AUDIOLOGY AND MDR TB

KING DINUZULU HOSPITAL COMPLEX

Presented by:
Verusha Rugbeer

Developed by:
Verusha Rugbeer and Nishita Doolabh

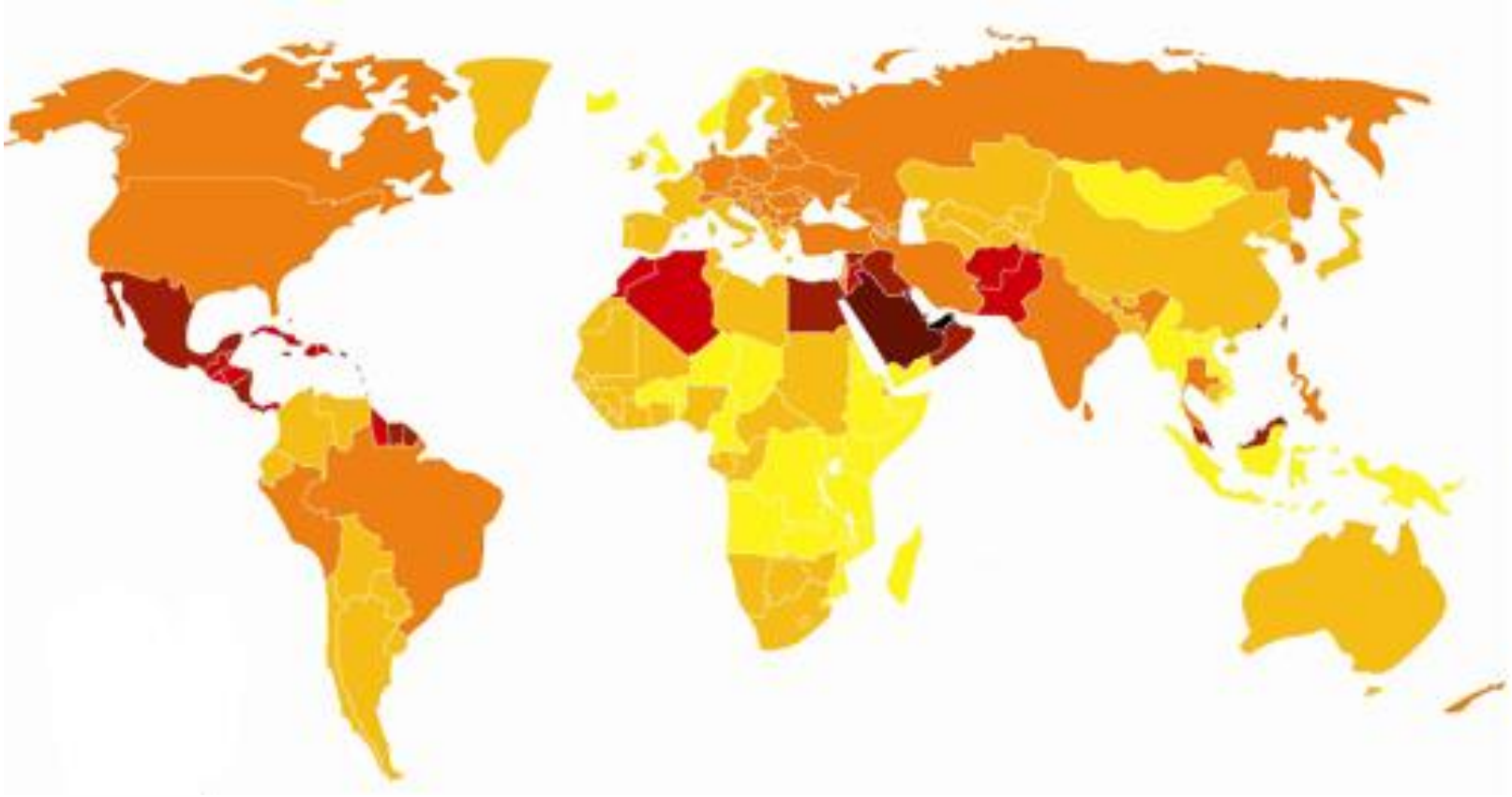
What is Audiology

- The science of hearing
- An audiologist is a health care professional that is dedicated to hearing and hearing related disorders.
- An audiologist is involved in the:
  - detection
  - identification
  - diagnosis
  - management
  - rehabilitation

…of the auditory and vestibular system

A Global Phenomenon

According to a GBD Study, hearing impairment is the third leading cause of disability



Hearing Loss & MDR-TB in SA

- In South Africa the incidence of hearing impairment is further exacerbated by infectious diseases and the use of ototoxic medications
- Research has firmly established that aminoglycosides cause permanent hearing loss in humans (Cianfrone, Pentagelo, & Cianfrone, 2011).

Effects of Aminoglycosides

Integral part of MDR TB treatment, and has well documented adverse reactions:

Table 1: Classes of TB drugs

Classes	Anti-TB drugs	Comments
1st line drugs	Rifampicin (RIF)	Core of initial TB treatment None are ototoxic
	Isoniazid (INH)	
	Pyrazinamide (PZA)	
	Ethambutol (EMB)	
2nd line drugs	Streptomycin (SM)	Aminoglycoside used in retreatment TB Ototoxic & nephrotoxic
	Kanamycin/Amikacin	Aminoglycoside used in MDR-TB Ototoxic & nephrotoxic
	Capreomycin*	Polypeptide drug used in MDR-TB Ototoxic & nephrotoxic
	p-Aminosalicylic acid	No ototoxic potential documented
	Levofloxacin	
	Moxifloxacin	
	Gatifloxacin	
	Cycloserine	
	Ethionamide	

OTOTOXICITY

- Ear poisoning
- Damages a person's inner ear or auditory nerve
- This damage can be permanent.
- Symptoms of ear damage include hearing loss, unsteadiness, feeling of ear fullness, dizziness, unable to tolerate head movement and light-headedness.

Ototoxicity – Death of Hair Cells

oto = "ear" and toxic = "poison"

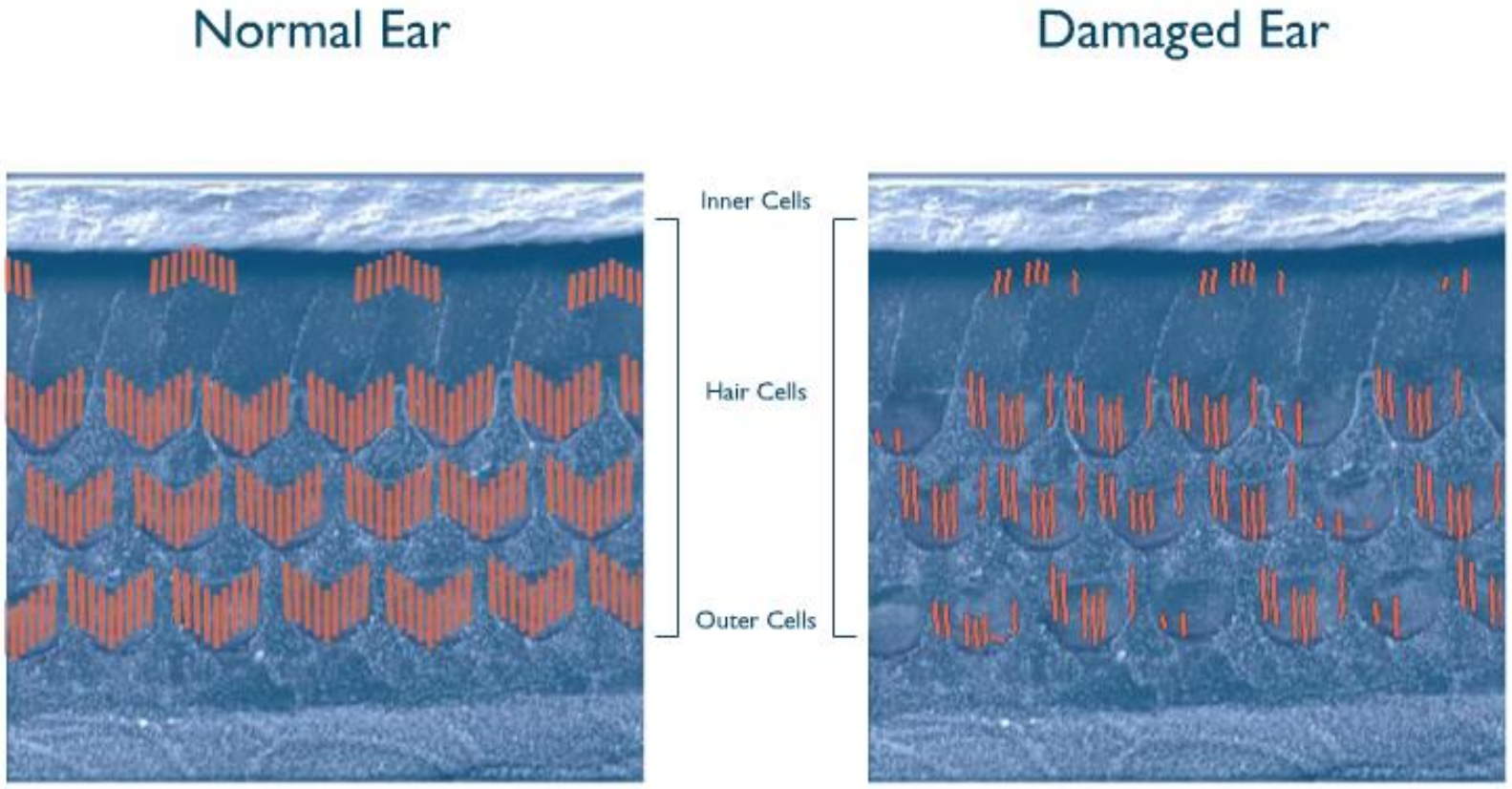
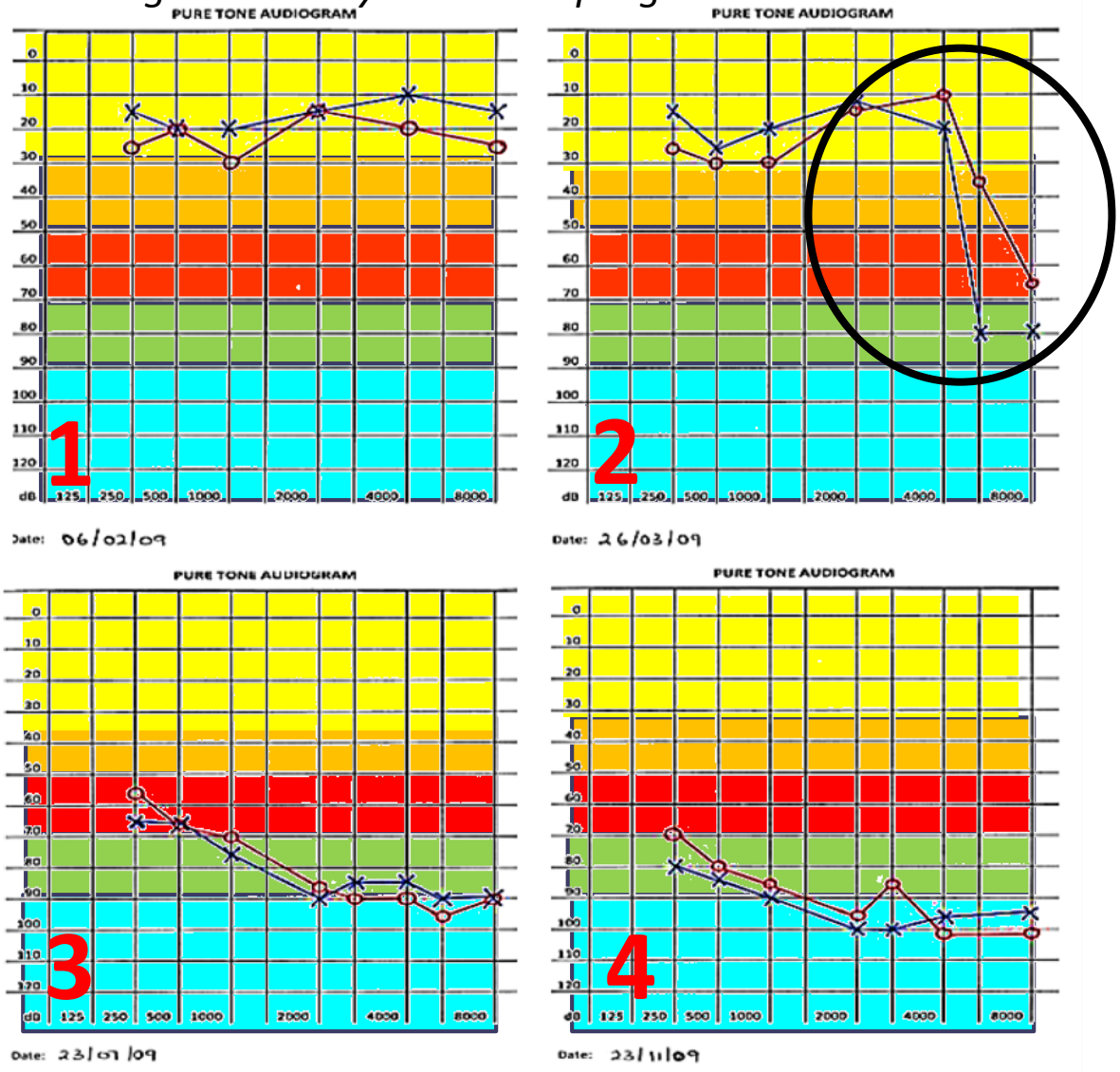
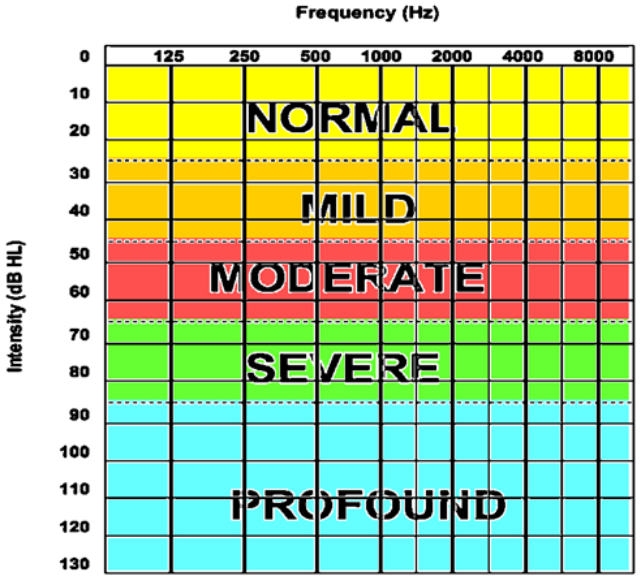


Figure 4: Baseline and follow-up audio-grams of a patient on treatment for MDR-TB showing bilateral symmetrical progressive sensorineural hearing loss (SNHL)

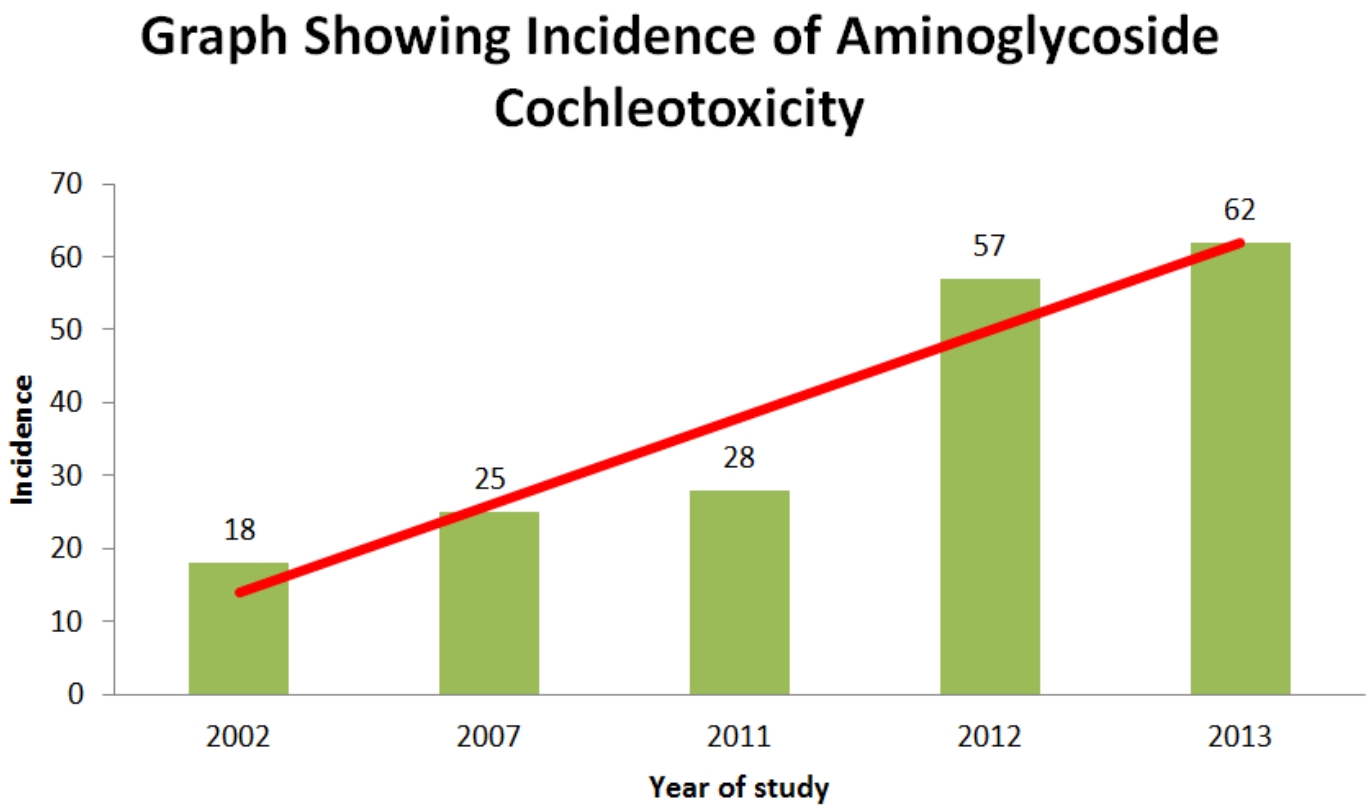




Hearing Loss as an Adverse Event

Study	No. of participants	Percentage of HL
Jacobs & Ross, 2012 (study conducted at KDHC)	350	28.7%
Van der Walt et al., 2013 (study included all 9 provinces in SA)	108	38.9%
Brust et al., 2013 (study conducted in KZN, SA)	91	69%

Incidence of Hearing Loss



2002 – De Jagger et al.

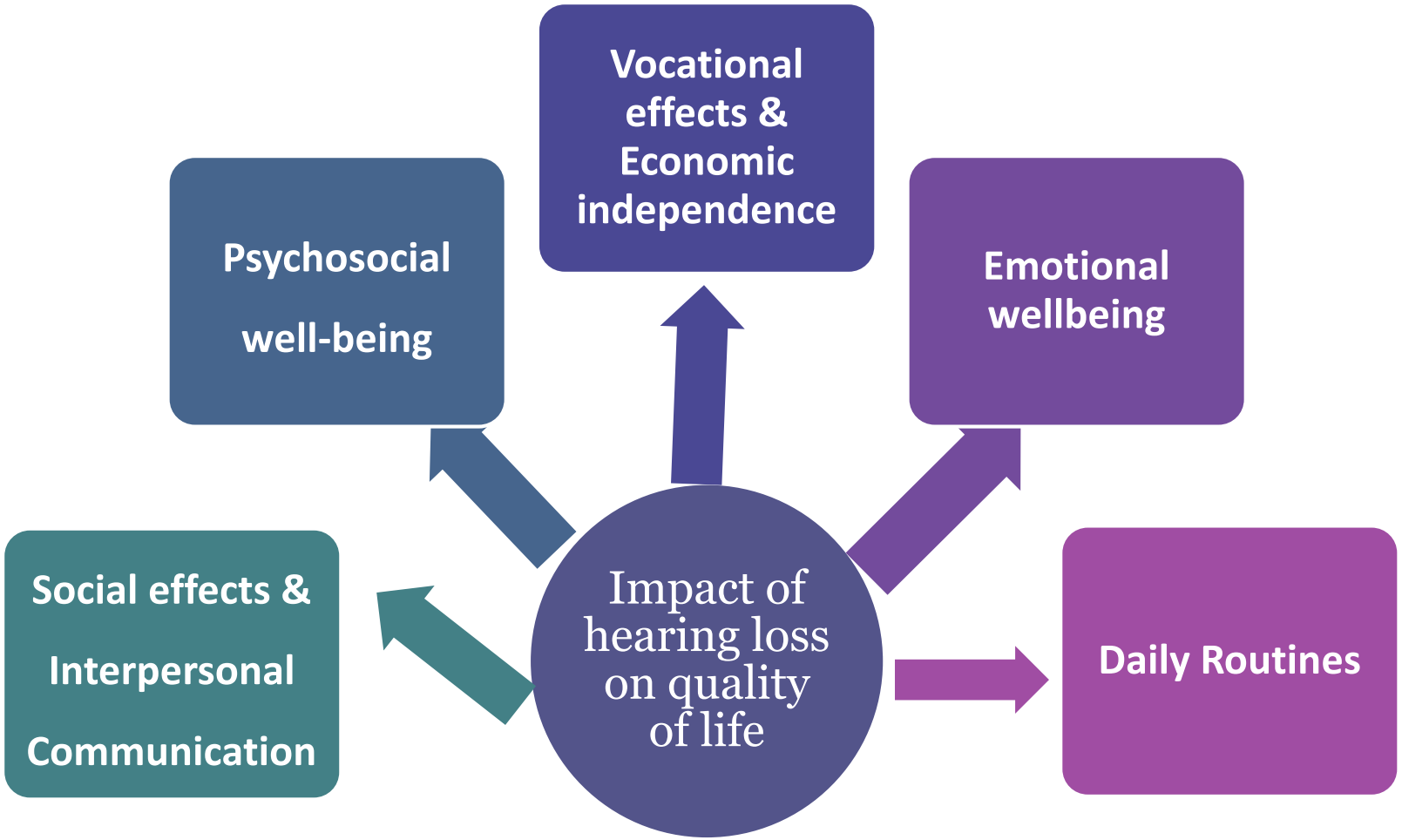
2007 – Duggal et al.

2011 – Sturdy et al.

2012 – Harris et al.

2013 - Appana

Impact of Hearing Loss



Prevention

Primary Prevention

- Do not prescribe ototoxic medication
- Not always possible

Secondary Prevention

- Timely detection of cochlear damage
- Monitoring and evaluations
- Early intervention
- Enhance quality of life

Audiology in an MDR-TB unit:

The audiology department plays an important role in the MDR TB unit. Within the MDR TB unit, the audiologist is involved in monitoring each patients hearing on a monthly basis.

- This is so that we can detect small changes in the patients hearing status.
- Once these changes are detected, the doctor is informed
- Doctor may be able to decrease the dosage, reduce frequency or stop ototoxic medications to prevent further damage
- Depending on the severity of the patients hearing loss, the audiologist may also be able to provide the patient with a hearing aid.

Audiology requirements in an MDR-TB Unit:

- Every MDR-TB unit should have a minimum of one audiologist (staffing dependent on hospital bed status) to monitor ototoxicity of treatment and its effects on hearing.
- Conventional Audiology Testing:
  - Otoscopic examination
  - Tympanometry
  - Pure tone testing (air conduction for screening & bone conduction for diagnostic testing)
  - DPOAE's
  - ABR

Audiological Monitoring and Evaluations of MDR-TB patients

- Baseline (Prior to initiation of MDRTB treatment)
- Monthly audiological follow ups, while on treatment
- Exit audiogram (Prior to discharge)
- Monitoring and evaluations 6 months post treatment

QUESTIONS

References

- Bardien, S., Human, H., Harris, T., Hefke, G., Veikondis, R., Schaaf, S. H., . . . de Jong, G. (2009). A rapid method for detection of five known mutations associated with aminoglycoside-induced deafness. *BMC Medical Genetics* .
- Brust, J. C., Sha , S. N., van der Merwe, T. L., Bamber , S., Ning , Y., Heo , M., et al. (2013). Adverse Events in an Integrated Home-Based Treatment Program for MDR-TB and HIV in KwaZulu-Natal, South Africa. *J Acquir Immune Defic Syndr* , 436-440.
- Chen, Y., Huang, W.-G., & Zha et al, D.-J. (2007). Aspirin attenuates gentamicin ototoxicity: From the laboratory to the clinic. *Hear Res*, 178-182.
- Cianfrone, G., Pentagelo, D., & Cianfrone, F. (2011). Pharmacological drugs inducing ototoxicity, vestibular symptoms and tinnitus: a reasoned and updated guide. *Eur Rev Med Pharmacol Sci.*, 601-636.
- Guthrie, O. W. (2008). Aminoglycoside induced ototoxicity . *Elsevier* , 91-96.
- Harris, T., & Heinze, B. (2012). Tuberculosis (TB), Aminoglycoside and HIV- Related Hearing Loss. *South African Medical Journal, 102*, 363-365. Retrieved June 3, 2015, from http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S0256-95742012000600020&lng=en&nrm=iso&tlng=en
- Jacobs, T. Q., & Ross, A. (2012). Adverse effects profile of multidrug-resistant tuberculosis treatment. *South African Family Practise* , 531-539.

References:

- Konrad-Martin, D., Gordon, J. S., Reavis, K. M., Wilmington, D. J., Helt, W. J., & Fausti, S. A. (2005). Audiological Monitoring of Patients Receiving Ototoxic Drugs. *Division 6 publication*, 17-22.
- Metha, U., Durrheim, D. N., & Blockman, M. (2007). Adverse drug reactions in adult inpatients in a South African hospital serving a community with a high HIV/ AIDS prevalence: prospective observational study. *Br J Clin Pharmacol*, 396-406.
- Mukadi, Y., Maher, D., & Harries, A. (2001). Tuberculosis case fatality rates in high HIV prevalence populations in sub-Saharan Africa. *AIDS* , 143-152.
- Peterson, L., & Rogers, C. (2015). Aminoglycoside-induced hearing deficits – a review of cochlear ototoxicity. *South African Family Practice* , 1-6.
- Seddon, J. A., Godfrey-Faussett, P., Jacobs, K., Ebrahim, A., Hesseling, A. C., & Schaaf, H. S. (2012). Hearing loss in patients on treatment for drug-resistant tuberculosis. *Euro Respiration Journal*.
- South African Department of Health. (2009). *South African National Tuberculosis Guidelines*. Retrieved from http://www.google.co.za/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CBwQFjAA&url=http%3A%2F%2Ffamilymedicine.ukzn.ac.za%2FLibraries%2FGuidelines_Protocols%2FTB_Guidelines_2009.sflb.ashx&ei=YlFsVZLOB4SE7gbp-4KgBA&usg=AFQjCNGrbXUQp6CITx-6rN7gixh2syj5wA&si

References:

- Stevens, G., Flaxman, S., Brunskill, E., Mascarenhas, M., Mathers, C. D., & Finucane, M. (2011). Global and regional hearing impairment prevalence: An analysis of 42 studies in 29 countries. *The European Journal of Public Health, 23*(1), 146-152.
- Xing, G., Chen, Z., & Cao, X. (2007). Mitochondrial rRNA and tRNA and hearing function . *Cell Res*, 227-239.