audiologist should therefore request CPD activities in this area, especially as the assessment and rehabilitation is rather complex and thus requires ‘expert’ training.

In SA, the proposed CAPD test battery for children older than 8 years and adults (Campbell & Wilson cited in Campbell 2003) included: screening, behavioural diagnostic testing (one test from each of the following categories: Dichotic tests, temporal ordering, monaural-low redundancy and binaural fusion) and electrophysiological procedures (ABR, AMLR, MMN, P300 and OAEs). For clients with low proficiency in English behavioural measures included: Dichotic Digit Test (DDT), Frequency/Pitch Pattern Sequence Test (PPST), Duration Pattern Test (DPT), Psychoacoustic Pattern Discrimination Test (PPDT) and Masking Level Difference (MLD).

Current test materials have been developed by international Audiologists who have also recorded this test battery on CD that could be ordered by any audiologist (Campbell, 2003). The difficulty in using these tests on the SA population lies in the linguistic stimuli used (American terminology) and the CD developed was recorded by an American audiologist thus the difference in accent and stimuli would impact on the reliability and validity of the results. Importantly normative data has been established on the American population. Attempts have been made to develop preliminary normative data for the CD, for English speaking adults and children in SA (Saley, Campbell and Wilson, 2003 cited in Campbell, 2003). However further research is necessary before SA norms could be used clinically (Campbell, 2003) and considering the linguistic diversity of the SA population, testing material in other languages could be developed, or alternatively, normative data for second language English speakers should be established as well.

Further, the lack of electrophysiological testing equipment revealed in this study contributes toward the lack of testing (refer to Figures 3(a) and 3(b)), as ideally both subjective and objective measures should be performed before making a diagnosis. Should the pre-recorded test be used (i.e. the CD discussed), the audiology practice would need to be equipped accordingly.

Jerger and Musiek, (2000) suggested that audiologists use a minimal test battery for school age children that included behavioural tests, electrophysiological and electroacoustic tests and neuroimaging. However controversy regarding test protocol still exists (Musiek & Baran, in Katz 2002) and the need for further research in the areas of assessment, neurological development and plasticity, intervention and professional practice has been called for (Stach, 2000; Jerger and Musiek, (2000). In SA, a consensus on an ideal screening protocol and tasks that should be used to assess CAPD need to be established along with referral criteria.

Also, normative data must be established for current test material. Test material specific to the SA population should also be developed.

Mismatch Negativity (MMN)

Mismatch negativity shows a pre-attentive central code of stimulus change that originates in the auditory and possibly frontal cortices (Stapells, 2002:p386). The presence of the MMN signifies that the change detection system at the level of the auditory cortex has discriminated the stimuli. Thus the presence of the MMN indicates that a person can discriminate stimuli. Also, under most instances, the presence, latency and amplitude of the MMN has been proven to have a good correlation with behavioural discrimination of simple stimuli (Naatanen and Alho, 1997; Stapells and So, 1998).

Results: 68 respondents from the public sector and 70 respondents from the private sector completed the question. Results revealed that mismatch negativity was not used clinically by approximately 98% of respondents in each sector, with the most frequent reason for non-practice being “no equipment” (~70%), followed by “insufficient training” (~20%). (Refer to Table 9 and Figures 3(a) and 3(b)).

The non-practice of MMN by respondents appears to be reflective of the limited clinical use of MMN in audiology practice generally. As discussed by Stapells (2002:p400), clinically, the MMN appears to be questionable in any population and does not demonstrate good within subject repeatability. Poor repeatability implies that this cannot be currently used to monitor therapy. Further no consensus of recording parameters has been reached, and no diagnostic conclusion can be reached in the absence of the MMN. Therefore much clinical research is required before this can be applied clinically (Stapells, 2002). Studies indicate that MMN could possibly be used to indicate an individual differences in discrimination ability (the easier

the stimuli discrimination the larger the MMN) and therefore has potential to demonstrate the effect of therapy programmes in developing discrimination abilities and could likely be used to predict the outcome of comatose patients. According to Bishop (2003), MMN is increasingly being used to as the brain's index to distinguish between two sounds.

Behavioural Site of Lesion (SOL)

Results: 70 respondents from the public sector and 72 private sector respondents answered this question. The results revealed that SOL testing was "never" performed by the majority of respondents. In the public sector, approximately 11.42% (n=8) used these tests routinely, 35.71% "(n=25) sometimes, and 52.85% (n=37) "never". Similarly most private sector respondents indicated "never" performing these tests (59.72%, (n=43), 29.16% (n=21) conducted the SOL tests "sometimes" and 11.11% (n=8) routinely. (Refer to Table 9)

The primary reasons for "never" performing these procedures given by the majority of the respondents employed in the public sector was a "lack of equipment" (70.58%, n=24) and "no case load" (20.58%, n=7). Private sector respondents however identified options of "no equipment" (38.48%, n=15), "insufficient training" (16.27%, n=7), "no case load" (23. 07%, n= 9) and other (16.27%, n=7), as significant reasons for not conducting these tests. (Refer to Figures 3(a) and 3(b) above).

Behavioural SOL tests are clinically valuable towards obtaining a differential diagnosis regarding the site of pathology i.e. cochlea or retrocochlear. This offers the advantage of making a substantiated referral, directs further testing, and more clearly outlines the clients' prognosis for intervention (Roeser, Valente & Hosford-Dunn, 2000; Martin, 1994). For example a sensori-neural hearing loss with a retrocochlear SOL, would imply a different benefit from amplification as opposed to a cochlea loss. SOL procedures are however limited

to testing the adult population, as client participation and understanding of the test requirement will determine the reliability and validity of the results (Martin, 1994).

The results obtained seem to indicate that approximately 40% of respondents are using SOL procedures, and the remaining 60% of respondents have provided similar reasons for non-practice of SOL procedures i.e. “no equipment”, “insufficient training” and “no case load”. With regards to the “lack of equipment”, this reason is disturbing as SOL tests are available on all diagnostic audiometers. (Note: From the above results 24 and15 respondents from the public and private sector respectively provided this as a primary reason for non-practice. In comparison to the results obtained for the audit of basic test battery procedures, the number of respondents suggesting a lack of equipment i.e. a diagnostic audiometer, is inconsistent with the results indicated for basic test battery procedures. (Refer to Table 8). Therefore this result is questionable.

As mentioned above, any setting offering audiology diagnostic services should be equipped with functioning audiometers. It is acknowledged that audiologists who are not working in the area of diagnosis will not have a case load requiring this service as indicated by the results of this study. The reference to “insufficient training” is concerning. Again, this could be addressed as a CPD activity. Importantly, these result indicate that SOL procedures are being used, and must be retained in training programmes, despite the emergence of more advanced SOL procedures,

The clinical utility of behavioural SOL test appears to be giving way to objective electrophysiological procedures (Martin, 1994:p207) that provide more sensitive and specific assessments. Further the subjective nature of the tests is posed as a limitation to validity and reliability of assessments. However these tests do provide significant information for a

differential diagnosis (Martin, 1994). Thus the incorporation of AEPs into a test battery, would suggest that behavioural SOL tests may not need to be performed. However, the results of this study have indicated that AEPs are grossly underused due to a "lack of equipment". Therefore, although Behavioural SOL tests may appear to be 'outdated', in test contexts where a caseload exists, and in the absence of all other tests of differential diagnosis, SOL should be performed as it serves to provide a clearer diagnosis and direct further treatment options. SOL tests are therefore still necessary in audiology practice in the SA context, and audiologists should have equipment available to conduct these procedures when needed.

Otoacoustic Emissions (OAEs)

A useful advance in audiology has been otoacoustic emissions (OAEs). OAEs are low-level sounds originating within the cochlea specifically the outer hair cells and are detectable when both the cochlea and the middle ear are functioning normally (Robinette and Glattkein, 2000).OAEs are measured in the external ear canal and reflect the active processes occurring in the outer hair cells of the cochlear. When outer hair cells are structurally damaged or non-functional, OAEs will not be elicited by the acoustic stimuli (Hall and Chase, 1993:p29). Although the emissions occur naturally, they are usually evoked for clinical purpose using transient stimuli (transient evoked otoacoustic emission, TEOAEs) or tone pairs (distortion product otoacoustic emissions, DPOAEs) (Sininger, 2002).

Results: 70 respondents from the public sector and 73 private sector respondents completed this question. The result of the study revealed that 41.09 % (n=30) respondents working in the private sector performed the test "sometimes", 20.54% (n=15) "always', with 38.35% (n=28) indicated "never" conducting the test. Public sector use of OAEs differed, with OAEs "never" conducted by 54.28% (n=38) of respondents, whilst 30.00% (n=11) reported "always" performing the test, and 15.71% (n=21) "sometimes". (Refer to Table 9).

The principle reason for never conducting this test was due to “no equipment” as indicated by 97% and 88% of respondents employed in the public and private sector respectively. (Refer to Figures 3 (a) and 3 (b)).

The results indicate that approximately 60% of private practitioners have invested in OAES, and approximately 35% of respondents practicing in the public sector have access to OAEs. The limiting factor behind the lack of use of this measure appears to be the “lack of equipment” which could be interpreted to be due to cost of equipment. Since reasons of “no case load” or “insufficient training” did not feature as reasons for non-practice, clearly the clientele requiring this test exists and audiologists feel that they have sufficient knowledge in this area.

To highlight the value of OAEs the following discussion will present the clinical use and implications of this measure. From this discussion it would become evident that the use OAEs should be included in the test battery and is essential for screening.

OAEs have been found to be useful clinically as it is a non invasive, quick, repeatable measurement able to test discrete frequency regions of the cochlea by assessing outer hair cell function. The variety of clinical applications include: (1) screening programmes particularly for neonates, noise induced hearing loss, (2) differential diagnosis between sensory (cochlear) and neural hearing loss, (3) testing for functional hearing loss (pseudohypocusis), (4) partially estimate hearing sensitivity within limits, (5) ototoxic monitoring, tinnitus assessments, and it also serves as an important component in the cross check principle (Durst and Moon cited in McCormick, 2004, ; Robinette and Glattkein 2002; Sininger, 2002 and Hall and Chase, 1993: pg 29). Further, the presence of TEOAEs has been found to correlate with normal hearing thus is used for infant hearing screening, to validate electrophysiological auditory threshold. DPOAEs are found to be particularly useful

for diagnosis of hearing loss, and exploration cochlear mechanics in patients with Meniere's disease (Robinette and Glattkein, 2002).

In all its varied applications OAEs have been shown to be high in utility and effectiveness. In addition, literature has highlighted that the measure of OAEs may be more sensitive to detecting changes in cochlear function than behavioural pure tone audiometry (Robinette and Glattkein, 2002). OAEs appear to be a useful and essential clinical tool that must be used during screening as well as diagnostic testing. As with all other tests, OAEs cannot be used in isolation, but as a brief procedure that can be easily integrated into a test battery and the variety of clinical applications suggested, makes it an important and valuable investment in any test environment.

Electrocochleography (ECochG)

ECochG is an electrophysiological technique of recording the electrical responses of the cochlea in response to auditory stimuli (Hall and Meuller, 1998).

Results: 69 public sector respondents and 70 private sector respondents completed this question. All respondents working in the public sector indicated "never" performing this procedure. A majority of "never" responses (91%) was also obtained from private sector audiologists, with 7.14% (n=5) respondents "sometimes" performing the procedure. The primary reasons given by all respondents for the non-practice of ECochG were "no equipment" (~80%) and "insufficient training" (~15%). (Refer to Figures 3 (a) and 3(b)).

Electrocochleography is a useful clinical tool towards diagnosis and in intraoperative monitoring. However, the procedure involved appears to be a deterrent to the use of

eletrocochleography measures. The discussion to follow will review the clinical use of ECochG, and look at other tests that provide similar information, which could possibly explain why audiologists opt not to perform ECochG.

The recording of the electrocochleogram involves an invasive technique using a series of electrodes that are placed along the ear canal and tympanic membrane and on the promontory in the middle ear. Insert phones are used to conduct the auditory stimuli. Electrocochleography has been found to be a valuable technique clinically, with application extending to (Hall and Mueller, 1998; Ferraro & Durrant, 2002): a) assessment and monitoring of Meniere's disease and endolymphatic hydrops and the assessment and monitoring of treatment strategies for these disorders; b) enhancement in the presence of wave I of the ABR in the presence of hearing loss or less than optimal recording conditions, c) predictor of the degree of sensori-neural loss and d) measurement and monitoring of cochlear and auditory nerve function during surgery.

From the above applications, it is clear that ECochG should be performed in the case of cochlea related pathology and would be incorporated into the test battery as required. Also, it is possible that equipment has not been obtained since other tests that address some of the above mentioned clinical applications can be used. For example, Otoacoustic Emission Testing (OAEs) can provide similar information on cochlea functioning, and the Acoustic Brain Stem Response (ABR) could be used for intraoperative monitoring. Thus, depending on the tests available to the clinician, it is possible that other procedures yielding similar clinical applications are being used in light of the lack of training in this area.

While information obtained through ECochG is valuable, this procedure is more invasive than other tests performed in audiology and requires expert training and skill. Clinical training in

ECochG testing is not currently covered in the undergraduate training programme, and is usually acquired through ENT training. Thus audiologists probably opt for the use of less invasive procedures. Also since intraoperative monitoring is not being performed in the majority of hospitals (as discussed previously), audiologists have not invested in equipment. Should this change, clinical training in ECochG will need to be addressed.

Electronystagmography (ENG)

Electronystagmography is used to determine if vestibular damage is a cause of dizziness or vertigo and may be recommended when the person is experiencing dizziness or vertigo, when there is impaired hearing, with suspected toxicity from certain antibiotics, and when psychologic causes of vertigo are suspected (Hall and Meuller, 1998).

Results: Results revealed that 95.65% and 80% of respondents from the private and public sectors indicated "never" performing electronystagmography testing. The primary reason provided for the non-practice of ENG amongst all respondents was the "lack of experience" (80%).

These results are possibly a reflection of the relatively recent introduction of ENG in SA. The use of the test is also determined by ENT referrals, and the caseload requiring this specialized assessment. Clinically, electronystagmography provides exact measurements of eye movements rather than the objective observation of standard caloric stimulation and can be recorded behind closed eyelids or with the head in a variety of positions (Desmond, 2000). The need for vestibular treatment and the impact of vestibular disorders on daily functioning has been emphasized in recent research that has indicated a correlation between dizziness, and functional decline, disability and decreased quality of life (Desmond, 2004:p6). The appropriate assessment and treatment of vestibular disorders is a growing concern

(Desmond, 2004). It is likely that the purchasing of ENG equipment in both the public and private sector will depend on the ENT support for the use of this procedure as well as case load. Please refer to the later discussion on vestibular rehabilitation.

In sum, AEPs are important for assessing and diagnosing lesions associated with the auditory nerve, brainstem and central auditory nervous system, across all age groups (Mason, 2004; Martin, 1994). For the adult population, it is particularly useful in assessing pathologies and functional hearing loss. In the area of Paediatric Audiology, objective tests have become imperative measures. The challenge to infant testing and remediation is that subjective testing is unattainable at this age, and with younger children and persons with multi-disabilities, inadequate or unreliable results may be obtained (Mason, 2004). Thus, the assessment of audiological functioning for infants and young or difficult to test children is largely dependant on objective tests namely: ABR, ASSR, OAEs and ECochG, with ABR testing reportedly the most frequently used procedure, and reportedly the most popular AEP for hearing screening, followed by OAEs (Stach, 2002).

More so, the current practice of paediatric audiology has emphasized the principle that the best outcome for a child with hearing loss can be achieved when his or her hearing status is established reliably and intervention is provided as early as possible (Cone-Wesson, 2005, Yoshinaga-Itano, 2002). The efficacy of the early intervention programmes hinges on the ability to predict hearing in newborns accurately. This and other basic information should ideally result in timely management strategies including proper fitting of amplification. The use of AEPs namely ABR and ASSR as predictors of auditory thresholds can thus assist in achieving this goal (Mason, 2004; Sininger and Cone-Wesson, 2002).

The above review of clinical applications of each test and the varied, unique information provided from each is significant. Objective testing equipment is a vital component of the battery of tests necessitated to make an accurate diagnosis. Whilst the cost implications in investing in such equipment are significant, the implementation of an outdated battery of tests comes at a price for all concerned, particularly for the patient. Audiological services lacking necessary equipment to test the population they serve, would imply that clinicians have the stress of possibly obtaining an inadequately informed audiogram, which would result in limitations during the intervention phase in terms of selecting the optimum hearing aid fit, rehabilitation strategy and in determining the prognosis for the client concerned, as highlighted through the course of the discussion.

The availability and quality of audiology testing facilities with the requisite equipment and personnel necessary to diagnose any type and degree of hearing loss is expected, and as noted by Dalzell et al., 2000, cited in Gravel, White, Johnson, Widen, et al., 2005, “audiological uncertainty" has been cited as the reason for delays in confirmation and amplification fitting in cases of mild forms of hearing loss. The caseloads experienced in state hospitals, far exceed those in private practice. It is imperative that hospitals be equipped to test the client population. While patient referral to hospitals that have the requisite equipment is the current model of service delivery, this not only inconveniences the client, but results in delayed assessment and management of the client. Although this is not ideal service delivery, patients are eventually able to access appropriate assessment and treatment. If a case load exists this should be an interim measure, towards the goal of fully equipping audiology departments with the appropriate measures applicable for the population serviced.

3.2.3 <u>Subsection C:</u> Paediatric Audiology

The assessment of infants and young children should be performed using age appropriate

behavioral tests supported by objective tests as discussed in the section on diagnostic audiology (McCormick, 2004).

RESULTS: The results and discussion for each area of paediatric audiology are presented in Figure 4. Primary reasons for non-practice of services are listed in Table 10. In the discussion of the results to follow, it must be noted that work places were grouped into sectors as discussed earlier, therefore the "never" responses are most likely to be from those work settings that do not test paediatric clients such as hearing aid companies and the military. Since the majority of respondents were employed in state hospital and private practice the results appear to be reflective of the sample and settings at which paediatric testing is expected to be performed.

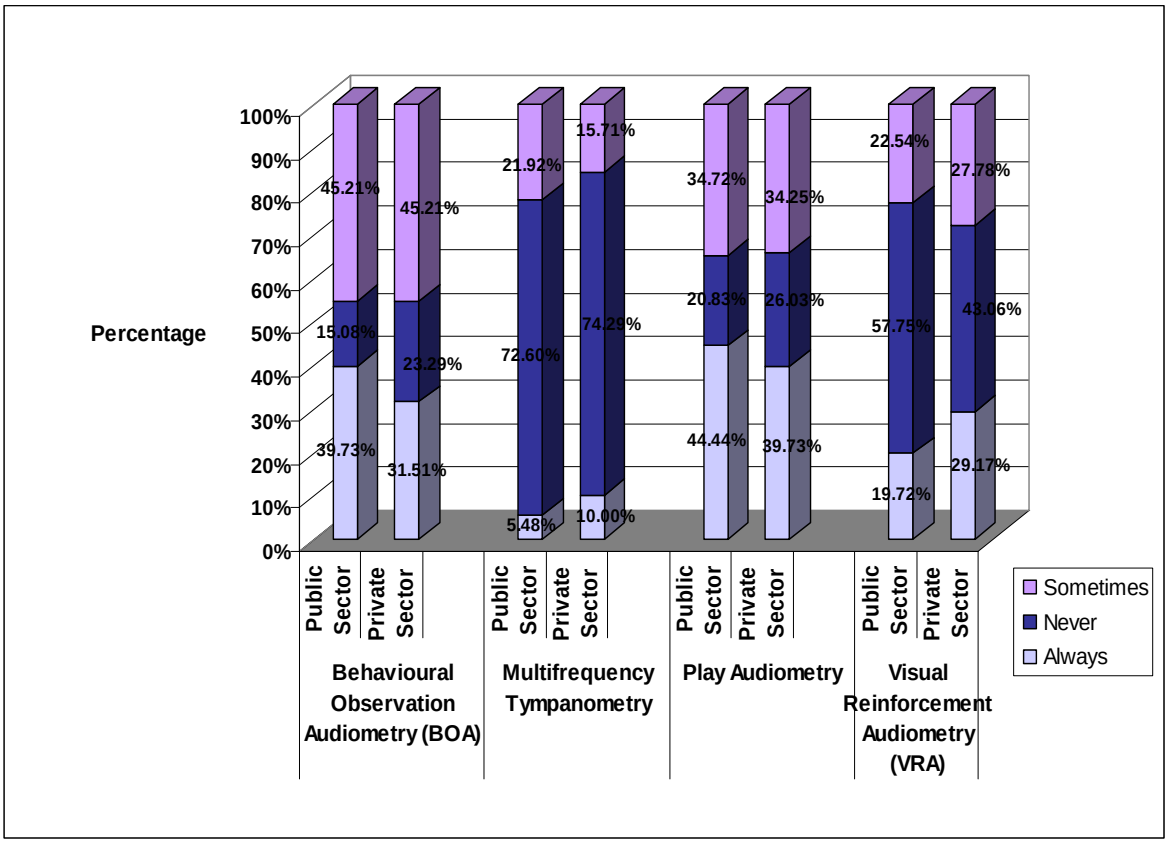

Figure 4: Audit Results of Pediatric Services Provided Across Sectors

Table 10: Most Frequent Primary Reasons for "Never" Providing Paediatric Services

PAEDIATRIC AUDIOLOGY SERVICES	Public Sector			Private Sector		
	"Never" (total count)	No Equipment Count	No Caseload Count	***"Never" (total count)***	No Equipment Count	No Caseload Count
Behavioral Observation Audiometry (BOA)	***10***	5 (50%)	5 (50%)	***17***	4 (23.52%)	6 (35.29%)
***Multifrequency Tympanometry**	***53***	37 (69.8%)	4 (7.54%)	***50***	31(62.00%)	4 (8.00%)
Visual Reinforcement Audiometry (VRA)	***40***	32 (80%)	5 (12.50%)	***30***	20(66.66%)	5 (16.66%)
Play Audiometry	***14***	8 (54.14%)	4 (28.57%)	***19***	6 (31.57%)	7 (36.84%)

**** Multifrequency Tympanometry:*** Insufficient Training: public sector 7(13.20%), private sector 10(20%)

It is important that the discussion on electrophysiology be considered together with the following audit results on the use of subjective paediatric tests.

Behavioural Observation Audiometry (BOA)

Behavioural Observation Audiometry is the most basic and subjective method used in clinical evaluations of infants and difficult to test children. BOA involves the use of a variety of sounds produced by noise makers or an audiometer, to elicit generalized responses (Shoup and Roeser, 2000:p317).

Results: 73 respondents per sector completed this question. Most respondents from the public sector appear to be performing behavioural observation audiometry. Of the 73 responses, 39.73% (n=29) indicated "always" conducting BOA, 45.21% (n=33) sometimes, with 15, 08% (n=11) "never" responses. The results from the 73 respondents employed in the private sector were very similar, with BOA being performed "always" and "sometimes" by 31.51% (n=23) and 45.21% (n=33) respectively and "never" by 23.29% (n=17). (Refer to

Figure 4). The main reasons indicated for “never” conducting the test were “no equipment” and “no case load”. (Refer to Table 10).

The results indicate that BOA is common practice in assessing infants and difficult to test children. Literature has highlighted that although BOA is no longer recommended for obtaining frequency specific assessments in newborns, in infants and children with developmental delays, it is still useful for examining auditory responsiveness in high risk neonates (Shoup and Roeser, 2000:p317). The advantages of BOA include the independence of specialized equipment and a limited time is required for evaluation. However limited audiometric information is obtained and a wide range of responses are acceptable. Gravel (2001) noted that BOA is very subjective, with high test/retest variability, however valuable rudimentary information is obtained, but this information must be accompanied by objective electrophysiological tests (refer to discussion in Subsection B: Diagnostic audiology).

In view of the lack of use of objective electrophysiological tests indicated by this study results, one has to question the adequacy and accuracy of infant testing and assessment of difficult to test children being conducted in SA. This area is of critical importance in light of the strong emphasis on early identification, assessment and intervention.

Multifrequency Tympanometry

The clinical use and value of multifrequency tympanometry has been debated for some time due to shortfalls observed in eliciting measures from infants and the interpretation of the results using the conventional classification of tympanograms. It has been recognized that the use of the conventional 226Hz tone is inappropriate for testing infants less than 7 months

of age, because of the poor sensitivity i.e. a high rate of false negatives were obtained (Purdy and Williams, 2001).

Results: This question was answered by 73 public sector and 70 private sector respondents. Results indicated that multifrequency tympanometry primarily "never" used in practice by most respondents working in both sectors. Approximately 73% (n=52) respondents from each sector indicated "never" conducting the test, with routine use by only 21.92% (n=4) and 17.71% (n=7) respondents, from the public and private sectors respectively. The remainder of respondents conducted the test occasionally. (Refer to Figure 4). The most frequent reasons provided for "never" performing this measure was "no equipment" (> 60%), "insufficient training" (> 13%) and "no case load" (~8%). (Refer to Table 10).

The results of this study indicated minimal use of this test measure. This could possibly be because the clinical value of multifrequency tympanometry has recently received more attention in light of early identification and new born hearing screening. Thus, multifrequency tympanometry is not available as a test selection on all older models of tympanometers, and this could explain the reason given of "no equipment". According to Flower & Shacks (2002:187), this measure is more complex and is not as easily understood as conventional tympanometry and therefore may not yet be incorporated into the test battery.

Investigation into the use of multifrequency tympanometry for infant testing began as neonatal tympanograms obtained using the 226Hz probe tone characteristically produces a W-shape and were found to produce 'normal' results in the presence of middle ear effusion (Flower & Shacks, 2002). This result could be explained in terms of the impact of otitis media on the mass and stiffness of the middle ear system. Middle ear disorders such as otosclerosis and middle ear effusion increase stiffness of the middle ear and affect the

transmission of low frequency signals. A higher probe tone of 660Hz or 678Hz which is mass dependent has been shown to be more sensitive for testing middle ear function in infants (Benton, Brough & Dodd, 2004; Flower & Shacks, 2002; Purdy and Williams, 2001).

A middle ear pathology left untreated could result in a temporary or even permanent hearing loss. In view of the emphasis on infant screening and early identification of hearing loss, this measure would indeed add value to the early detection of one of the most common infant medical problems, namely otitis media. Further, tests such as OAEs and ABRs are dependent on normal middle ear function (Hall and Mueller, 1998). Should a false negative result be obtained by using a 226Hz probe tone one may proceed with the above tests which in turn would illicit a false result for these tests. Therefore especially in the case of infant testing, multifrequency tympanometry should be applied if anything, as a precautionary measure.

It is most probable that training programmes have begun to include multifrequency tympanometry. The “insufficient training” reported by respondents (refer to Table 10) could be addressed through CPD activities. Also, CPD activities on infant testing and screening should include the need for the use of multifrequency tympanometry.

Visual Reinforcement Audiometry (VRA)

VRA is used to test children between the ages of 6 months and 3 years using operant conditioning whereby a response (head turn) to auditory stimuli results in reinforcement using an animated toy (Shaw, 2004).

Results: This question was answered by 71 public sector and 72 private sector respondents. The audit results suggest that VRA was performed slightly more frequently by private sector

respondents. Approximately 57% of private sector respondents and 42% of respondents employed in the public sector provided this service as required in practice. Respondents from both sectors indicated “never” performing VRA large due to the “lack of equipment “and to a lesser extent, “no case load”. (Refer to Figure 4 and Table 10).

The results obtained could be reflective of the number of audiologists servicing the paediatric population. The public sector results could be due to the nature of the work setting i.e. audiologists working in schools will not test paediatric clients, community clinics may work on a referral system to district hospitals, and those hospitals servicing adults only, will not be equipped with this equipment. Literature indicates that VRA has been found to be a reliable tool in paediatric audiometry, and is useful not only for assessment, but also in hearing aid fitting and verification (Gravel, 2000). Therefore ideally, all audiology practices servicing the paediatric population should possess VRA equipment. In addition, SA audiologists must begin working towards the goal of early identification and intervention. Therefore, in light of the current lack of use of electrophysiology tests by respondents, audiology practices should at least be equipped with VRA.

Play Audiometry

Play conditioning audiometry is used to assess the hearing sensitivity of children between 3.5–6 years of age. Like VRA, this test is based on operant conditioning, and results are dependent on child participation and reliable conditioning. Pure tone air and bone conduction testing is performed using a conditioning method requiring the child to respond to sounds by placing an object into a box each time a sound is heard. This test procedure mimics that of adult testing, in that ear specific and frequency specific hearing thresholds are obtained by presenting pure tone stimuli through head phones (Wood, 2004).

Results: This question was completed by 72 public sector and 73 private sector respondents. The majority of the respondents working in the public sector performed play audiometry routinely (44.45%, n=32), 34.72% (n=25) "sometimes" and 20.83 % (n=15) "never". Similarly most private sector respondents conducted play audiometry (39.73%, n=29) while 34.25% occasionally used this procedure, with "never" responses from 23.03% (n=19) of respondents. (Refer to Figure 4). Primary reasons for the lack of service provision by public sector respondents were "no equipment" (53.34%, n=8) and "no case load" (26.66%, n=4). The private sector respondents indicated "never" performing play conditioning audiometry for reasons of, "no equipment" (36.84%, n=7), "lack of case load" (31.58%, n=6) and "other" (21.05%, n=4). (Refer to Table 10).

This result appears to be reflective of local practice. It is likely that paediatric testing is not performed at all practices as suggested by the response of "lack of case load". The lack of equipment suggested however, is a cause for concern. As discussed, the equipment required to perform play conditioning audiometry is the same as that of 'adult' pure tone air and bone conduction testing. Results of the audit of pure tone testing (investigated in Section A: The basic test battery) revealed that approximately 3 respondents from each sector never provided the tests. Given this result, one would expect that a similar result should have been obtained for this service in the paediatric population as equipment requirements are the same. This lack of consistency in responses does raise uncertainty regarding this result pertaining to "no equipment".

In sum, from the results obtained it is apparent that paediatric behavioural tests are being performed fairly often by approximately 50% respondents. Audiologists appear to have a much larger adult clientele. This could be a result of poor public knowledge regarding infant hearing loss and the benefits of early intervention. With the call for universal new born

screening (refer to Subsection F: Hearing Conservation and Prevention), the need for follow-up paediatric (infant) testing will arise. This implies that audiology practices in both the private and public sector servicing the paediatric population have to be appropriately equipped to service this population.

As discussed earlier, a comprehensive test battery comprised of behavioral and electrophysiological procedures, including OAEs provide a good representation of the loss in both the peripheral and central auditory system. Gravel (2001:p85) noted that “Unfortunately, as clinicians are learning rapidly, there are a number of “pitfalls” that must be anticipated when evaluating the hearing status of infants and very young children and when monitoring children with confirmed permanent hearing loss over time”. The consequence of clinical errors and an inadequate testing protocol impact on the intervention as well as family and child. In her review of eight cases of infant testing Gravel (2001:p95), reported that misdiagnosis resulted primarily from the inability of the audiologist to administer a battery of tests and examine the correlation of tests used using the cross check principle. However, it was acknowledged that the cost and time involved in such an approach is challenging, and given the increase in newborn screening programmes, one needs to assess whether or not current practice is able to achieve this comprehensive test approach.

Thus SA audiologists need to collectively discuss a feasible way of providing paediatric audiology services. A possible arrangement could be adopted from the recent (2003/2004) service delivery model implemented in England, in responses to the RNID reports regarding the provision of outdated audiology services. As mentioned in the literature review, audiology services were found to have limited technical expertise, lack of funding to fit hearing aids and inconsistent follow-up and rehabilitation in NHS clinics throughout England and Europe. Currently a pilot project is being conducted, involving a Private Public Partnership (PPP), to

increase hearing aid service delivery. This partnership model was funded through the Department of Health. Private practitioners were contracted to help deliver NHS services, and were trained accordingly. Public sector case loads were seen by private practitioners, and hearing aids on the tender list were fitted as would have been done in an NHS clinic. Patients remained the responsibility of the NHS. According to the NHS reports this partnership has assisted in reducing the large case loads experienced in the public sector, and reduced the patient waiting periods.

The above model of service delivery can be adapted in SA to meet the needs of paediatric audiology services and possibly expand to other areas of audiology practice, such as hearing aid provision. Private audiologists could try to form a partnership with the public sector, whereby the Department of Health funding be used to equip selected private centers/practices, who in turn service some of the paediatric case load seen in public hospitals. This partnership could have benefits of increasing diagnostic and rehabilitation of infants and children, more practices would be equipped appropriately thus increasing the quality of service provision to all clients, patient waiting periods will be shortened and public sector (state hospital) audiologists would have a more manageable case load that would fit the resources available in hospitals i.e. most hospitals have one piece of equipment (e.g. ABR) to service all patients resulting in long waiting periods.

In view of the study results the researcher recommends that a task group for paediatric audiology should be formed to address issues concerning UNHS implementation, and follow-up services. Test equipment required for paediatric diagnostic assessments as well as rehabilitation must be given priority should the goal of UNHS be achieved in SA. Consensus on the development of feasible paediatric testing procedures and referral protocols must be

reached. Attention must be given to current student training and CPD activities in the area of paediatric audiology.

3.2.4 Subsection D: Amplification

Discussion of the results for this section has been divided into two parts. Results for the following areas with supporting discussion will be presented first: Assistive Listening Devices (ALDs), Auditory Brainstem Implants, Bone Anchored Devices, Cochlear Implant Mapping. This will be followed by the presentation of results and discussion of hearing aid service provision.

Assistive Listening Devices (ALDs), Auditory Brainstem Implants, Bone Anchored Devices, Cochlear Implant Mapping

The audit results for the following areas are presented in Table 11: Assistive Listening Devices (ALDs), Auditory Brainstem Implants, Bone Anchored Devices, Cochlear Implant Mapping. The primary reasons given for not providing or working with these devices/procedures are displayed in Tables 12 (a) and 12 (b).

Table 11: Audit Results of Amplification Provision

AMPLIFICATION	SECTOR	ALWAYS Count	NEVER Count	SOMETIMES Count	TOTAL *(n=)*
Assistive Listening Devices (ALDs)	Public Sector	5	48	17	***70***
	Private Sector	14	23	36	***73***
Auditory Brainstem Implants	Public Sector	1	***68***	2	***71***
	Private Sector	0	***71***	0	***71***
Bone Anchored Devices	Public Sector	2	***60***	9	***71***
	Private Sector	6	***47***	20	***73***
Cochlear Implant Mapping	Public Sector	3	***66***	3	***72***
	Private Sector	1	***68***	3	***72***
Earmould Impression Taking	Public Sector	17	30	26	***73***
	Private Sector	35	9	29	***73***

Assistive Listening Devices (ALDs)

Hearing aid users can function comfortably in quiet, close or a one-to–one situation. However, the introduction of back ground noise, increased distance from the sound source and reverberation degrade intelligibility much faster for people with a hearing loss, irrespective of hearing aid use. Thus people with hearing loss have difficulty functioning in group conversation. It is for these reasons that assistive listening devices are recommended, as they transmit signals from a sound source to the hearing aid (Bengtsson and Brunved 2000).

Results: 70 public sector and 73 private sector respondents answered this question. Results suggest that assistive listening devices (ALDs) are provided to a much larger extent by respondents working in the private sector. Of the 73 private sector responses, 19.18% (n=14) indicated “always” providing ALDs, 49.32% (n=36) sometimes, with 31.51% (n=23) “never” responses. The majority of public sector respondents “never” provided ALDS, (68.57%, n=48) with occasional provision by 31.51% (n=23) and routine provision by 7.14% (n=5) respondents. (Refer to Table 11). The primary reasons given for “never” conducting the test by public sector respondents were “no equipment” (67.39%, n=31) and “no caseload” (15.21%, n=7) and insufficient training (6.52%, n=3). Reasons for non-provision by private practitioners included “no equipment” (33.33%, n=7), “no case load” (38.09%, n=8) and insufficient training (19.04%, n=4). (Refer to Table 12(a) and 12(b)).

In order to understand the use of ALDS and the lack of provision of such devices in the public sector the following discussion will review ALDS and factors impacting on use. The term assistive listening devices (ALDs) encompass the broad range of assistive devices that are designed to help with receptive communication.

As mentioned above, the listening needs of persons with hearing loss cannot be successfully addressed with hearing aids alone. Assistive listening devices and systems (ALDs), either solely or in conjunction with the use of personal hearing aids, facilitate listening in various acoustic environments. Listening situations that are especially problematic even with hearing aids, such as large groups, on the telephone, in restaurants and at concerts and movies are ideally suited for ALD use. For children with hearing loss, or with CAPD these devices facilitate learning and communication (Edwards, 2002).

The study results also suggest the ALDs are not available to the public sector as indicated by the large number of "never" (68.57%, n=48) responses due to "no equipment" (67.39%, n=31). This could be attributed to the cost of personal ALDs, and possibly the lack of a budget for the provision of ALDs in state hospitals. Thus it is most likely that respondents employed in the public sector who indicated "always" (14%, n=5) working with ALDS could have been audiologists working in an education or rehabilitation setting. The result obtained from the private sector indicated that most audiologists are providing ALDs as required by the clientele. As highlighted Bengtsson and Brunved (2000), the use of ALDs is client specific and is often dictated by the client's life style, situational needs and finances.

Auditory Brainstem Implants

The auditory brainstem implant (ABI) was designed specifically for patients with Neurofibromatosis Type II (NF2, which is characterized by bilateral acoustic neuromas. Surgery often results in severe damage to the auditory nerve, and since cochlear implantation is dependent on intact auditory nerve functioning, this is not an option for these patients (Jackson, Mark, Helms, Mueller and Behr, 2002).

Results: 71 respondents per sector completed this question. The large majority of respondents had not worked with patients that have had auditory brainstem implants i.e. 100% and 95% never responses from private and public sector respondents respectively. One respondent from the public sector indicated routinely working with patients that have undergone auditory brainstem implantation and 2 respondents indicated involvement "sometimes". (Refer to Table 11). The primary reasons given by respondents for "never" practicing in this area were "no equipment" (> 40%); "no caseload "(30%) and "insufficient training" (20%). (Refer to Tables 12 (a) and 12 (b)).

An auditory brainstem implant system provides an opportunity for hearing-impaired patients to detect and recognize auditory information through electrical stimulation of the auditory neurons of the cochlear nucleus (CN). The development of brainstem implant systems is still in its infancy, with research into a fully implantable device still on the way (Miller and Fredrickson, 2002). Thus these results are expected and reflective of the very recent introduction of auditory brainstem implants.

Bone Anchored Devices

Results: This question was answered by 71 public sector and 73 private sector respondents. Bone anchored devices are fitted more in the private sector overall. These devices are not prescribed by most respondents (private sector = 64.38% and public sector = 84.51% never responses). Private and public sector respondents working with patients with bone anchored hearing devices amounted to 35.56% (n=26) and 15.49% (n=11) respondents respectively. (Refer to Table 11). Primary reasons provided for not prescribing bone anchored hearing aids were "no equipment" and "no caseload". (Refer to Tables 12 (a) and 12(b)).

Bone anchored devices are fitted for a specific type of loss, and although seldom used, are fitted on patients with chronically discharging ears or when the use of an earmould is not practical, (e.g. atresia) (Staab, 2002).Thus these results are likely to be reflective of the limited clients needing these devices. (Refer to Table 12).

Cochlear Implant Mapping

Results: 72 respondents per sector completed this question. Cochlear implant (CI) mapping was not performed by most respondents i.e. 91.67% (n=66) and 94.45% (n=68) "never" responses were obtained per sector. 5% (n=4) respondents were routinely conducting CI mapping, 3 of whom were working in the public sector and 1 privately. 4.12% (n=3) respondents working in each sector indicated performing CI mapping sometimes. (Refer to Table 12). The primary reasons for non-practice in this area by respondents working in both sectors were "no equipment" (~50%), "no caseload" (>20%), "insufficient training" (~15%) and "other" (~5%). (Refer to Tables 12(a) and 12(b)).

Cochlear implantation fitting began fairly recently in SA, therefore these results appear to be reflective of the current early stage of CI fittings in the country. Although the cochlea implant appears to be a very promising device, very strict candidacy criteria as well as the exceptionally high cost of the fitting and surgery are limiting factors to fittings. Cochlear implantation has been found to be a safe procedure when performed in children over 12 months old. With the implementation of universal newborn hearing screening, increasing numbers of children will be identified and diagnosed at a very early age. However cochlear implantation in very young children remains controversial. Of concern is the high risk of otitis media, which could threaten the integrity of the device (Discolo & Hirose, 2002). Also despite the numerous advances that have taken place in the field of anesthesiology, infants remain at

higher risk during surgical procedures compared with older children and adults (Discolo & Hirose, 2002).

Rehabilitation centers serving children with cochlear implants are slowly emerging in SA, and it is likely that the purchasing of the equipment/mapping software in public and private clinics will be determined by the caseload. Student training in this area will possibly be incorporated to a much larger extent into the curriculum, in light of the developing caseload. Further training and education in this area could be accomplished through CPD activities as the need arises. This area could also be considered as one requiring additional licensing.

HEARING AID SERVICES

The goal of the hearing aid selection process is to define the appropriate physical and electroacoustic characteristics of the desired hearing aids for particular individuals using methods that will facilitate verification, and validation of the devices. Once suitable aids are selected, the process of fitting and verification begins (Dillon, 2000). During the fitting phase, acoustic, and where applicable cosmetic adjustments are made to the hearing aid to satisfy the comfort of the user. Verification refers to measures made to determine that the hearing aids meet the basic electroacoustic requirements, cosmetic appeal, comfortable fit, and real-ear electroacoustic performance. Verification methods include the use of behavioral aided and unaided tests, and objective measures such as real ear response (Valente, Bentler, & Seewald, 1998). Fine tuning of the aid refers to the finer electroacoustic adjustments to meet particular listening comforts of the user. Depending on the hearing aid technology, minor adjustments are performed manually or by using computer based adjustments (i.e. Hi-PRO and NOAH software).

RESULTS: Audit results reflecting service provision in the above mentioned areas are

displayed in Figures 5 (a) and 5(b) below. Figures 6(a) and 6(b) are graphical displays representing the primary reasons indicated for non-delivery of each area of hearing aid services by respondents from the public and private sectors respectively.

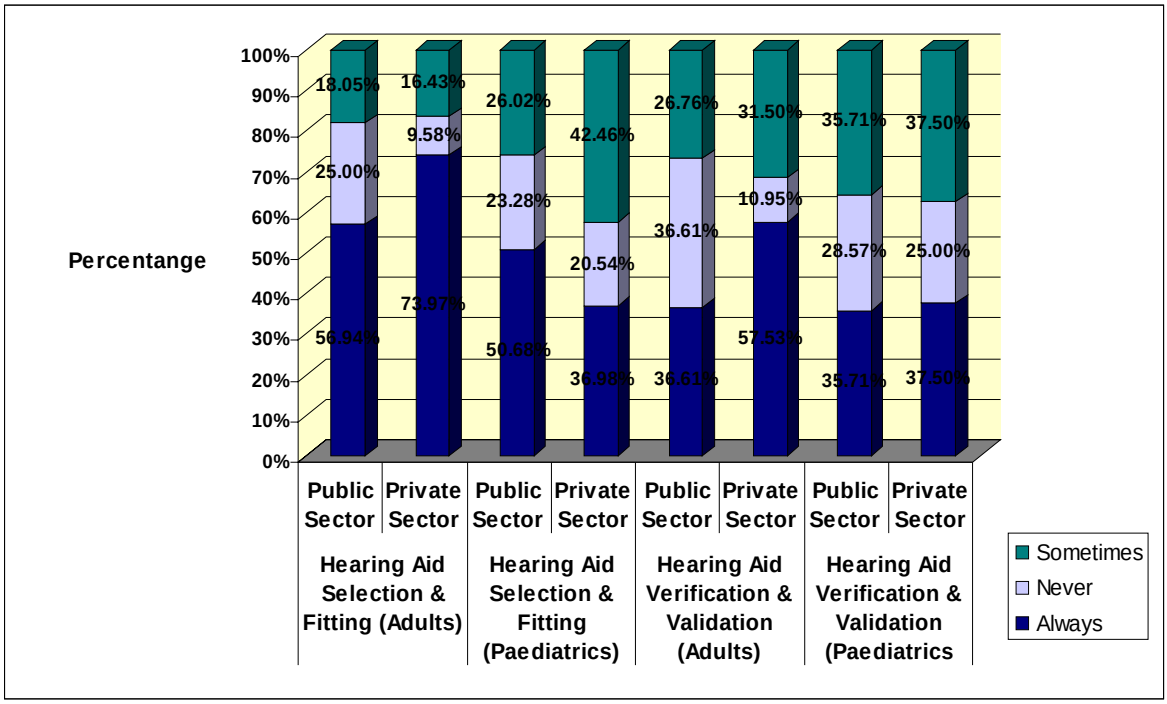

Figure 5(a): Audit Results Regarding Hearing Aid Service Provision: *Public Sect. n=72, Private Sect. n=73*

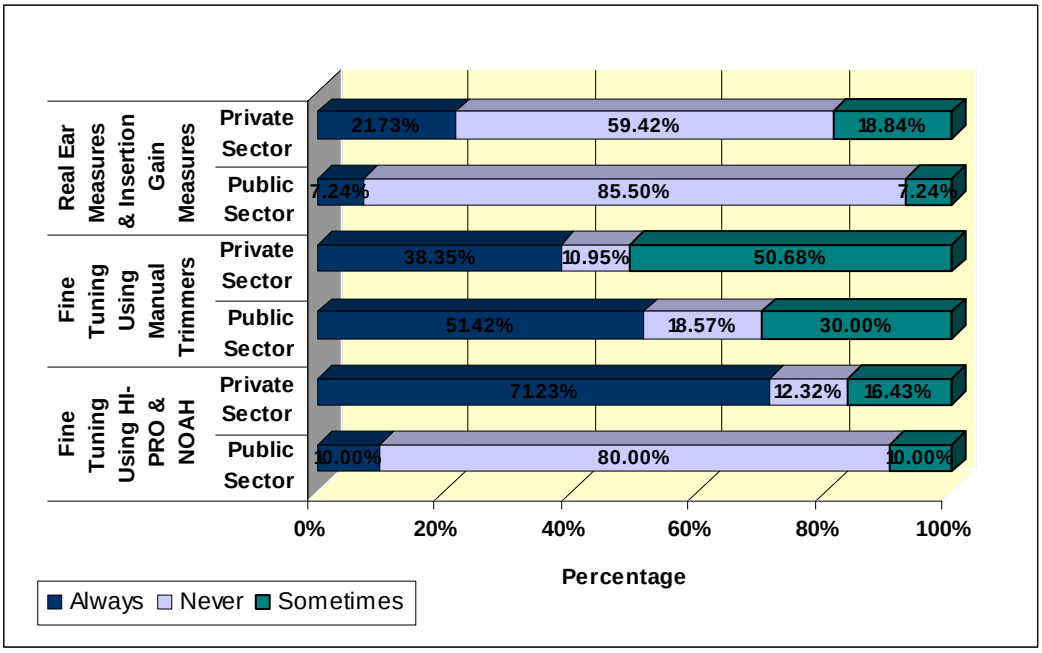

Figure 5(b): Audit Results Regarding Hearing Aid Service Provision: *Public Sect. n=72, Private Sect n=73*

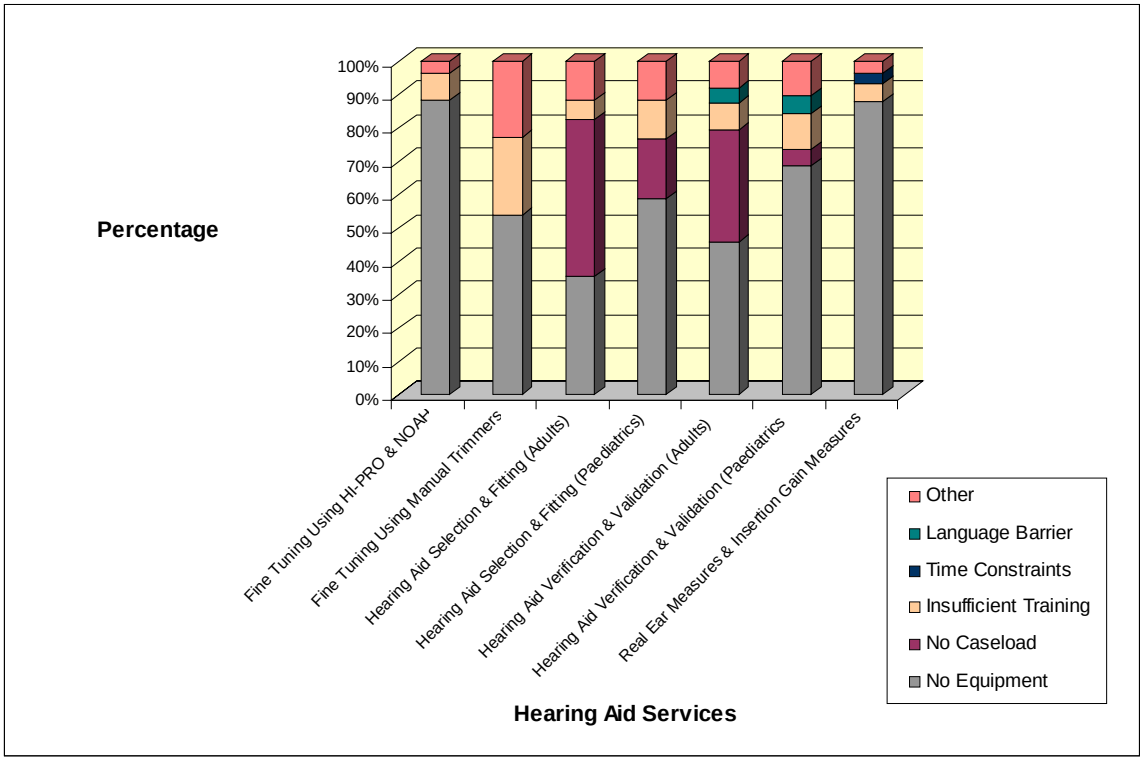

Figure 6(a): Public Sector: Primary Reasons for "Never" providing Hearing Aid Services

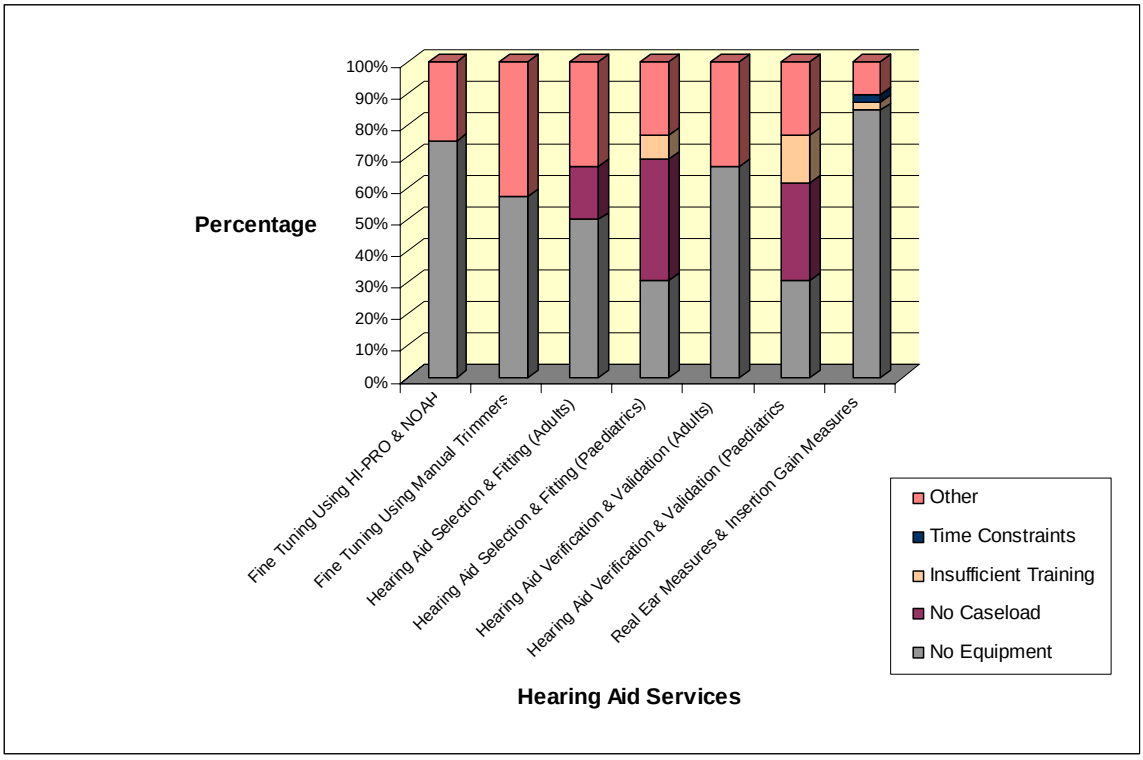

Figure 6 (b): Private Sector: Primary Reasons for "Never" providing Hearing Aid Services

Hearing Aid Selection and Fitting (Adults)

Results: This question was completed by 72 public sector and 73 private sector respondents. Results suggest that hearing aid selection and fitting of adults is commonly performed by the majority of private sector respondents (73.97%, n=54). 16.43% (n=12) respondents indicated occasionally servicing this population, with 9.58% n (=7) "never" responses. A similar trend was observed by respondents employed in the public sector, with 56.94% (n=41) regularly fitting adult clients, 18.05% (n=13) "sometimes", and 25% (n=18) "never". (Refer to Figure 5(a)). Reasons indicated for not fitting hearing aids by public sector respondents were mainly "no caseload" and a "lack of equipment". The 9.58% of private practitioners not providing hearing aid services also revealed reasons of a "lack of equipment", "other", and "no caseload". (Refer to Figures 6(a) and 6 (b) respectively).

Although a large percentage of public sector respondents are fitting adults, results suggest that a larger number of private practitioners fit this population. According to White (2002: p735), in a recent survey of clinical practices in the United states and Canada conducted by Medwetskt et al. (1999), results revealed that most hospitals focus primarily on diagnostic audiology services, and minimally engage in hearing aid dispensing. This was thought to be due to the large number of patients that need to be seen pre or post ENT treatment, and the fact that most hospitals do not have the financial infrastructure to sufficiently support hearing aid provision for all hearing aid candidate patients. These findings are also typical of the situation in SA hospitals (refer to discussion on service delivery issues). To the researcher's knowledge, the budget allocation toward adult and paediatric hearing aids differs and strict protocols govern the dispensing of hearing aids. For example, the age of the patient, need and motivation for hearing aid use and case history would influence the provision of the limited number of hearing aids available. Therefore not all adult patients requiring hearing aids are necessarily fitted i.e. the demand is greater that the supply.

Hearing aid dispensing makes up a significant part of private practice (Lubinski and Fratali, 2001), as suggested by the results of this study. Clientele of private practitioners can often afford to purchase a hearing aid and are usually members of a medical aid scheme. Despite the fact that state hospitals do service a larger case load, (and therefore should be fitting more hearing aids), it is likely that more hearing aids are fitted privately, as the decisions to fit (and to fit unilaterally and bilaterally), and payment of a hearing aid is dependant on the client, and not influenced by the restrictions placed by government funding and hospital protocols in the public sector.

Regarding fitting and selection protocols used by audiologists, no official study has been published in SA. This area should be investigated in order to identify similarities or differences in protocols, and the adequacy of training in this area. As highlighted by Sammeth & Levitt (2000:p251) “Objective measures of performance in combination with unbiased assessment of consumer satisfaction are needed if hearing aid fitting of high quality is to be maintained”.

Improvements in hearing aid technology have resulted in a range of fitting strategies. Clinical knowledge and training is important as these strategies differ in theoretical approach, amount of information needed for implementation and the amount of information obtained. In order to ensure a quality fitting, audiologists must know what measurements would be necessary for each technique, the differences in what each fitting technique recommends, how the fitting technique meets the patient goals and what verification/validation method each fitting protocol demands (Sammeth and Levitt, 2005).

Hearing Aid Selection and Fitting (Paediatric)

Results: 73 respondents per sector completed this question. Results reveal that hearing aid

selection and fitting of paediatric clients was performed by most of the respondents working in both sectors (>75% per sector). A larger number of respondents from the private sector indicated fitting this population “sometimes” (42.46%, n=31), while 36.98% (n=27) performed selection and fitting routinely. Results suggested that this trend appeared to be reversed in the public sector i.e. 26.02% (n=19) respondents occasionally and 50.68% (n=37) respondents “always” fitted children. Approximately 20% of respondents per sector revealed “never” fitting hearing aids. (Refer to Figure 5(a)). The most frequent reason for “never” fitting hearing aids as indicated by public sector respondents were “no equipment”, with reasons of a “lack of case load”, “insufficient training” and “other” contributing minimally. The lack of paediatric fitting by private sector respondents was largely attributed to “no caseload”, and minimally to the “lack of equipment” and “other”. (Refer to Figures 6(a) and 6(b)).

The above discussion on hearing aid dispensing to adults also applies to these results. The higher percentage of routine fittings in the public health sector could be said to be reflective of the population serviced. The public health system probably encounters a larger number of paediatric clients than the private sector due to the clientele serviced. Clients within the public health system are usually from poorer socio-economic backgrounds, living in poor conditions where disease, poor nutrition and limited education are rife. As a result, infants and children are likely to contract infections, or be born with high risk conditions due to poor nutrition and health of the mother (Swanepoel, 2004). Also, due to the limited and/or delayed access to health services; conditions such as otitis media may go untreated resulting in a permanent hearing loss. Thus the prevalence of hearing loss within this majority population serviced by the public health system is much higher than that of the higher socio-economic population seen in private practice.

It is highly likely that the statistic of paediatric hearing aid fittings in the public sector would be much higher if budget allocations supported the demand; if infant screening programmes were implemented to identify children with hearing loss and predisposing factors and higher staffing provided to meet patient and administrative demands. Private practitioners appear to have a larger adult clientele and therefore paediatric hearing aid fittings are performed more occasionally than routinely. This could be reflective of the challenges of paediatric fitting. Literature has highlighted that the hearing aid fitting will only be as good as the information on which it is based (Gravel, 2001), therefore the limitations due to lack of equipment for diagnostic and hearing aid fitting and verification evident by this study are possibly impacting on the number of paediatric clients fitted (refer to the discussion on paediatric audiology).

Further, training in paediatric audiology in general appears to be insufficient, and is possibly another reason for limited service delivery for this population. (Refer to Tables 10, 12(a) and 12 (b)). Also, the focus on newborn hearing screening and early intervention globally has been included into SA policy (refer to discussion on neonatal screening). Early identification will most possibly result in an increase in the paediatric caseload seen privately. This was highlited by Harrison and Roush, 1996 (cited in Gravel, 2001:p98) who noted that in the not too distant past audiologists would have expected to confirm the type, degree and configuration of the loss by age 2. However the drive toward early assessment for infants and young children has created opportunities for audiologists to provide amplification to children with permanent hearing loss very early in life.

The reality of early identification and intervention brings with it the responsibility of accurate diagnosis and depiction of the loss as well adequate counselling of parents on the management options available to the child, so that they can make an informed decision on an

intervention strategy. To this end the researcher suggests that future studies and discussions regarding the following should be considered:

1. The supply vs. demand of paediatric audiology services within the public sector and factors impacting on hearing aid fittings
2. The age of fitting. The global focus on early assessment and intervention suggests that fitting should begin by or before 6months of age (Littman et al, 2002; Yoshinaga-Itano, 2001; Beauchaine, 2001) This information would serve to determine the extent to which we are meeting the goal of early assessment and intervention.
3. Importantly a national survey investigating the test battery approach used to assess infants and young children should be conducted as the accuracy of results is detrimental for appropriate selection and fitting of amplification (Scollie and Seewald, 2002; Gravel, 2001&1998; Stapells, 1998; Paediatric working group, 1996). Study results have revealed that objective diagnostic tests necessary toward a comprehensive infant evaluation are usually not performed due to a lack of equipment (refer to audit results of diagnostic audiology services, Table 9).
4. The availibity of aural rehabilitation services and persons providing these services i.e. private audiologists, private speech-language therapists and school based audiologists/ speech-language therapists. Infants and children fitting with amplification should be placed in an aural rehabilitation programme in order to maximize the benefit of amplification for speech and language and auditory development (Yoshinaga-Itano, 2001, Boothroyd, 2001).

Hearing Aid Verification and Validation

Hearing aid verification and validation is part of the fitting process. Verification enables the clinician to evaluate whether the aid is providing appropriate levels of audibility for speech and appropriate levels of output limiting for loud sounds (Paediatric Working Group, 1996). It

is also the responsibility of the dispensing audiologist to ensure that the aid is functioning appropriately, and providing the necessary amplification required for the hearing loss. Verification is achieved using subjective behavioral measures i.e. aided pure tone and speech audiometry, functional gain, self report questionnaires and objective measures i.e. electroacoustic verification using real ear measures (Valente and Vaente, 2002; Dillon, 2001)

Hearing Aid Verification and Validation (Adults)

Results: This question was answered by 71 public sector and 73 private sector respondents. The practice of hearing aid verification and validation among respondents working in private sector was as follows: 57.53% (n=42) always, 31.50% (n=23) sometimes, and 10.95% (n=8) never. Since approximately 10% of private sector respondents also indicated not fitting adults, it can be assumed that these "never" responses for verification were obtained from the same respondents. 36.61% (n=26) of respondents from the public sector performed verification and validation procedures routinely, 26.76% (n=19) "sometimes", and 36.63% (n=26) "never". (Refer to Figure 5(a)). In the public sector, 25% of respondents indicated not performing adult hearing aid fittings. A logical assumption would be that these respondents would also not perform verification therefore these results suggest that 11% of respondents who fit aids, do not conduct verification & validation. Reasons for not performing verification by private sector respondents included "no equipment" (~66%, n=4) and "other' (~25%, n=2). Public sector respondents indicated "no caseload" (33.33%, n=8) and "no equipment" (45.83%, n=11) as key reasons for non-practice. These reasons were also indicated as main reasons for not fitting adults. Thus overall results obtained for hearing aid selection, fitting and verification appear to correlate. (Refer to Figures 6(a) and 6(b)).

The study results indicate that verification is performed regularly by some of the respondents. It is important that every fitting should be verified (Dillon, 2001). By not conducting verification

measures, the contribution of the aid to the user cannot be determined with certainty, nor can the clinician make an informed decision on the need for further adjustments to the instrument. This process is important as the appropriateness of the fit and perceived benefit of the aid would greatly influence the use of the aid. Validation questionnaires and scales completed by patients provide imperative information on the quality and satisfaction of the fitting. It is therefore essential that verification and validation measures be determined for all hearing aid fittings.

It is acknowledged that client follow-up does prove problematic in the public sector, and would impact on verification. Due to cost incurred in traveling to hospitals and clinics, patients may not always return as ideally required for verification and fine tuning. Thus it is important to spend time with the client on the day of the fitting and to verify the fitting during this appointment. This is may be difficult to achieve due to the caseload and small staff compliments, however it would be better to ensure a 'good' fit' and increase the likelihood of hearing aid use. As discussed above, verification measures can be performed using subjective and objective measures (i.e. real ear response). Literature and studies have indicated that objective measures are more accurate in verifying hearing aid performance than aided threshold testing and functional gain and have been recommended as protocol for verification. Therefore, although respondents are performing verification, it is not clear what measures are being used. The audit results reflecting the use of real ear and insertion gain would possibly provide an answer to this question. (Please refer to the discussion to follow on Real Ear and Insertion Gain).

Hearing Aid Verification and Validation (Paediatrics)

Results: 70 public sector and 72 private sector respondents completed this question. Trends in hearing aid verification and validation services for children appeared to be the same

among respondents employed in each sector. Results reveal that hearing aid verification and validation is regularly performed by 37% of respondents per sector, with 37% “sometimes” verifying the fitting and approximately 25% never performing this service. Since approximately 25% of respondents per sector indicated not fitting hearing aids, it could be assumed that the same respondents have indicated not performing hearing aid verification. (Refer to Figure 5(a)). Reasons for not performing verification were the same as that for non-practice of verification for adults i.e. “no equipment” and “other”. (Refer to Figures 6(a) and 6 (b)).

Infant hearing aid fitting carries, in some ways, a higher level of responsibility than hearing aid fittings for older patients. Since infants can not verbalize the appropriateness and comfort of the fitting, and will not be able to for months or even years, verification using objective measures is critical to achieving the best calculated fit, and should be performed with every fitting (Moodie, Sinclair, Fisk & Seewald, 1998; Dillon, 2001). From the above results it is clear that verification/validation with every fitting (as with adult fittings) is not being achieved as indicated by the response “sometimes”. (Refer to Figures 6(a) and 6(b)).

The important questions to answer are: (1) what is the implication for non-practice, (2) which verification procedure should be conducted and (3) what are the challenges to verification in SA?

According to Seewald, Moodie, Sinclair, Scollie (1999), one of three different measurement options can be applied at the verification stage of the paediatric fitting process. The options include measurement of aided sound field thresholds, sound field probe-microphone measures, and 2-cc coupler-based measures, with an age-appropriate or individualized coupler to real-ear transform. In a local survey conducted by Smith (2004) investigating paediatric hearing aid fitting, selection and verification protocols used by audiologists in

Gauteng, results revealed that behavioral test procedures were used primarily for assessments and most audiologists primarily used sound field measures to verify fittings, due to a lack of real ear equipment.

Traditionally behavioral functional gain measures have to be used to verify hearing aid performance in children. However the limitations of functional gain measures are (Lewis, 2000:p159): 1. it is dependent on client participation thus the ability of the child to respond would impact on the information obtained, 2. may not provide an accurate estimate of the hearing aid performance under typical use, 3. importantly maximum power output (MPO) across the frequency range can not be measured, and 4. functional gain measures are made at relatively low input levels and may over estimate the amount of gain available for higher input sounds. This discrepancy would occur whenever the aid is functioning in its non-linear operating range.

Real-ears measures are thought to be feasible measures (Lewis, 2000:p160) as they:
1. can be performed by input levels comparable similar to those encountered in daily use, 2. provide information about gain in regions of normal hearing, 3. measure MPO levels, 4. are less time consuming and require less cooperation from the child and 5. provide greater frequency resolution than is available with functional gain measures.

With regards to validation, this information is important to demonstrate the limitations and benefits of the child's listening abilities especially for speech perceived (Paediatric Working Group, 1996: p59 cited in Lewis, 2000:p162). The difficulty with validation for children is that they can not express then benefit or limitations of the aid, thus the audiologist has to rely on information from many sources including parents, care-giver, teachers etc that is noticed through informal observation. The difficulty that may be encountered in public hospitals is that

sometimes children return for follow-up appointments accompanied by family/community members, thus this information may be difficult to obtain in these instances.

Real Ear and Insertion Gain Measures

Results: 69 respondents per sector completed this question. Results revealed that the majority of respondents (85.50%) employed in the public sector never conducted real ear and insertion gain measures, with the minority of 7.24% always using these measures, and 7.76% occasionally. Use of these measures appeared to be more frequent in private sector, as 21.73% respondents indicated routinely performing real ear and insertion gain, 18.84% sometimes, although most respondents (59.42%) never conducted these measures. (Refer to Figure 5(b)). The primary reason for not performing real ear and insertion gain measures was "no equipment". (Refer to Figures 6(a) and 6(b)).

Following from the discussion on paediatric verification and validation, of the three methods of verification mentioned, it is apparent from these results that most respondents do not use real ear measures for verification. Thus it can be assumed that verification through sound field aid response testing is used as a main method of verification. To evaluate the implications of not practicing these measures in the hearing aid fitting and verification process, the following discussion will review the clinical value of real ear measures and implication for non-practice of these measures.

Real ear measures have been described as probably the most "reliable and efficient method for assessing the benefits of amplification" (Valente and Valente, 2002:p707). According to ASHA (1998) guidelines for hearing aid fitting, real-ear measures should be the preferred method for verifying hearing aid performance. According to Dillon (2001:p107), for the purposes of verification, real ear (probe microphone) measures offer several advantages

relative to sound field aided threshold testing. Firstly, the test signals applied in these procedures are more representative of the levels and spectral characteristics associated with everyday inputs to a hearing aid. Secondly, real-ear performance can be measured across the entire frequency and intensity continuum.

This flexibility provides clinicians with comprehensive input/output electroacoustic data and, perhaps most importantly, a direct measure of the maximum levels of sound that a hearing instrument will deliver into the ear of an infant or young child across frequencies. Relative to aided threshold testing, a third advantage of probe microphone procedures is that reliable behavioral responses are not required to measure real-ear hearing aid performance. Rather, probe-microphone measures require only passive cooperation from the infant or child (Dillion, 2001 ; Seewald, Moodie, Sinclair, Scollie, 1999). Scollie and Seewald (2001:p121) also noted that electroacoustic verification in paediatric hearing instrument fitting informs the clinician whether the hearing aid instrument will facilitate auditory development and also provides a reasonable substitute for feedback from the infant/ child, i.e. older children and adults can indicate if sound quality and loudness is adequate, and benefit can be assessed through a speech/loudness perception test, as this is not possible in infants and young children. By verifying that the hearing instrument is functioning at prescribed levels, one can expect the child to have positive auditory experiences.

Evidence based practice and research clearly emphasizes the value of real ear measures for hearing aid verification. Results suggest that this measure has not been incorporated sufficiently into audiology practices, and are especially lacking in the public sector. A concerning factor is that the study results have indicated that a higher percentage of respondents from the public sector are fitting paediatric clients. Therefore it is even more

relevant and important that the audiology services in this sector are adequately equipped to fit this population more accurately.

Fine turning using HI-PRO & NOAH and Manual Trimmers

Results: This question was answered by 70 public sector and 73 private sector respondents. Results indicate that most of the respondents (>85%) working in the private sector routinely use HI-PRO and NOAH as well as manual trimmers for fine tuning, and both methods appear to be equally used. In contrast, 80% of respondents from the pubic sector "never" perform fine tuning using HI-PRO and NOAH but mostly use manual trimmers as indicated by approximately 81% of respondents. "Never" responses were attributed primarily to a "lack of equipment" i.e. Hi-PRO and NOAH software and "other". (Refer to Figures 5(b) and 6 (a) and (b))

The results are possibly reflective of the difference in hearing aid technology fitted per sector. The trend in fitting privately appears to be largely digital technology that requires Hi-PRO and NOAH for fine tuning. The public sector on the other hand continues to provide predominately analogue technology, with a smaller low end digital range. This accounts for the high percentage of use of manual trimmers.

In sum, the variations in work settings, and hindering factors to hearing aid provision and SA contextual differences significantly contribute to protocols used. Some may argue that comparison to first world practices may seem inappropriate. However, all clients should be provided with the most appropriate technology to meet their hearing loss and communicative needs. In the public sector, budgets are allocated for purchasing a range of hearing aid technologies, but with inadequate measures taken to invest in appropriate fitting and verification equipment and software (such as NOAH), clinicians are faced with the daunting

task of attempting to provide well fitted hearing aids and to encourage patient compliance. However, the appropriateness of the fitting will have direct bearing on the perceived benefit of the aid. If a realistic expected benefit is not perceived, chances of user noncompliance increase.

Paediatric hearing aid fitting is especially concerning. Infants and children can't provide subjective feedback, therefore, good, appropriate fittings are dependent on electroacoustic measures using real ear. This was supported by the Paediatric Working Group (1996:p55) who noted that "no facility should fit hearing aids to children if it lacks the equipment for electroacoustic evaluation. Probe microphone measures of real-ear hearing aid performance should be obtained with children whenever possible". This reiterates the argument that merely providing and funding hearing aids is not good enough. Clinicians must have the equipment to support fittings and manage outcomes and to offer quality services.

Another very important and current issue that audiologists must be aware of is the threat of our professional autonomy concerning hearing aid dispensing. Locally and internationally professionals associated with serving hearing impaired clients have attempted to compete for the right opportunity to dispense hearing aids and to provide hearing-aid-related services (Andanda, Bonaretti & Wemmer, 2004; Turner, 1998). Locally, hearing aid acousticians advertise as 'experts' in hearing aid dispensing, although, by the nature of training, audiologists are the highest qualified professionals to fit hearing aids, as well as to provide the much needed counselling and rehabilitation that accompanies hearing aid fittings. While training is the most fundamental credential of a health care professional, implementation of this knowledge and quality service provision is equally important.

According to Tuner (1998) audiologists by virtue of their training, should be regarded as experts in the area of hearing aids. Thus training institutions must ensure that adequate time

is provided for training in this area, to ensure a high standard of service delivery and to maintain the “expert” status of audiologists as hearing aid dispensers. With regards to private practice, hearing aid sales form an integral source of revenue for audiologists and “may be the only activity that provides a sufficient volume and reimbursement to ensure that audiology continues as a viable profession” (Turner, 1998:p1). Practitioners should make every effort to ensure hearing aids are fitted and verified appropriately as patient satisfaction impacts on sales, user compliance and the perceived value and expertise of an audiologist.

In sum, rehabilitation including hearing aids was the foundation of the profession and is a key area to the survival of the profession. Every effort should be taken to ensure quality hearing aid service provision, to market and advertise the audiologist as the most appropriate person to fit hearing aids, and to defend the scope of audiology practice. An area of particular concern is paediatric hearing aid fittings. Audiologists, despite expert training are wary of challenges of assessment and fitting of this population. The fitting of aids by persons other than an audiologist is therefore exceptionally concerning. It is the researcher’s opinion that urgent discussions addressing this issue must be held, in the interest of the profession and the patient care in particular.

As emphasized by Bess (2000: pp 249): “if we desire to afford children a sound foundation through early amplification we must provide the next generation of audiologists with a sound foundation for amplification for children” and training should be grounded in evidence based practice/ audiology as “evidence based audiology deemphasizes institution and unsystematic clinical research”. From the above quotation, it is evident that wide-spread investigations on current practice trends and hearing aid selection, fitting and verification protocols used by SA audiologists are necessary. Further, factors impacting on practice should be explored in detail, as well as feasible measures of improving hearing aid service delivery in both the

private and public sector. Such investigations will serve to inform future practice, training and research in this area.

3.2.5 Subsection E: Hearing Prevention and Conservation Programmes`

"For most people, the sense of hearing is not only a critical portal for language allowing for communication with others but is also a vital element for staying oriented within the environment. Thus, audition is a defining element of quality of life" (Fausti, Wilmington, Helt & Helt, Konrad-Martin, 2005:p62)

In the area of prevention, audiologists are responsible for the designing, implementation and coordination of community, industrial and recreational hearing screening programmes, which focus on prevention through education. The above quotation embraces the fundamental need for such services and programmes to all persons, and also serves to entrench the importance of the drive towards early identification of and intervention for hearing loss. In South Africa, the current Primary Health Care (PHC) model governing health service delivery, places emphasis on bringing health care services to the community. The need to move SA Health services from a largely curative one to a community oriented service focusing on the promotion of health and prevention of disease and disability has been addressed in the *White Paper on the Transformation of the Health System in South Africa* (Department of Health, 1997:p5-6).

The primary level of prevention within the PHC model is concerned with the prevention of disease and accidents that may cause disability whilst the secondary level of prevention addresses the need for early identification of impairments and disease, followed by early intervention (White Paper on a National Integrated Disability Strategy, 1997:p22-26). It is

therefore clear that hearing screening and community outreach educational programmes are well supported by SA health service policies and service delivery models.

The primary aim of hearing screening is to divide the screened population into two groups: those that have a high probability of presenting a hearing impairment, and require a complete audiological diagnostic evaluation and those with normal hearing or low risk of developing a hearing loss (Lutman, 2000:p367 cited in Swanepoel, 2005). Any person exposed to environments, diseases or situations that predisposes them to the risk of hearing loss should been screened.

Community Screening

Community screening should address the needs and logistics of the community at which the audiologist is employed. For most, screening of school ages children is priority, and depending on the social and medical infrastructure of the community, adults of various age groups would also be targeted in such projects (Fausti, Wilmington, Helt & Helt, Konrad-Martin, 2005).

Audit results reflecting the frequency of community screening provision is displayed in Table 13. The distribution of the primary reasons given for “never” providing community screening is displayed in Tables 17 (a) and 17(b).

Table 13: Audit Results of Community Screening Services

SECTOR	Always		Never		Sometimes	
	Count	(%)	Count	(%)	Count	(%)
Public (n=71)	22	30.99%	26	36.62%	23	32.39%
Private (n= 72)	7	9.72%	32	44.45%	33	45.83%

Results: Results indicated that hearing screening in communities is performed routinely by 30.99% (n=22) of the 71 respondents employed in the public sector, with 32.39% (n=23) respondents “sometimes” providing this service and the remaining 36.62% (n=26) “never” participating in community screening. Of the 72 respondents employed in the private sector, a minority of 9.72% (n=7) respondents provided screening regularly, 45.83% (n=33) “sometimes”, and 44.45% (n=32) “never”. (Refer to Table 13).

Of the 23 respondents employed in the public sector, the most frequent reason given for “never” providing screening was that of time constraints (60.86%, n=14), followed by reasons of “no equipment” (n=3), “other” (n=4) and “no caseload” (n=2). Similarly, the distribution of reasons obtained from the 30 respondents employed in the private sector, were “time constraints” (n=11), “no equipment” (n=7), “no caseload”, and “other” (n=4). (Refer to Tables 17 (a) and (17(b)).

Approximately 60% of respondents employed in the public sector appear to be participating in screening programmes. The results from the private sector respondents were also promising, with approximately 50% indicating involvement in screening. The level of involvement is for the most part a product of the work environment. The following discussion of the results will present factors that need to be considered in each work setting as these results should be interpreted in accordance with workplace setting and the opportunities provided for community screening projects to be incorporated into the job. Following this, the researcher will present literature emphasising the importance of and need for community screening in SA.

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Ideally all clinicians should be involved in community screening at some level. However, workplace restrictions such as limited staffing and time constraints could impact on the level of participation in screening programmes. Also, screening is generally not a 'fulltime' area of service delivery and often 'slotted' into the main focus of the practice. Further, as screening is usually performed outside of the work environments, the staff compliment would impact on the feasibility of providing screening services.

The results indicate that approximately 50% of private practitioners do provide screening services. It is assumed that these services are provided as an 'additional' service' that is accommodated depending on the type and nature of the practice. Also, for private practitioners and hospital based therapists located in peri-urban and urban areas, 'community' screening programmes for the most part would involve school screening and projects facilitated by professional bodies. As these services are provided outside of the practice, they would certainly impact on time and will depend on the co-ordination of both the institution and audiologist to see the programme through. It is acknowledged that the provision of local and outreach community screening is difficult to co-ordinate and may not be feasible to include into regular practice. Professional organizations such as SAAA should aim therefore to develop projects in consultation with private audiologists, to encourage

participation in community screening. Aside from addressing public education, such projects would also serve to market the profession.

Public sector respondents provided “time constraints” as a key reason for not performing community screening. As respondents from the public sector were predominantly employed in state hospitals, (as per results on the demographical information) these results should be considered within the hospital context. Audiology services in state hospitals concentrate on a large diagnostic and re-habilitation caseload, often with limited staff. Screening programmes applicable in this context are usually infant screening and ototoxic monitoring. Thus it is very likely that the caseload seen leaves little time for participation in additional outreach projects such as community screening programmes.

With regards to respondents employed in community clinics/hospitals based in rural areas, one could assume that hearing screening may be more feasible to incorporate into their work schedule as home visits and community outreach programmes are an essential service delivery requirement in such areas. The dire need for screening services especially in rural areas is clearly supported by the high prevalence of infectious diseases such as HIV/AIDS and tuberculosis (TB), genetic disorders and trauma found in rural communities (O’ Grady 2004:p25, Swanepoel, 2004) which is often a result of poor socio-economic factors, limited accessibility of health care and poor nutrition (Swanepoel, 2004). Thus a high incidence of congenital and acquired hearing loss and ear infections could be expected in these communities. In addition children living with HIV/ AIDS have increased susceptibility to secondary infections that could impact on auditory functioning such as chronic otitis media. A high prevalence of OM has been documented in persons with HIV /AIDS (Lalwani & Sooy, 1992). OM left untreated could result in permanent hearing loss. This in turn would impact on education and employment. As stated by Swanepoel (2004:p14), “Hearing impairments

comprise approximately 22% of disabilities in children in SA…Although figures differ across provinces the rural children between birth and 10 years are twice more likely to have three or more disabilities than their urban counterparts".

The above discussion emphasizes the urgent need for preventative measures such as screening. Should factors contributing to hearing loss go undetected and untreated; the outcome will be a large group of inactive individuals, requiring more expensive rehabilitation.

The implementation of screening programmes in rural areas seems to be hindered by many factors as limited infrastructure, lack of telecommunication, limited awareness of audiology services by the community, and SLHT were not trained to work with the challenges of rural setting, i.e. no equipment, and dealing with inadequate budget.

Although this article was published a decade ago, it appears that these challenges are still very applicable to rural service delivery today. In view of the introduction of community service, SLHT training should place emphasis on equipping graduates to meet the above mentioned challenges. Graduates should not only develop skills in dealing with under resourced departments and within community cultures and beliefs, but should also be prepared for 'business/ managerial aspects' such as motivating for equipment, using a budget and budgeting and negotiating skills.

As mentioned by McKenzie (1992), school screening is an important area of service delivery and limitations due to human resources is a major contributor to the provision of this service. School (nursery and primary) screening also assists in identifying children suffering with conditions such as otitis media, impacted cerumen and attention and concentration problems that may be associated with auditory processing difficulties, all of which would negatively impact on learning. Further, prenatal hearing losses due to early child disease such as

meningitis, otitis media, chicken pox, and measles can be detected through schools screening (Martin, 1994). Recently concern has been raised regarding the growing use of loud electronic gadgets and toys and young adults listening to stereos and portable music devices (e.g., walkmans, MP3 players and cell phones) at high volumes, as these trends are most likely the cause of a rising incidence of noise induced hearing loss. Thus a new need for screening has emerged through this misuse of technology.

Irrespective of the community and location, the hearing status of young children and teenagers is now becoming an area of concern due to an increase in incidence of noise-induced hearing loss. The impact of the misuse of loud electronic devices appears was reported in a number of studies. In the US, results of the Third National Health and Nutrition Examination Survey revealed that among 6,166 youth between 6 and19 years 14.9 percent had a hearing loss in one or both ears (Fausti, Wilmington, Helt & Helt, Konrad-Martin, 2005). Montgomery and Fujikawa (1992, cited in Stephen, et al, 2005) reported that the percentage of second graders with hearing loss had increased 2.8 times (280%) over a 10-year period, and the percentage of eighth graders increased over 4.0 times (400%) during the same period while 15 percent of college graduates were found to have levels of hearing loss equal to or greater than their parents. These studies highlight the need for school screening and public awareness regarding recreational hearing loss.

It is likely that the results revealed in the above mentioned studies are possibly reflective of the youth in SA as well. The use of portable music devices (e.g., cell phones, MP3 players and walkmans) at exceptionally high volumes are most possibly also practiced by SA youth. Today, cell phones are a part of SA culture. Most adults and some school going children irrespective of socio-economic profiles, have access to cell phones. The more expensive high-tech devices such as MP3 players and computerized toys have infiltrated the SA market

as well. Further, although the use of such devices may not be accessible to the poorer majority of our population, they have the misfortune of relying on taxies equipped with exceptionally loud music on a daily basis. Thus overall, the amount of recreational noise exposure is growing significantly in our country.

Hearing conservation programs that are tailored to school-age children and deliver early and repeated education regarding hearing and hearing loss are now necessary to establish consistent use of technology and of hearing conservation practices. Children and parents should be educated on protective measures to prevent hearing loss at home and school and during social and recreational events.

Large scale community screening may be difficult to coordinate. However on a smaller scale, hearing screening at schools, the work place, recreational areas such as the gym and in community centres is feasible. The focus of public education on hearing and services provided by audiologists appears to be lacking. Negative, discriminatory attitudes, ignorance and beliefs towards disability were noted as a significant barrier toward development of disabled children as empowered, independent individuals (Swanepoel, 2004). Education through community screening would hopefully change misconceptions of disability, educate and empower parents to better cope with the needs of a hearing impaired child and promote the value of treatment for disability. Importantly however, follow-up services and supporting medical and rehabilitation referral systems must be in place in order to deal with the client demand, and to reap the benefits of screening.

Neonatal Screening

Newborn hearing screening has been advocated for many years to assess babies with risk factors. The concept of universal newborn hearing screening (UNHS) arose in 1994, by Joint

Committee on Infant Hearing Screening (JCIH) in the US, who advocated the identification of hearing impairment for all infants within the first three months of life. The JCIH supplementary Year 2000 position statement continued to endorse early intervention, through an integrated, interdisciplinary approach. In South Africa, the Hearing Screening Position Statement (HSPS) 2002, compiled by the Professional Board for Speech, Language and Hearing Professions of the HPCSA, accepted the 2002 JCIH position statement as a definitive document on infant hearing screening, and also advocated infant hearing screening using electrophysiological tests as the first step towards diagnostic assessments (HPCSA 2002:1).

Results: Audit results reflecting neonatal screening provision is displayed in Table 14 below. The distribution of the primary reasons given for "never" providing neonatal screening is displayed in Tables 17 (a) and 17(b). Results revealed that approximately 53% of respondents from each sector were not performing neonatal screening, with 28% routinely providing the service. The remainder of the respondents provided this service occasionally. (Refer to Table 14). Respondents from both sectors indicated the following as primary reasons for not conducting the screening: "no case load" (~ 32%), "no equipment" (~ 30%) and "time constraints" (~ 20%). (Refer to Table 17 (a) and (b)).

Table 15: Audit Results of Neonatal Screening Services

SECTOR	Always		Never		Sometimes	
	Count	(%)	Count	(%)	Count	(%)
Public (n=71)	20	28.17%	**37**	***52.11%***	14	19.72 %
Private (n= 73)	21	28.77%	**40**	***54.79%***	12	16.44%

UNHS is certainly an exciting concept, and is essential for early intervention. However follow-up infrastructure and resources must also be in place for the benefits of UNHS to come to

fruition. The following discussion will examine the above results, and discuss the value and implementation of UNHS and developments in UNHS in SA.

The results obtained could be reflective of the work setting of respondents, as those respondents employed in settings other than hospitals would not have a caseload of neonates. (Refer to Table 17(a) and (b)). Private practitioners not located in hospitals but offering the service would therefore need to access a hospital/clinic for the caseload and promote the screening through antenatal classes etc. Therefore the 50% of respondents providing this are possibly largely representative of respondents employed in hospitals/clinics. Approximately 30% (~11) of respondents per sector did not perform neonatal screening due to a “lack of equipment”. Equipment used for neonatal screening includes automated OAEs and/or ABR (AABR) and should include multifrequency tympanometry. Previously discussed audit results had revealed the lack of availability of electrophysiological equipment, and multifrequency tympanometry. Hence it is likely that some work settings, having access to the caseload have yet to purchase this screening equipment.

“Time constraints” could be a factor as neonatal screening is performed prior to discharge in the case of a hospital. It is therefore possible that visiting the neonatal units on a daily basis would depend on the availability of the audiologist. Further it is plausible that private practitioners located outside of hospital/ clinic settings, but servicing hospitals and clinics, may fail to screen all infants prior to discharge, due to other appointments.

According to Yoshinaga-Itano (2002:p221), evidence based research has indicated that universal newborn hearing screening (UNHS) results in early identification of congenital hearing loss leading to the provision of earlier intervention. Also, rehabilitation outcome

results have indicated significantly improved language development when compared to children with a later identified hearing loss, a language development follows a similar pattern of age appropriate “typical development” within the first five years of life. As promising as the outcomes of UNHS may appear, the question of the feasibility of implementation of new born hearing screening programmes and whether or not such outcomes are possible in developing countries has been raised (Olusanya, 2004 cited in Swanepoel 2005:p90)

From the results of this study, this question is indeed an important one to address. This is especially important in light of the call for mandatory UNHS by the JCIH, and the inclusion of this requirement in our local HSPS. Also, in rural SA most births occur outside of a hospital (Olusanya, 2004:p297 cited in Swanepoel 2005:p91), thus systems need to be devised to inform parents of this service but more importantly outreach infant screening programmes should be incorporated into PHC programmes to ensure that parents have access to this service.

As highlighted by Swanepoel (2005), challenges to infant screening in SA include shortage of man power, attitudes and cultural beliefs towards disability, low levels of awareness by health care workers, the lack of follow-up services and the wide range of life threatening diseases. Parental compliance has been flagged as a major challenge in developed counties such as the US, (White, 2003 cited in Gravel, White, Johnson and Widen, et al. 2005), where it remains difficult in many places for health facilities to track those infants who failed screening in the newborn period and return them for follow-up regardless of the protocol being used. Evidence suggests that in some localities, despite concerted efforts at bringing infants back for re-screening or diagnostic audiological evaluation, as many as 50% of infants may be lost to follow-up (Gravel, White, Johnson and Widen, et al. 2005).

Heath care services in SA as in all developing countries are largely oriented to treating life threatening disease and tend to neglect health services serving to address quality of life (Olusanya, 2000:167 & Madriz, 2001:p91 cited in Swanepoel, 2005:p76). Therefore, investment in audiological equipment may not be on the list of priorities in health care settings as is apparent from the lack of resources evident in the findings of this study. It is therefore understandable that, objections have been raised against the false hope that UNHS could bring to parents and children should support services not be in place. Ideally, early detection should result in early intervention, however for this to be achieved, administration, follow-up and intervention strategies must be implemented and links between components established for the programme to be beneficial to the infant and their family. According to Swanepoel (2005), although follow-up services and infrastructure to support EI is not available currently, limited studies released on UNHS from developing countries have concluded that UNHS is viable and feasible in developing countries.

Further, Olusanya et al, (2004:p296 cited in Swanepoel 2005:91) suggested that the benefits of wide spread infant screening could include positive results such as the compilation of epidemiological data, parental empowerment resulting in more active seeking of intervention, growth and development of audiological services and inclusion and integration of the child with hearing impairment.

The HPSCA task force on neonatal hearing screening highlighted the following goals

- Ideally, by 2010 98% of all newborn infants will be screened
- Testing should involve Otoacoustic Emissions (OAEs) and Auditory Brainstem Response (ABR) Screening
- Identification should take place by 3 months of age
- Referrals and intervention by 6 months

Currently, what appears to be lacking are screening protocols, implementation strategies and infrastructure to support follow-up and intervention. Literature has highlighted that successful implementation of infant screening relies on adequate infrastructure, human resources, use of a common screening protocol, accurate record keeping, community involvement and a committed health system (Gravel, White, Johnson and Widen, et al. 2005; Moeller, 2000) The promise that EI has shown in developed countries is a reality that is achievable in SA provided that audiologists, allied health professionals, hearing aid manufacturers and the health system collectively strive toward the development of screening protocols appropriate to the SA context, feasible implementation of infant screening, the development of supporting infrastructure and provision of affordable intervention.

Industrial Audiology

The prevalence of occupational hearing loss in industry has risen into the millions in countries throughout the world and has been classified as an occupational disease (Libscomb, 1994). NIHL has become one of the most common health risks in industry, particularly the SA mining industry. The Compensation Fund Annual Report of 2003, revealed a staggering 2 549 claims for NIHL, contributing to 57% of the total claims for occupational diseases. These statistics alone suggest that industrial audiology is a much needed service in SA.

Results: Audit results reflecting industrial audiology service provision is displayed in Table 15. The distribution of the primary reasons given for "never" providing services in industrial audiology is displayed in Tables 17 (a) and 17(b).

Table 16: Audit Results of Industrial Audiology Service

SECTOR	Always		Never		Sometimes	
	Count	(%)	Count	(%)	Count	(%)
Public (n=69)	**3**	***4.35%***	**52**	***75.36%***	14	20.29%
Private (n= 72)	**26**	***36.11%***	**19**	***26.39%***	27	37.5%

Results suggest that industrial audiology services are predominately provided by respondents working in the private sector, with a minority of 26.39% (n=19) of the 72 respondents “never” working in this area due to a “lack of case load”, “no equipment” or ” time constraints”. Of the 69 respondents working in the public sector, industrial audiology services were “never” provided by 75.36% (n=52) and occasionally performed by 20.29% (n=14) of respondents. The key reason provided for non-practice in the area was “lack of case load” (66.66%, n=32) with reasons of “no equipment” and “time constraints” contributing minimally. (Refer to Tables 15, 17 (a) and 17(b)).

The audit results clearly indicate that industrial audiology is primarily provided by private practitioners, with a few public sector respondents venturing into this arena of practice. The reasons for non-practice suggested by respondents could be attributed to this structure of service provision. The following discussion will provide an overview of industrial audiology in SA and present literature exploring the role of an audiologist in industrial audiology followed by a concluding discussion on the possible initiatives that audiologist should consider, towards improving participation in and the quality of industrial audiology services in SA.

Within the SA Audiology profession, it is common knowledge that occupation nurses usually tend to be employed in larger industries such as the mining industry, and other heavy industries and are responsible for conducting hearing screening. This trend is followed as South African legislation and regulations for occupational hearing loss acknowledge an audiologist, occupational nurse, occupational safety officer and occupational doctor as competent persons, appropriately qualified to conduct hearing screening for NIHL (Circular Instruction 171, 2001 & Noise Regulation for Occupational Hearing loss, 2003). Also, in accordance with regulation, the primary role of the SA audiologist in occupational hearing loss is to conduct a diagnostic audiological evaluation and to provide necessary relevant

reports and information required for a compensation claim and hearing protection devices (Circular Instruction 171, 2001 & Noise Regulation for Occupational Hearing loss, 2003).

Further, audiologists in private practice providing screening services more often do so in addition to their standard daily practice. As the screening is performed at the site or sometimes performed at the practice, screening usually involves the use of portable equipment and often a sound booth. Thus reasons of a “lack of caseload”, “time constraints” and “no equipment” appear to be governing service delivery in industrial audiology locally.
The above discussion has highlighted that hearing screening/evaluations and HPD fitting are viewed as the two areas involved in industrial audiology in SA. However literature concerning the role of the audiologist in industrial audiology has highlighted a much broader scope of industrial audiology service delivery as will be presented in the following discussion.

Industrial audiology is growing in its scope of service delivery (Feuerstein, 2002). The development and implementation of a hearing conservation programme (HCP), has been considered a central service in industrial audiology.These programmes include identification, and amelioration of noise-hazard conditions, identification of hearing loss, prescription and counselling for the use of hearing protection, education and training of employees and the training and supervision of non audiologists performing hearing screening in the industrial setting (ASHA, 2004; Feuerstein, 2002; Libscomb,1994). According to literature, audiologists should play a key role in the areas of education and training, HPD prescription and fitting and record keeping (ASHA, 2004; Libscomb, 1994; Suter 1990) and need to exercise leadership in the development and implementation of HCPs (Fausti, Wilmington, Helt, Helt. W, Konrad-Martin, 2005, ASHA, 1996, Libscomb, 1994).

According to *ASHA Ad Hoc Committee on Occupational and Environmental Hearing Conservation* (1996:11), the extent to which audiologists are involved in each component of

the HCP is dependent on education and training. Audiologists should embrace this broad scope of practice in industrial audiology and introduce the concept of HCPs to the industrial sector and policy makers.

Industrial audiology appears to be practiced in a limited context, focusing on diagnosis and assessment of hearing loss, and HPD provision. The audiology profession in SA should try to develop a service plan to meet the demands of education and training as well as promotion of audiological services. For example, allied professions such as dentists are at risk of developing NIHL due to the use of ultrasonic equipment, however most dentists appear to have little awareness of this fact. There are numerous such examples of vocations that exceed the 85dB/ 8hr noise limit as set by legislation, however are unaware of the need for audiological monitoring and HPD use. In an attempt to reduce the occurrence of occupational hearing loss, audiologists should try to assert a more collaborative role in policy development, development of screening protocols and monitoring of hearing prevention measures undertaken in industries.

Ototoxic Monitoring

Initial ototoxic drug exposure typically affects cochlear regions coding the high frequencies. Continued exposure results in a spread of damage to progressively lower frequencies. In a similar manner, by the time dizziness is reported, permanent vestibular system damage probably has already occurred (Fausti, Wilmington, Helt, Helt and Konrad-Martin, 2005).

Results: Audit results reflecting ototoxic monitoring service provision is displayed in Table 16. The distribution of the primary reasons given for “never” providing services in industrial audiology is displayed in Tables 17 (a) and 17(b).

Table 17: Audit Results of Ototoxic Monitoring Services

SECTOR	Always		Never		Sometimes	
	Count	(%)	Count	(%)	Count	(%)
Public (n=71)	6	8.45%	**42**	***59.14%***	23	32.39%
Private (n= 73)	7	9.59%	**40**	***54.79%***	26	35.62%

The results revealed similar trends in practice of ototoxic monitoring among respondents per sector. Results suggest that ototoxic monitoring was not performed by more that 50% of the respondents per sector. Less than 10% of respondents per sector routinely performed ototoxic monitoring, with approximately 30% occasionally involved in monitoring. (Refer to Table 14). The reasons provided for this lack of service delivery by public sector respondents were a “lack of training” (n=13), “no caseload” (n=10), “time constraints” (n=7), “no equipment” (n=6) and “other” (n=6). Respondents working in the private sector suggested a “lack of case load” (n=17) as the main reason for not providing ototoxic monitoring, with reasons of “no equipment” (n=10), “time constraints” (n=4) and the “lack of training” (n=3) indicated by the minority of respondents. (Refer to Table17 (a) and 17(b)).

As ototoxic monitoring is usually conducted for patients placed on long term ototoxic medical regimes, who most possibly have life threatening conditions this client base is often treated in hospital. Thus ototoxic monitoring is usually conducted by hospital based audiologists, and explains the “lack of caseload” reported by respondents. Also, patients on long term medication such as TB sufferers, if discharged, would most likely return for a hearing test to the hospital that commenced treatment as part of their routine medical check-up, and therefore it is unlikely that non-hospital based audiologists would be involved in ototoxic monitoring. Hence the result of no caseload is most probable for most respondents.

The response of “time constraints” as a primary reason for non-practice could imply that

although the caseload exists, monitoring was not conducted due a lack of staff to fulfill the service demands of the workplace. However, the ototoxic induced hearing loss is a quality of life issue and in the least, patients and their families should be counseled regarding the progression of the hearing loss, change in life style and communication that would occur as a result of the hearing loss. The possibility of rehabilitation could also be explored (Konrad-Martin, Helt, Reavis, Gordon, Coleman, Bratt, and Fausti, 2005).

A significant number of respondents suggested that the lack of equipment and training were the primary reasons for not performing monitoring. The resultant damage to cochlea hair cells, implies that monitoring programmes should ideally use OAEs (refer to the audit of diagnostic services for further discussion) for screening, with ongoing audiological evaluation protocols including the use of the basic test battery and diagnostic OAEs. Since hospitals and clinics should be equipped to perform a basic hearing test, the “lack of equipment” can therefore be interpreted as the lack of screening/ diagnostic OAEs. The “lack of training” noted is concerning as many of the same considerations are required for the successful implementation of ototoxicity monitoring programs as for any other screening programme. This could possibly be interpreted as the lack of knowledge of the logistics of developing a monitoring programme and possibly developing an adequate monitoring protocol.

Ototoxic monitoring is an important service, and although life and death issues do take precedence over quality of life, patients should be informed of the effects of treatments. More so, ototoxic monitoring serves a critical role in informing treatment regimes regarding the onset and progression of hearing loss, so that when possible, alternate therapeutic treatments could be provided to either prevent or minimize the loss (Stephen et al, 2005). This service is indeed important and practitioners requiring training should request CPD workshops to address their concerns.

In Sum poor implementation of hearing protection programs and a lack of audiometric screening and monitoring programmes leave patients vulnerable to unrecognized and untreated hearing loss until speech communication is impaired. Widespread implementation of prevention programmes is a dire health need. Strategies for fulfilling this need include education on hearing loss prevention and research on causes of and evidence-based treatments for hearing loss which can be translated into clinical practice. It is crucial that hearing loss prevention, conservation, early identification, and best practice outcomes be developed and implemented across the nation.

3.2.6 Subsection F: Habilitation and Rehabilitation

RESULTS: Audit results reflecting service provision in the following areas: cochlea habilitation and rehabilitation, vestibular rehabilitation and tinnitus are displayed in Figure 7(a) with auditory training, speech reading, language therapy with a hearing impaired child and manual communication displayed in Figure 7(b). A representation of distribution of the primary reasons indicated for non-delivery of each area of (re) habilitation provided by respondents from the public ad private sectors respectively is displayed in Tables 18 (a) & 18 (b).

Cochlea Implant Habilitation and Rehabilitation

Cochlea Implant Habilitation

Results: This question was answered by 72 public sector and 73 private sector respondents. The results revealed that approximately 80% of respondents per sector revealed not providing cochlear implant (CI) habilitation. The lack of service delivery in this area was primarily due to a “lack of caseload” as indicated by the majority of respondents working in both sectors. The second most frequent reason provided was “insufficient training”. (Refer to

Table 13). 7% (5) respondents working in the public sector and 8% (6) private practitioners were regularly involved in CI habilitation, with occasional practice by 10%(7) respondents. (Refer to Figure 7(a)).

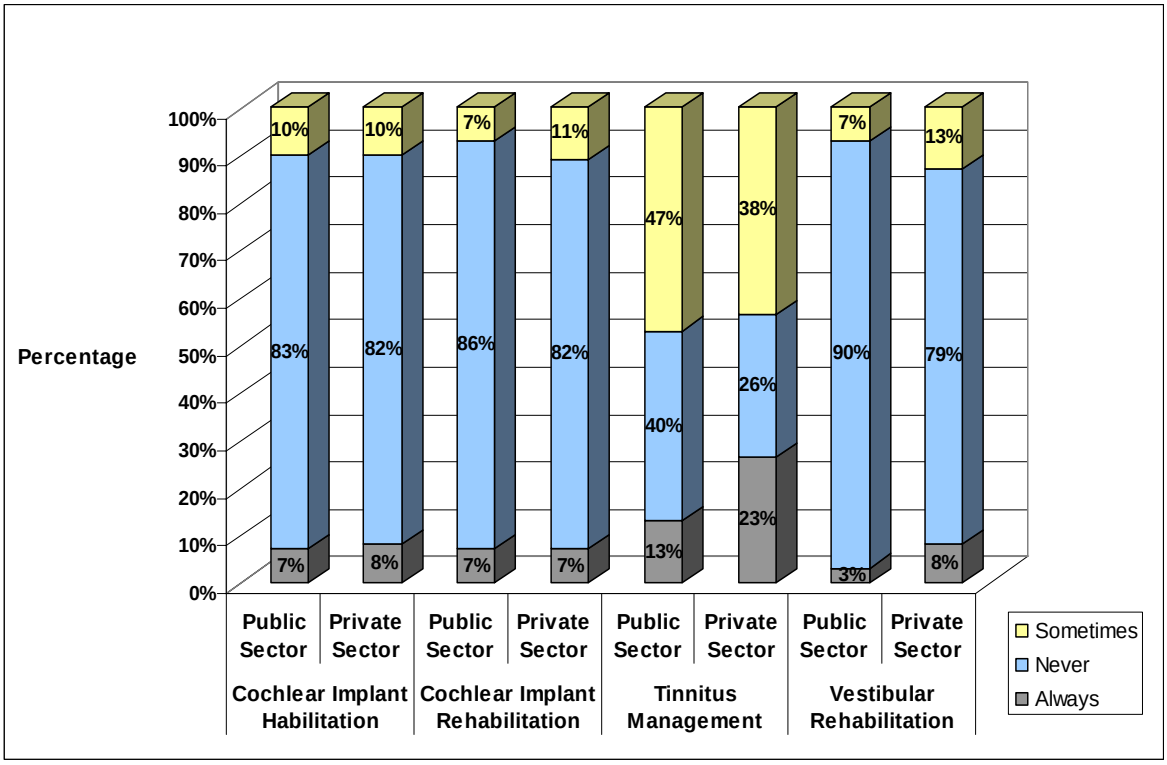

Figure 7(a): Audit Results of (Re) Habilitation Services Provision: ***Public Sect n=71, Private Sect n=73***

Cochlea Implant Rehabilitation

Results: This question was answered by 71 public sector and 73 private sector respondents. As expected, results obtained for CI rehabilitation were no different to that of CI habilitation. Approximately 80% of respondents per sector revealed not providing cochlear implant CI rehabilitation (refer to Figure 7(a)). The lack of service delivery was largely attributed to a "lack of caseload" as indicated by the majority of respondents working in both sectors. The second most frequent reason provided was "insufficient training". (Refer to Table 13). 5 (7%) respondents working in the each sector revealed routine provision of CI rehabilitation.

The “lack of caseload” was an expected finding as cochlear implant fittings have only recently been performed in SA. Candidacy criteria, cost and invasiveness of the surgical procedure are limiting factors to the number of clients being fitted. Of medical concern is the higher risk of anesthesia for infants and the higher risk in young children for otitis media, which could threaten the integrity of an implanted device (Discolo & Hirose, 2002). More so, much controversy in this area still exists among professionals, the deaf, and parents of deaf children (Pedley and Giles 2005; Discolo & Hirose, 2002).

Inadequate training appears to be contributing to the lack of provision of cochlear implant (re)habilitation services. The result could imply that students do not obtain sufficient exposure to cochlear implant users. (Please note that a discussion on training will be presented in the parallel study by Kathleen Wemmer which focuses on future training in audiology, and therefore will not be addressed in this discussion).

Rehabilitation is a critical component of the implant process. It must be provided in order for the child to receive maximum benefit from the device. According to Pedley and Giles (2005:p76), audiologists seem to offer a range of aural rehabilitation service provision following cochlear implantation. These services were found to be determined by the financial factors, time and the rehabilitation approach used by the clinician. Ideally, users especially children should receive auditory training and speech perception training as well as intensive speech and language therapy (Pedley and Giles, 2005).

Vestibular Rehabilitation

Vestibular rehabilitation (VR) refers to the process of training the patient in the techniques for recovery from vestibular weakness (Desmond, 2004:p214). Patients who benefit from VR are those who may experience continuing vertigo or disequilibrium due to poor CNS

compensation after an acute injury to the vestibular system, or ongoing labyrinthine dysfunction, and or who may develop “mal- adaptive postural control” (Shepard, 2002:p433).

Results: This question was answered by 71 public sector and 73 private sector respondents. Most respondents reported not practicing vestibular rehabilitation. Of the 73 respondents working privately, 8% provided vestibular rehabilitation services regularly, 13% “sometimes”, while the majority of respondents 79% “never” worked in this area. The same trend in practice was observed by public sector respondents. 3% practiced vestibular rehabilitation routinely, 7% “sometimes”, and 90% “never”. (Refer to Figure 7(a)).The main reasons for non-practice indicated by all respondents was “insufficient training” (~45%), and “no equipment” (~ 40%). (Refer to Tables 18 (a) and 18(b)).

The results of the study are indicative of the early stages in the development and use of vestibular rehabilitation techniques and programmes (Desmond, 2000:644), and as showed in the audit of ENG services, vestibular evaluation is likewise not commonly practiced in SA. It is likely that as more audiologists become involved in vestibular assessments, treatment in this area will increase accordingly. The reasons of “insufficient training” and “no equipment” \are expected as VR is a relatively new area that has possibly not been included into clinical training programmes, and the purchasing of equipment would be dictated by the caseload requiring this service.

The results of the study appear to be reflective of practice internationally as well as was apparent in the following quotation by Desmond, (2004:p8), “Even though the diagnostic capabilities and treatment of options available to vestibular patients have increased dramatically in the past two decades, most patients complaining of dizziness do not have access to trained vestibular specialists”.

The need for vestibular treatment and the impact of vestibular disorders on daily functioning has been emphasized in recent research that has indicated a correlation between dizziness, and functional decline, disability and decreased quality of life (Desmond, 2004:p6). Previously treatment for vestibular disorders would have included medical intervention, surgery and counselling to cope with the dizziness. Vestibular rehabilitation provides an alternative form of treatment, and recent literature has supported the use of these exercises and repositioning techniques (Desmond, 2000:p640, Shepard, 2002:p433). According to Shepard (2002:p433) vestibular and balance rehabilitation programmes have benefited approximately 70% of patients with poor balance and dizziness, for whom other treatment methods were unsuccessful. This was also supported by Desmond (2000, p: 644) who noted that vestibular rehabilitation is still in its infancy and despite the reported success of VR, patients continue to be treated with medication that often proves ineffective for most patients.

The above discussion supports the training and use in vestibular rehabilitation therapy. This area of practice appears to be a fast developing area that should be included in student training and as a CPD activity along with vestibular evaluation. Also, clinicians should try to collate data regarding the number of clients requiring vestibular assessments and rehabilitation in order to inform the need for equipment and to direct future practice in this area.

Tinnitus Management

Tinnitus is a symptom, which appears to be related to various sources however the aetiology of tinnitus remains unanswered. Thus currently uncertainty exists in the area of tinnitus management and its treatment outcomes. Perry & Gantz (2000) suggested that tinnitus patients reveal a profile that is consistent with tinnitus of sensorineural origin, including (a) history of noise exposure and concurrent or subsequent onset of tinnitus; (b) tinnitus that is

symmetrical (equally loud bilaterally), stable, and nonpulsatile; (c) tinnitus of long duration; and (d) an audiogram consistent with a diagnosis of symmetrical sensorineural hearing loss. Such a profile would suggest that further diagnostic testing would not be necessary, and management could proceed.

Results: This question was answered by 72 public sector and 73 private sector respondents. The greater part of respondents working in private practice and the public sector indicated practicing tinnitus management. Results suggest that tinnitus management is practiced more routinely by private practitioners. The distribution of responses was as follows: Public sector: 12.5% (n=9) “always”, 40.28% (n=29) “never” and 47.22% (n=34) “sometimes”. Private Sector: 23.29% (n=17) “always”, 26.03%% (n=19) “never” and 51.68% (n=37) “sometimes”. (Refer to Figure 7(a)).

The most frequent primary reasons provided by public sector respondents for non-practice was “insufficient training” (46.15%, n=12) and “no case load” (42.30%, n=12). Similarly 41.17% (n=7), and 23.52% (n=4) of private practitioners indicated “insufficient training” and “no case load” respectively as reasons for not providing tinnitus management (Refer to Tables 18 (a) and 18(b)).

The results suggest that management of tinnitus is being practiced to a fair extent, i.e. 74% (n=54) and 60% (n=43) of respondents from the private and public sector respectively are providing this service. The difference in the number of respondents per sector practicing tinnitus management appears to be mainly due to the difference in caseloads requiring this service, i.e. of the 29 public sector respondents “never” practicing tinnitus management, 19 respondents indicated not having a caseload for this service. (Refer to Table 18 (a) and 18(b)).

The insufficiency of training in this area appears to be the main obstacle to practice. Therefore following discussion will review issues related to student training and practice in tinnitus management, and present points to consider regarding training in this area.

Literature has highlighted that the issue of training commonly arises in investigations into tinnitus management and uncertainty in the use of management approaches (Henry, Zaugg, Schechter, 2005; Jastreboff & Hazell 1998). As noted by Hazell, 1995 (cited in Henry, Zaugg, Schechter, 2005: 23) "Clinical management of hearing disorders involves the use of well-established procedures that are widely available and fairly uniform across clinics. These kinds of services are fairly straightforward in the provision of comprehensive hearing health care. Although there are certainly differences in the quality of services provided, a patient has reasonable assurance that the care received will adhere to a standard of accepted clinical practice and well-defined protocols. When the primary complaint is tinnitus, however, the patient does not have this same level of assurance"

Due to the limited understanding and knowledge about the exact cause of tinnitus, a range of treatment approaches are presently practiced. However, Henry, Zaugg, Schechter, (2005) found that although different methods of tinnitus treatment have been available to audiologists, relatively few audiologists have received the necessary training or have adopted a structured treatment approach to manage tinnitus patients. Dobie (2004a) also pointed out that individuals who suffer from tinnitus are at a distinct disadvantage when seeking clinical services for their condition as a myriad treatment options are available, although most are without evidence basis.

Literature highlights that most audiologists restrict intervention to counselling, hearing aid fitting and referral to ENTs for medical and pharmacological treatment (Schechter & Henry, 2002, Jastreboff & Hazell 1998). To the researcher's knowledge no published data exists

regarding the commonly practiced tinnitus management approaches in use by clinicians in SA, nor has the efficacy of treatments used been investigated. Therefore one has to rely on clinician's experience to support and assess the effectiveness of the techniques.

It is clear that clinical training in tinnitus management is lacking, but the need is recognized. Henry et al. (in press) described four broad areas that will require consensual definition to achieve standardization of tinnitus management within the field of audiology: (a) clinical procedures, (b) research evidence to support clinical procedures, (c) audiology graduate programs, and (d) patient educational programs. In SA, the creation of guidelines on tinnitus management (for well supported approaches) could possibly address the variation in practice mentioned in literature and encourage practice for those who perceived student training inadequate to confidently practice in this area.

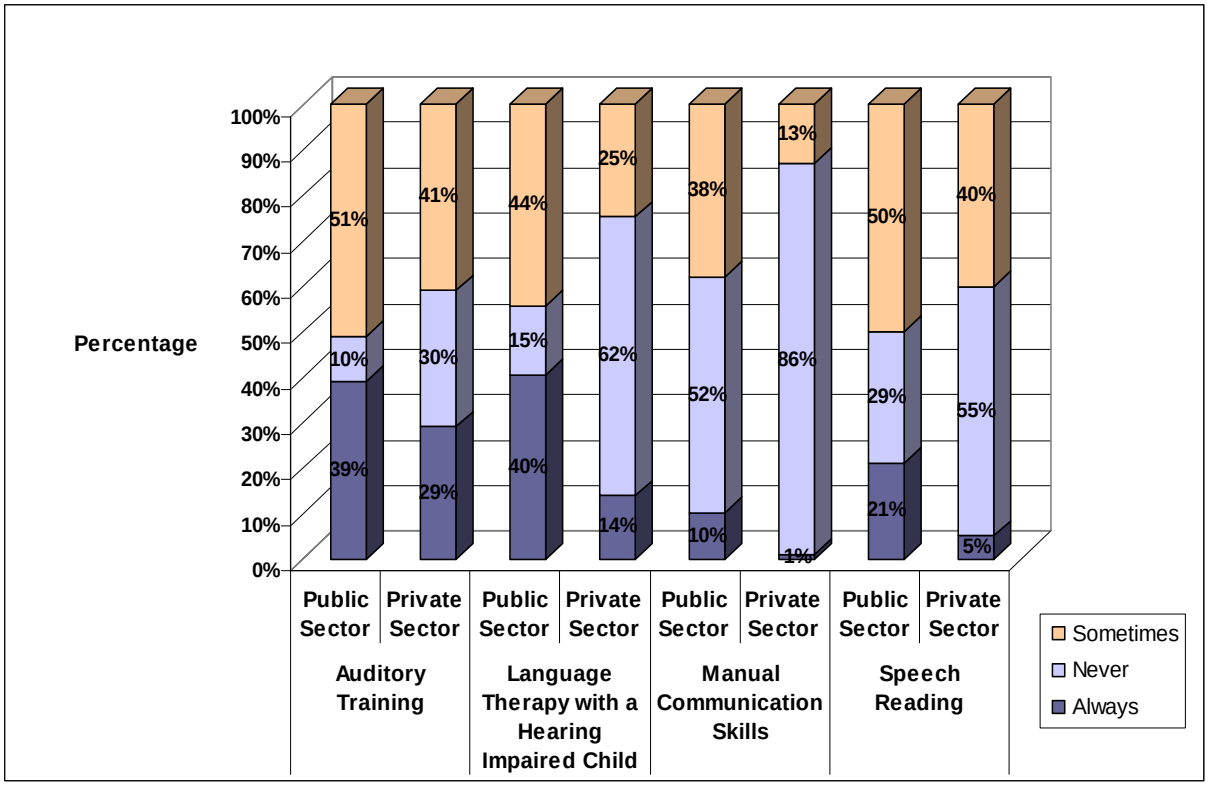

Figure 7(b): Audit Results of (Re) Habilitation Services Provided *Public Sect n=72, Private Sect n=73*

Auditory Training

Results: This question was answered by 72 public sector and 73 private sector respondents. The majority of respondents working in both sectors indicated providing auditory training i.e. public sector 90% and private sector 70%. (Refer to Figure 7(b)). The main reason for non-practice by 30% of private sector respondents was the “lack of caseload” (47.36%, n=9) and “other” (31.57%, n=6). (Refer to Table 18(a) and 18(b)).

The study results revealed that most respondents who have a caseload requiring auditory training are providing the service. The higher number of public sector respondents providing rehabilitation programmes that include auditory training is possibly reflective of respondents employed in public special schools and rehabilitation centers and can also be related to the higher percentage of routine paediatric hearing aid fittings revealed in this study (refer to the audit results and discussion on Paediatric Hearing Aid Selection and Fitting). Auditory training is an essential part of a rehabilitation programme especially in prelingually hearing impaired/ deafened individuals (Zwolan, 2002). Also amplification alone will not facilitate the understanding of the auditory information and speech-language acquisition and development. Thus it is important that clinicians fitting hearings aids provide rehabilitation as needed by the client and this will also enable the user to perceive the benefit of the amplification device.

Speech Reading

Results: This question was answered by 72 public sector and 73 private sector respondents. The majority of public sector respondents conducted speech reading as part of their rehabilitation programme i.e. 50%, (n=36) “sometimes”, 20.55% (n=15) “always” while 29.17% (n=21) “never” provided this service. The practice of rehabilitation including speech reading was “never” provided by 54.79% (n=40) of respondents employed in the private sector. Responses of “sometimes” and “always” were obtained from 39.73% (n=29) and

5.48% (n=4) private practitioners respectively. Reasons provided for non-practice by private practitioners included “no caseload” (44.44%, n=16), “insufficient training” (22.22%, n=8), “other” (25.00%, n=9) and “time constraints” (8.33%, n=3). Respondents from public sector provided reasons of “no caseload” (25.00%, n=5), “insufficient training” (30.00%, n=6) and “time constraints”.

Results suggest that clients seen by public sector clinicians are being trained in the use of speech reading, with fewer private practitioners practicing this service. The majority of private sector respondents indicated never conducting speech reading. This is concerning as the results of the audit of hearing aid fitting clearly indicated that most audiologists were fitting hearing aids, with most fitting the adult population predominately. Inadequate training appears to impact the use of speech reading in therapy. However, time constraints and inadequate training appear to be influencing the lack of service delivery in this area. With regards to training, this result could imply that students do not obtain sufficient experience with hard of hearing and deaf learners or adults in their clinical programme or that less time is placed on rehabilitation during clinical training.

The importance of speech reading is well reported in literature pertaining to rehabilitation. As highlighted by Boothroyd (1998:p7), speech reading is an additional source of input that is used for perceiving speech in face-to face situations. In a primarily auditory situation, speech reading functions as a valuable supplement to hearing and for those who have very little audition, speech reading becomes the only source of sensory evidence about speech. Thus speech reading is an essential skill that aids in communication. It is for this reason that all hearing aid users or hard of hearing/deaf persons, should be trained (depending on the clients communicative need) or be counseled regarding use of this additional avenue of information.

Language Therapy with a Hearing Impaired Child

Results: This question was answered by 72 public sector and 73 private sector respondents.The majority of respondents employed in the public sector performed language therapy with hearing impaired children (85%). The 15 % of respondents not providing this service provided reasons of “no caseload”, “time constraints” and “other”. On the contrary, 62% of private practitioners revealed “never” providing this service, 25% did on occasion, and a minimal 14% routinely worked in this area. The primary reasons for non-practice provided were “no caseload” (39.53%, n=5), “time constraints” (13.95%, n=6), “insufficient training” (11.62%, n=5) and “other” (32.55%, n=14). (Refer to Figure 7(b), and Tables 18 (a) and 18(b)).

Inadequate training and time constraints appear to be impacting on the provision of language therapy to hearing impaired children by private practitioners, however “other” factors appear to be influencing service provision. This area should therefore be further investigated. As noted previously, most private practitioners indicated fitting amplification to primarily the adult population (refer to the discussion of Hearing Aid Selection and Fitting) and this could possibly contribute to the lack of service delivery revealed in this area. The importance of language therapy with hearing impaired children has been raised in literature. Literature highlights that the pervasive impact of hearing loss on language acquisition requires the use of a multi-dimensional intervention approach as the advancement in amplification alone is insufficient to facilitate language acquisition and development (Boothroyd, 2000).

According to Osberger (1986) cited in Moeller, Osberger and Morford (1987:p164) many hearing impaired children have major academic difficulties in higher academic years, that appear to be related to the semantic and syntactic difficulties) and the areas of greatest difficulty are reasoning skills and vocabulary (Osberger and Morford,1987). Boothryod (2000)

also noted that only 1/3rd of the content of speech is visible to the reader. Therefore the individual would need to use linguistic knowledge and context to fill in the missing information. This literature highlights the importance of language acquisition, in order to develop competence on speech reading through as a by product of language development, general education and experience with face to face communication.

The above discussion emphasizes the need and importance for the provision of this service to children with hearing loss, and every effort should be made to ensure that future clinicians are adequately prepared in the provision of language therapy using a holistic multidimensional approach.

Manual Communication

Results: This question was answered by 72 public sector and 73 private sector respondents. Rehabilitation in manual communication was not provided by the majority of respondents. 86% (n=62) of private practitioners “never” use rehabilitation programmes using manual communication, with occasional use by 13% (n=9) of respondents. The primary reasons for non-practice were a “lack of caseload” (37.93%, n=22), insufficient training (43.10%, n=25) and “other” (15.51%, n=9). Respondents employed in the public sector revealed a similar trend in results, with 52% (n=38) of “never” responses, 38% (n=28) “sometimes” and 10% (n=7) providing routine rehabilitation with manual communication. The reasons for non-practice also included “insufficient training” (66.66%, n=24), “no caseload” (16.66%, n=6) and “other” (16.66%, n= 6).

Inadequate training appears to significantly impact on the use of manual communication in therapy. This result could imply that students do not obtain sufficient experience with hard of hearing and deaf learners or adults in their clinical programme.

The above results are probably reflective of the fact that the bilingual-bicultural approach has been adopted as the primary communication mode used in schools for the hearing impaired, thus most Deaf and hard of hearing children would develop manual communication skills at school, and may not require additional intervention. The topic of mainstreaming hearing impaired children continues to be debated, however the lack of infrastructure and support systems (such as interpreters) proving as imperative obstacles to such programmes (Drew, 2002). Mainstreaming would possibly imply that Deaf and hard of hearing children will require additional intervention using both manual and oral communication. Also, with the introduction of early identification and intervention it is likely that as children are fitted with amplification at an earlier age, the communication options selected by parents and the schooling system may change. However the importance of the acquisition of both the oral and manual modes of communication is now being increasing acknowledge as a beneficial to the child in terms of socialization. Literature supports a team involvement of an audiologists, early interventionists and deaf educationalists in the intervention programme selected for the child (Martin, 1994).

3.2.7 <u>Subsection G:</u> SERVICE DELIVERY ISSUES

The role of audiologists across the numerous workplace settings are defined by requirements and practices of a specific workplace setting. Although professional theoretical and clinical knowledge, skill and areas of expertise are variables that would impact on the quality of service provision, factors related to logistics, finance, professional autonomy, support form associated professionals, and availably of resources are equally instrumental to effective, efficient quality service provision (Hosford-Dunn, Roeser and Valente, 2000).

Literature concerning service delivery in audiology and speech-language pathology within public health sectors highlighted the following factors that appear to be impacting on

audiology service delivery in (Lubinski and Fratali, 2001, Nzarina, 2002) :a) *Delayed referrals from other professionals , b) Lack of knowledge by other professionals , c) Lack of testing facilities to cope with demand, d) Lack of staff, e) Lack of upward mobility for audiologists in the workplace and f) Lack of consistency of funding at a regional & provincial level.* Literature regarding private practice management and professional issues in audiology noted key factors that influence service delivery (Lubinski and Fratali, 2001, ASHA, 2004) included *a) Delayed referrals from other professionals, b) Limitations of autonomous decision making with regard to test protocols, c) Limited medical aid coverage for audiological treatment and management, d) Restrictions with regard to advertising of services, and e)Limited availability of communication devices needed by patients*.

In Section B sub-section H, respondents employed in each sector were asked to indicate whether or not these factors were applicable to their work context. The aim of this question was to merely determine if these factors were evident in each sector and to highlight factors that appear to be most frequently encountered by respondents. In order to understand the implications and impact of these factors on service delivery in the various work settings, and to propose a strategy to address these factors, a more in depth study needs to be conducted. Such a study would obtain a more a specific description of service delivery issues and how these factors appear to be impacting on audiology service provision in the workplace (viz. specialized schools, state hospital, community clinics etc).

Thus, the results to be presented merely serve to draw attention to factors influencing audiological service delivery in order to inform and direct future research endeavors in this area. It is beyond the scope of this report to present an in depth discussion regarding each issue. Further, the results of this question do support, and shed light on the audit findings and the reasons provided for non-practice of services per sector.

Service Delivery Issues Encountered in the Public Sector

Results: The results obtained are displayed in Table 19(a) below. Over 70% of respondents employed in public sector indicated that the following issues were problematic in their workplace: *delayed referrals from other professionals, the lack of knowledge by other professionals, the lack of testing facilities to cope with demand and the lack of upward mobility for audiologists in the workplace.* 92% of respondents were in agreement that there was a lack of consistency of funding at a regional & provincial level and 68% of respondents identified an inadequate number staff as a problem in their work setting.

Table 29(a): Service Delivery Issues Occurring in the Public Sector

SERVICE DELIVERY ISSUES: PUBLIC SECTOR	Response				Total (n=)
	No		Yes		
	Count	Percent	Count	Percent	
Delayed referrals from other professionals	16	22.53%	**55**	**77.46%**	***71***
Lack of knowledge by other professionals	15	21.12%	**56**	**78.87%**	***71***
Lack of testing facilities to cope with demand	21	29.57%	**50**	**70.42%**	***71***
Lack of staff	22	31.42%	**48**	**68.57%**	***70***
Lack of upward mobility for audiologists in the workplace	19	27.14%	**51**	**72.85%**	***70***
Lack of consistency of funding at a regional & provincial level	5	7.04%	**66**	**92.95%**	***71***

The highly reported occurrence of the above mentioned service delivery issues emphasize the urgent need for the promotion of audiology, its relevance and clinical importance to the health profession. It is common knowledge that the service delivery issues reported by public sector respondents are largely a result of the restricted budget common to public health system. However the issue of the “lack of knowledge by other professionals” could be a contributing factor to the limited budget allocated to audiology services as the need for, and

clinical use and expansion of audiology services (especially in light of the advancements in the field of electrophysiology) is very likely, unknown to persons controlling decisions regarding budget allocation. It is therefore important that clinicians put forward motivations for budgets that are supported by clinical data, and evidence of the contribution of test procedures towards increased patient care.

The issue of "delayed referrals" could be the result of the "lack of knowledge by other professionals" in combination with issues such as caseloads and administration. As mentioned in the former discussions regarding the results of the audit of audiological services delivery, limited knowledge and acknowledgement of audiology services could possibly be impacting on the limited range of audiology services provided. This is supported by the results reflecting the high recognition of the following issues: *"lack of testing facilities to cope with demand" (70.42%), "the lack of upward mobility for audiologists in the workplace" (72.85%) and the "lack of consistency of funding at a regional & provincial level" (92.95%).*

These issues appear to be recognized by the Department of Health however it is the researcher's opinion that audiologists should also share the responsibility of motivating for change and recognition of services. According to Kraus (1998) significant changes have taken place in the planning of district health care in SA, yet improvement in service delivery at grass roots has been disappointing. A recent survey commissioned by the Health Systems Trust suggests that improvement in distinct health care is also being hindered by inappropriate human resource planning and slow organizational transformation of hospital services. Current staffing was reportedly roughly half to a third of new recommended levels.

In the review of the period 1999-2004, the Department of Health had recognized the urgent need to uplift service delivery in the public health sector. Priorities for the period 2004-2009

included the promotion of communicable diseases and non-communicable illnesses, human resource planning and development, revising budgets, reorganization of support services and revitalization of public hospitals. The revitalization of the public health system was reported to include the construction of new hospitals, improvement of infrastructure, equipment, management and the 'modernization of tertiary services' would aim to review placements and services offered as well as to strengthen the referral system (Department of Health Strategic priorities for the National Health System, 2004-2009).

In light of these priorities, it is imperative that audiologists actively assert the needs of the departments, draw attention to the importance of audiology services and the range of service delivery areas that could be implemented. To this end the audiologist in SA should collaborate to develop service delivery protocols for key areas of service delivery (please refer to the previous discussion on the audit of service delivery), to develop proposals for motivations regarding equipment and staffing and importantly, to form a clear vision of and strategy for audiology service delivery in the public health sector.

Service Delivery Issues encountered in the Private Sector

Results: The results obtained are displayed in Table 19(b) below. Over 80% of private sector respondents indicated that the following issues were problematic in their workplace: *lack of knowledge by other professionals*, *limited medical aid coverage for audiological treatment and management and limited availability of communication devices needed by patients*. 76.11% of respondents agreed that *restrictions with regard to advertising of services* was a hindrance to their practice and 67.74% encountered *delayed referrals from other professionals* as was also indicated by majority of public sector respondents. The majority of respondents (62.68%) did not view *limitations of autonomous decision making with regard to test protocols* as an issue impacting on service delivery. (Refer to Table19 (b)).

Table 19 (b): Service Delivery Issues Occurring in the Private Sector

SERVICE DELIVERY ISSUES: PRIVATE SECTOR	Response				Total (n=)
	No		Yes		
	Count	Percent	Count	Percent	
Delayed referrals from other professionals	22	32.35%	**46**	**67.64%**	***68***
Limitations of autonomous decision making with regard to test protocols	**42**	**62.68%**	25	37.31%	***67***
Lack of knowledge by other professionals	11	16.17%	**57**	**83.82%**	***68***
Limited medical aid coverage for audiological treatment and management	7	10.44%	**60**	**89.55%**	***67***
Restrictions with regard to advertising of services	16	23.88%	**51**	**76.11%**	***67***
Limited availability of communication devices needed by patients	14	20.00%	**56**	**80.00%**	***70***

The lack of knowledge by and delayed referrals from other professionals is a serious issue that most certainly impacts on working relations and patient care. Limited knowledge, understanding and acknowledgement of the role of audiologists, as well as the clinical relevance of the variety of audiology services and procedures by allied health professionals seems to continually be an issue expressed by audiologists (Wolf, 2004). This issue should be given urgent attention by academia and through professional bodies. A possible avenue that can be taken would involve changing the tertiary training model to facilitate much closer working relations between and among health professionals, especially medical students, who will be the future referral source.

To the researcher's knowledge and through informal discussions with medical practitioners, the complexity and advancements in the field of diagnostic audiology is not known to most medical practitioners, who by virtue of their training are exposed to the basic audiological test battery and therefore assume this to be the scope of audiology. This is a serious pitfall in training that clearly has impacted negatively in the workplace. Professional bodies should

also consider developing CPD seminars and professional aimed at professionals such as nurses, ENTs, neonatologists, neurologists, internal medicine, general medical practitioners, paediatricians and other related health care specialists.

Related to marketing, the restrictions regarding advertising of audiology services appear to be an area that requires review. Advertising and marketing of audiology services is not only detrimental to the progression of the profession, but as autonomous professionals who have the most knowledge regarding hearing, the psychology of the patient and diagnosis and treatment of hearing loss, it does seem fitting that one should advertise ethically the areas of audiology practiced. Also, it is in the public best interest that the most appropriate and qualified professional be accessible. The restrictions on advertising currently do lessen the accessibility of audiologists especially in view of the advertising used by the hearing aid industry and other professionals who have gained the license to practice an area of audiology, but have limited knowledge regarding hearing assessment, client counselling and rehabilitation. Whilst professional ethics should always be maintained, the general public has the right to seek the most qualified person for particular condition. It is therefore the researcher's opinion that extensive restrictions on advertising limits marketing of our expertise and profession, and as limited public and professional knowledge has been identified as an issue impacting negatively on the practice of audiology, the rules governing advertising and marketing of audiology services should be reconsidered.

Another area of restriction appears to be concerned with the limited medical aid coverage for audiological treatment and management as indicated by 89.55% of respondents. The structure of the payment process has changed drastically in the recent years with medical aids as public health systems moving towards a model of Managed Heath Care. Managed Health Care in its broadest sense aims "to incorporate the concepts and techniques

associated with optimal effectiveness and efficiency that is offering care in the most appropriate setting of health care continuum, using only those interventions and treatments necessary to achieve the best results (outcomes), in the most efficient manner (shortest period of time)" (Cornett, 2001: pg 232). Accountability is now the key word in the health market place, as managed care methods move beyond cost-control mechanisms to demand for proof of clinical effectiveness. The Managed Health Care approach requires clinicians to motivate for the service rendered and to show evidence of necessity and a measure of benefit.

To address this change, SA audiologists and professional bodies should develop general documentation explaining and motivating for procedures and rehabilitative measures that could be supplemented as required by the consulting audiologist. Again marketing of services and advancement in the profession will possibly aid in this process. Further managed health care calls for evidence based practice and quality control through outcome measures. In health care, factors that need to be measured include health status of individuals, individuals change in behavior, knowledge about health care matters, satisfaction care after we have applied treatments and interventions and to demonstrate the long-term effectiveness of rehabilitation or the durability of outcomes. In audiology, outcome measures could focus on the benefit of diagnostic procedures in relation to quicker, more accurate treatment, community reintegration, quality of life, and consumer satisfaction with care i.e. counselling, hearing aid fitting and benefit, the benefit of the rehabilitation programme etc.

Such outcome measures would also be useful towards the 'evidence based clinical practice' required. According to Cornett (2001:pg233), evidence clinical practice refers to the "application of research data (scientific evidence) to clinical decision making. Clinicians who base their practice on the evidence use a systematic approach to selecting assessment and

treatment procedures". Thus SA audiologists also need to develop a research base aimed at creating norms, protocols and measures applicable to the SA clientele and each work context as well as standard methods of capturing information that could generate clinical evidence.

GENERAL DISCUSSION

The following general discussion will highlight pertinent areas and results regarding demographics obtained and the audit of service delivery.

A] Demographics

Education and Employment:

The majority of respondents (127) were graduates from the University of Pretoria, followed by 76 graduates from the University of the Witwatersrand. Results indicated a close distribution of graduates from the University of Cape Town and University of Kwazulu Natal i.e. 29 and 28 graduates respectively. The remaining respondents obtained undergraduate degrees from the University of Stellenbosch (n=14) and University of Limpopo (Medunsa) (n=2), with 6 graduates from other universities abroad.

Audiologists were primarily working privately, i.e. 50% (n=27) in autonomous private practice and a further 11.12% (n=6) in private practice owned/co-owned by an ENT specialist, with 18.52% (n=10) at state hospitals and 9.26% (n=5) employed in hearing aid companies. Of the 111 Speech- Language Therapists, 49.95% (n=51) were working in autonomous private practice, 26.13% (n=29) at specialized schools and 14.41% (n=16) at state hospitals. Employment of Speech and Hearing Therapists was predominately at state hospitals (32.10%, n=26) and in autonomous private practice (30.86%, n=25). 17.28% (n=14) were employed at specialized schools.

Professional Registration and Practice

Respondents were asked to select the professional registration they held with the HPCSA i.e. Speech Therapist, Audiologist, Speech and Hearing Therapist, and to indicate the professional capacity they were practicing in i.e. Speech and Hearing Therapist, Speech Therapist or Audiologist. Upon comparing professional registration, with professional practice, a discrepancy was evident largely between the number of respondents that were registered as Speech Language and Hearing Therapists and their current professional practice. Of the 185 respondents who maintain their registration as Speech and Hearing Therapists, only 85 indicated practicing in this capacity. Conversely, results indicated an increase from 29 registered Speech-Language Therapists to 114 practicing Speech-Language Therapists. Similarly, although 20 respondents were registered as Audiologists, 55 respondents were practicing in this capacity. The study results thus highlight that the majority of the 'dual' qualified respondents are practicing as predominately Speech Therapist and to a lesser extent, Audiologists or as Speech and Hearing Therapists.

The above results question the need for the continued training of Speech and Hearing Therapists currently maintained in some of the tertiary training institutes. If ultimately, Speech and Hearing Therapists practice in either Audiology or Speech Pathology, is it not more practical and beneficial that future gradates train for each profession separately? Although a theoretical overlap exits between the professions, would training in separately each profession not have the benefit of more focused clinical and theoretical training?

Since 1998, universities have responded to the expansion in the professions of Speech Pathology and Audiology by changing current training models that now offer a 'split' programme, qualify graduates as Audiologist or Speech Pathologist. A review of the competency profile of 'split' graduates complied by the HPCSA clearly indicates the expected

higher level of clinical competence and knowledge in advanced areas of practice such as electrophysiology. One of the perceived advantages of qualifying as Speech and Hearing Therapists was the possible flexibility of practicing within both professions. However, with the rapid advancements occurring in the field of Audiology especially, the transition back into Audiology and working as a competent Audiologist is becoming increasingly challenging. It is therefore imperative that continued professional development activities are monitored and formally investigated to ensure transition between each profession.

The continued training of all three streams i.e. Speech-Language Therapist only, Audiologist only and Speech and Hearing Therapists possibly raise dilemmas regarding the difference in practice, current registration and professional standing between the Audiologist, Speech Pathologist vs. the Speech and Hearing Therapists, employment as well as public and professional understanding of the differences among these professional qualifications.

With regards to registration, rightfully, since three different professional qualifications are offered, separate registration for each of these professionals should be in effect. However currently, all qualifications are registered on a single register. For example at the University of the Witwatersrand, a person qualifying with the Degree in B.A Speech and Hearing Therapy is registered as a Speech Therapist and Audiologist (HPSCA). The current register is confusing as it implies that the Speech and Hearing Therapist is the equivalent of a Speech Therapist and Audiologists. This is untrue by virtue of the difference in training for each qualification. This matter of registration should be dealt with urgently to avoid further confusion.

The researcher proposes the development of three registers viz. Speech Therapist/ Pathologist, Audiologist and Speech and Hearing Therapist. Should it be decided that the

training of Speech and Hearing Therapists no longer be appropriate, previously qualified Speech and Hearing Therapists should be requested to choose a profession of practice i.e. Speech Therapy or Audiology (especially as this study results indicated that most Speech and Hearing Therapist do practice in one profession only), and should one wish to maintain registration on both registers, then evidence of clinical and theoretical competence in both professions must be demonstrated. This should be achievable through CPD activities that are closely monitored and evaluated through professional bodies such as the HPCSA and tertiary institutions and continued evidence of practice. The Audiology profession should also contemplate what period of non-practice in the field is acceptable for one to re-enter the profession and how reinstatement should be facilitated. For example, should a short examinable course in audiology be introduced together with a practical component/professional supervision before one can be registered an Audiologist?

In terms of employment in public hospitals, historically all graduates qualified as Speech and Hearing Therapist, and were required to function in this 'dual' capacity. With the remodeling and modernization of the tertiary public health system, hospitals are said to be equipped with advanced diagnostic and habilitation equipment. It is therefore important that the Department of Health and associated professionals be informed about the transformation in training of Speech Pathologists and Audiologists, the reasons for this change and that post creation in accordance with current training output be implemented. Currently, the Department of Health's post structure is geared towards 'dual' qualifications (56%), with 17% allocated for Audiology and 27% Speech Pathology (Dr Mahlathi, Deputy Director General, Human Resources, Department of Health). It is imperative that post structure for Audiology and Speech Pathology be reconsidered with the increase in the number of 'split' graduates.

B] Audit of Service Delivery

Basic Test Battery, Diagnostic Audiology, Paediatric Audiology, Amplification, Hearing Prevention and Conservation, Habilitation and Rehabilitation Services

A dire need for the repositioning of audiology services was evident from, and emphasized by the results obtained from the audit of service delivery. The audit revealed that service provision by audiologists practicing in both the private and public sector were analogous, with majority of audiologists conducting the basic test battery. Areas lacking in service delivery included: Advanced Diagnostic Audiology, Paediatric Assessment and Amplification, Hearing Prevention and Conservation and Rehabilitation for adults and children. Results indicated that clinical training in CM is completely absent in the graduate training programmes in SA with a limited number of audiologists obtaining training possibly from medical persons such as ENT specialists. In countries such as the US where CM is within the scope of Audiology practice, debate still exists regarding the adequacy of training, and the appropriateness of audiologists to perform CM.

The most significant limitation in the delivery of audiology services was reportedly the “lack of equipment” by respondents practicing in both the public and private sectors. Results alluded to the fact the some workplaces are lacking basic diagnostic and screening equipment. It was beyond the scope of this study to investigate the reasons for the lack of equipment. It is highly likely that financial limitation is a large contributing factor to the non-practice of services however variables such as caseloads, training etc. could influence test procedures used. With the increased sophistication in testing tools and advancement in the scope of practice, many respondents also reflected “insufficient training” as a reason for limited service delivery in areas such as diagnostic electrophysiological test procedures, hearing aid verification using real ear measures and habilitation such as cochlear implant mapping. This

emphasizes the definite need for continued professional development (CPD) activities in the field.

Further, concerning limitations and pitfalls in areas of Advanced Diagnostic Audiology and Paediatric Audiology deserve immediate attention. Literature regarding the clinical significance of advanced object test measures provides a strong motivation for increased efforts towards the acquisition of electrophysiology equipment. Critically, in the area of Paediatric Audiology, objective tests have become imperative measures. The challenge to infant testing and remediation is that subjective testing is unattainable at this age, and with younger children and persons with multi-disabilities, inadequate or unreliable results may be obtained (Mason, 2004). Thus, the assessment of audiological functioning for infants and young or difficult to test children is largely dependant on objective tests namely: ABR, ASSR, OAEs and ECochG, with ABR testing reportedly the most frequently used procedure, and reportedly the most popular AEP for hearing screening, followed by OAEs (Stach, 2002). More so, the current practice of paediatric audiology has emphasized the principle that the best outcome for a child with hearing loss can be achieved when his or her hearing status is established reliably and intervention is provided as early as possible (Cone-Wesson, 2005, Yoshinaga-Itano, 2002). The efficacy of the early intervention programmes hinges on the ability to predict hearing in newborns accurately. The use of AEPs namely ABR and ASSR as predictors of auditory thresholds can thus assist in achieving this goal (Mason, 2004; Sininger and Cone-Wesson, 2002).

With the dependence of electrophysiological measures for paediatric assessments as well as significant diagnostic information in adult related pathologies, SA audiologists need to collectively discuss feasible options of acquiring such equipment. The development of well equipped centers would possibly be an effective means of servicing patients requiring

specialized tests and would also serve the benefit of developing SA specific normative data, and generate data bases capturing the incidence and prevalence of hearing loss, pathologies etc.

The expanding scope of audiology practice as a result of technological advancements has been acknowledged by SA audiologists and universities. The emergence of the “specialist” Audiologist has changed the face of Audiology in our country. The split programme does allow for more time and focus in training areas such as hearing aid technology and electrophysiology as well as rehabilitation. It therefore seems likely that the scope of practice of Audiology in South Africa will need to be redefined, as up to this point Audiology has not had a clear professional identity in the county. Overlap between the Scope of Practice of Audiologist and other “associate professionals” such as Hearing aid acousticians and ENT specialists needs to be clearly defined in terms of current practice and proposed training. Key areas that require collaboration by all Audiologists include issues related to test protocols, developing resources, equipping audiology practices and government departments and urgently, developing outcomes measures for audiology practice in each work setting. Such measures are essential to the Managed Health Care approach now adopted in SA.

The current transition in the SA context and health system brings with it the challenge of providing and expanding audiology services within this dynamic continuum. However, Audiology with its diversified areas of services can be implemented at grass roots level (i.e. hearing screening and public education programmes) with advanced diagnostic and rehabilitation services at a tertiary level. Therefore audiologists should try to be more proactive towards obtaining an improved recognition of services through the promotion of services. Motivation for equipment should be supported by clinical evidence and well defined outcome measures for quality service provision.

Service Delivery Issues Occurring in the Public and Private Sectors

All public sector issues investigated were viewed as problematic by public sector respondents i.e. *delayed referrals from other professionals, the lack of knowledge by other professionals, the lack of testing facilities to cope with demand, the lack of upward mobility for audiologists in the workplace, the lack of staff and the lack of consistency of funding at a regional & provincial level.* The modernization and revitalization of the public health system has reportedly been set as a priority by the Department of Health, to be addressed in the period 2005-2009 (Kraus, 1998). In light of this, it is imperative that audiologists motivate for the needs of the department, promote the need and clinical importance of audiology services for the population seen and the range of service delivery areas that could be implemented.

Over 80% of private sector respondents indicated that the following issues were problematic in their workplace: *lack of knowledge by other professionals*, *limited medical aid coverage for audiological treatment and management and limited availability of communication devices needed by patients*. 76.11% of respondents agreed that *restrictions with regard to advertising of services* was a hindrance to their practice and 67.74% encountered *delayed referrals from other professionals* as was also indicated by the majority of public sector respondents.

The urgent need to educate professionals and the public on audiology services and the clinical relevance of audiology practice has been highlighted by all respondents. Professional education may result in the acknowledgment of the importance of audiology services and positively impact on staffing, budget allocation and timely referrals. Results indicated that restrictions regarding advertising appear to be an area that needs to be reviewed urgently. Public accessibility to audiology services should also be considered when addressing these restrictions.

With regards to restricted medical aid payouts the audiology profession in SA must recognize the move towards the Managed Health Care Approach. To this end professional bodies need to develop general documentation motivating for all audiology services that could be made reference to by the consulting audiologist , and supplemented as required. This approach also requires the development of standard outcomes measures that would demonstrate efficacy of practice and the level of client satisfaction.

The researcher is of the opinion that contextual differences significantly contribute to protocols used and comparison to first world practices may seem inappropriate. However, a developing context should not imply stagnating, outdated practices and service delivery. Thus feasible measures towards improving service delivery by audiologist working in both the public and private sectors need to be explored. As noted by Garner, Kale, Dickson, Dans, & Salinas (1998:534) "When healthcare interventions are being implemented the whole healthcare system should be considered and activities for which evidence of impact is weak should be discarded and new evidence based activities should be added when appropriate". Our developing country is challenged by limited resources, and therefore it is particularly important to invest in health care that works.

Hindrances are occurring at a time when the need for audiology and speech pathology services is increasing steadily (Henri & Hallowell, 2004: p337). According to Henri and Hallowell (2004:p337), in order to strategically confront threats and obstacles to audiology service delivery, audiologists should have a "clear understanding of what the barriers to access are and a sound rationale for our services". The study results revealed that the focus on cost containment and reduction across all areas of health service delivery has resulted in a profound impact on access and provision of quality audiology services. A more in depth

investigation regarding areas of limited service delivery should be conducted, as workplace issues and need for services differ in each work setting.

With the current restructuring of the health system and the refocus on 'holistic' health care, audiologists now have the opportunity to re-establish the position of audiology services within the health system. It is imperative that strategies and infrastructure supporting audiological service delivery be developed and implemented without delay. The researcher proposes the following actions in responses to the results obtained in this study:

Recommendations

1. A professional forum including audiologist, associated professionals, tertiary training institutes and the Department of Health must be called for to address the vision of Audiology in SA, standards of audiology service delivery, test protocols and the provision of rehabilitation.

2. Development of Task Groups per area of audiology that serve to:
   - identifying areas of research
   - collate information and statistics that are currently available
   - assess the need for the service
   - develop minimal service guidelines (according to the workplace setting and case load/client needs)
   - develop outcome measures

3. Professional bodies and audiologists should meet with the Department of Health to address equipment shortages and a feasible way of moving audiology services forward. This should be supported with information on case load, need for service, a review of adequacy of the current referral system and pros and cons of this system.

4. Begin discussions regarding a feasible methods of purchasing equipment for audiologists in private practice and a possible partnership between private and public services.

5. The development of audiology centers offering specialized audiology services such as electrophysiology tests, paediatric diagnosis and hearing aid fitting, rehabilitation programmes and parent support.

6. A significant difference between the registration of graduates and the capacity of practice, i.e. practicing as an Audiologist only, Speech Therapist only or as a Speech and Hearing Therapist was clearly evident. 'Split' graduates are registered as either a Speech Therapist or Audiologist while Speech and Hearing Therapists registered as both Speech Therapist and Audiologist. The current register is confusing as it implies that Speech and Hearing Therapists are equivalent to Speech Therapists and Audiologists. Further results clearly revealed the majority of Speech and Hearing Therapists are currently practicing solely as Speech Therapists. These issues call for the review of training models and the decision regarding the continued training of 'dual' graduates as well as criteria for remaining registered as a 'dual' therapist. With the advancements in audiology, it is imperative that clinicians who have not practiced in Audiology for a significant period should first undertake a theoretical and clinical course in advancements in Audiology prior to re-entry into the profession to ensure an improved standard of service delivery.

CONCLUSION

Hearing impairments and deafness are serious disabilities that impact on quality of life, communication and socialization. Audiology is a developing profession dedicated to serving people with hearing impairments and is committed to the prevention of hearing loss. The true

complexity and immense value of the profession of Audiology is captured by the description by Gary Jacobsen (2002: p54) who stated: “I believe that we are truly fortunate. We rehabilitate. We are paid to restore the ability to communicate where it has been impaired. We are detectives. We piece together a puzzle that explains why a person is dizzy or why a person is disabled by tinnitus. We are inventors. We go to work to develop and evaluate hypotheses that may ultimately yield new tools or treatment. Finally, in our own way, we are healers. We make to work devices that restore hearing to those without hearing”.

Over the past decade this varied scope of audiology practice has grown as a result of technological advances, a better understanding of the complexity of the sense of hearing and increased sophistication of assessment tools. However, the profession of Audiology in South Africa has stagnated due to various challenges such as limited budget allocations for audiology services and poor knowledge and understanding of the scope of audiology practice by associated professionals and the general public.

Presently, as reflected by the audit results, service provision by audiologists practicing in both the private and public sector were analogous. The majority of audiologists were practicing the basic test battery, with evidence of a slow progression towards the provision of advanced diagnostic procedures. The central limiting factor to the range of audiological tests and rehabilitation provided, by most audiologists across sectors is the cost of equipment. Currently, objective electrophysiological tests, despite their significant clinical implications and value are unattainable in most audiology practices and government hospital departments resulting in the provision of basic audiology services by the majority of audiologists. This is concerning as such objective tests are especially necessary in assessing and diagnosing hearing loss in the paediatric population. Therefore, most audiologists, particularly private practitioners appear to be unable to service this population.

Further, with the inclusion of universal infant hearing screening in SA's health policy, it is likely that the need for early diagnosis and intervention services for paediatric clients would increase. This implies the need for an urgent focus on paediatric testing, amplification and rehabilitation through CPD activities and student training. Results also reflect the urgent need for the development of strategies to address the equipping of audiology practices/departments, improvement of provision of hearing screening services, rehabilitation services and public and professional education.

Since hearing loss is a non-life threatening condition, audiology services appear to be placed at the bottom of the hierarchy of public health services. This is concerning in view of the predicted statistics on the prevalence of hearing loss. The national Census of 2001 indicated that of the approximate 44.8 million people residing in South Africa, 2,3 million were reported as disabled, with hearing impairment being the third highest disability accounting for 313 600 (0,7%) of the disabled population. In addition, the HIV pandemic as well as the state of poverty and poor nutrition has been flagged as critical issues increasing the risk of hearing loss in children. It must be noted that without preventative measures, or left untreated, today's children living with HIV and in poor environmental conditions could possibly become tomorrow's young adult population with a disability such as hearing loss. This in turn will impact on the country's socio-economic structure and health care system (Swanepoel, 2004:p15). Therefore non-life threatening conditions such as communication impairments should receive urgent attention and support from the health sector. In view of these issues it is imperative that the respective professional bodies should begin communications with the Department of Health regarding the limited budgets allocated for audiology services, the employment of audiologists and the implementation of preventive measures through community outreach programmes.

The extreme lack of public and professional knowledge regarding the profession of audiology and the importance of audiology services is a serious issue. The use of advanced audiological procedures in many instances requires the support of allied health professionals such as ENTs, neurologists and paediatricians. Examples of such relationships include the dependence of the implementation of newborn hearing screening programmes on the support of paediatricians, as patients are more likely to comply with their paediatrician's recommendation and ENT referrals for vestibular testing. Most audiologists have identified delayed referrals and a lack of knowledge by professionals as key issues influencing service delivery. Audiologists and the respective professional bodies should place immediate attention on the education of allied health colleagues regarding the advanced scope of audiology services and tests available, as well as the impact of delayed referrals on patient management and prognosis. The responsibility of educating allied professionals and encouraging multidisciplinary treatment approaches also weighs heavily on training institutes. It is the researcher's opinion that it is essential for the Department of Audiology to be situated in the Faculty of Health Sciences or Medical faculty in order for the profession to be recognized by other medical professionals. Change regarding the inclusion of audiology services in patient care and the recognition of the extreme importance of quality of life issues can best be encouraged through a model of training.

Presently, in response to their recognition of the increase scope of audiology practice and need for expertise, universities have implemented changes in student training, now offering a 'split' curriculum, allowing for students to specialize in either Audiology or Speech Pathology, qualifying as either an Audiologist or Speech Pathologist. In addition, results have shown a gross difference between professional registration and current practice. Although the majority of respondents were registered as Speech-Language and Hearing Therapists, most

revealed practicing Speech-Language Pathology only and fewer working in Audiology only, with a minority practicing in a ‘dual’ capacity.

These results and the expanding scope of practice, raises following questions: Is there a continued scope for a Speech and a Hearing Therapists in view of the advancements in each profession and increasing need for expert services? Is a ‘dual’ trained Speech and Hearing Therapist the equivalent of a Speech Pathologist and Audiologists (as is currently understood)? Does a ‘dual’ Speech-Language and Hearing Therapist best meet the needs of our country? How should the differences between an Audiologist and Speech and Hearing therapist be marketed to the general public and professionals?

It is the researcher’s opinion that SA audiologists need to unite in deliberating and envisaging the way forward of the audiology profession in South Africa. As highlighted by White (2002: pg 738) “All professions seek autonomy, strive for respect from the public and search for respect from other professionals. Presently the field of audiology lacks the impetus for some of these needs because of its relative youth as a profession. Yet, this does not mean that these goals are not attainable. It will require a unified effort from all audiologists that is applied to the common good. Actions that are divisive will do little but fragment goals and complicate the process that is needed if we are to succeed”. In order for the profession to progress the following issues must be addressed:

a) Registration of Audiologists, Speech-Language pathologists and Speech-Language and Hearing therapist
b) The name of the degree and the faculty in which the department is situated in
c) The strengthening of professional autonomy, public and professional education
d) Current rules governing advertising

e) Unity regarding standards of practice and protocols

f) Service delivery issues such as equipping practices and hospitals, promoting audiology services and the development of clinical evidence and standard outcomes measures as necessitated by the managed health care approach adopted in SA

LIMITATIONS OF THE STUDY

1. The completion of the questionnaire relies on memory and perception, which may affect the reliability of the results. In addition, the possible unrepresentative return rate may bias results, which will limit external validity and accurate comparisons.

2. Service delivery results may be biased by individual responses, which may not accurately reflect the primary reasons for lack of service provision in Audiology departments and group practices.

3. The quantitative nature of this study resulted in the identification of reasons for non practice of audiology services, service delivery issues and areas of concern, but did not allow respondents to elaborate on their answers. However, this study was considered a pilot study, and therefore a qualitative framework could be used to investigate in more detail, the areas highlighted in this study.

IMPLICATIONS OF THE STUDY

1. The study has provided a comprehensive snap shot into audiology service delivery in SA, and issues impacting on service delivery. It has also revealed a huge shortage of equipment and the need for further training in some areas of audiology. Thus the profession of audiology in SA, through professional bodies should actively address these

shortfalls, and make every attempt to further investigate audiology service delivery in order for the profession of audiology to move forward in SA.

2. Results suggest that the SA Audiologists need to reach some consensus on the future of the profession and a feasible way of improving service delivery in both the public and private sector. This could be addressed through a forum dedicated to the future of audiology service delivery in our country.

3. The need for the development of outcome measures and evidence based practice initiatives has become evident. Audiologists need to establish these areas soon, and should consult with the appropriate personnel during this process e.g. health policy makers, department of health services, hearing aid companies, tertiary training institutions etc. If possible consultation with international audiologists working in countries that have developed such measures would be beneficial to understanding the process of development of this practice, identify possible pitfalls and areas of consideration. It is important and essential for SA audiologist to self-develop policies and measures tailored to meet the SA context and the future/growth of the audiology profession in our country.

4. **Implications for future Research**

4.1 The current study can serve a pilot study or phase one of a larger study into Audiology service provision, whereby a more in-depth investigation into areas/issues of concern highlighted in this study could be investigated. Also, both qualitative (ethnographic) and quantitative paradigms could be used to obtain a richer, more holistic understanding of audiology service delivery in SA. (Also refer to recommendations).

4.2 The audit results could direct individual areas of practice that should urgently be investigated and addressed such as development of screening protocols and outreach

programmes, adequacy and efficacy of the referral system used for advanced diagnostic audiology testing and provision of rehabilitation. (Refer to recommendations).

4.3 This study gathered valuable and useful data that can be analyzed further and will be reported in the near future. Due the nature and size of requirements of this report, the key information was selected and presented viz. Results of the audit of Audiology service delivery, reasons for non-practice and service delivery issues.

Concluding Comments:

Audiology is by no means a dying profession, but rather a profession that is expanding rapidly, demanding specialized training and expertise. Audiology serves to improve quality of life. This fact must be recognized and valued by associated professionals, the public and the Department of Health. SA audiologist must therefore make very attempt to promote the profession, to improve their clinical expertise and knowledge, and to embrace the expanding scope of audiology practice.