00101

TELEHEALTH

The outcomes of a mobile tele-diagnostic auditory brainstem response service to rural communities in Winterveldt, Pretoria North, South Africa

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Introduction and background

Newborn hearing loss is the most common congenital sensory disorder (Choe et al., 2023). The prevalence of hearing loss in South Africa is estimated to be around 4 million, with the prevalence of sensorineural hearing loss (SNHL) reported to be around 2% for children between the ages of 1 and 12 years (Khoza-Shangase, 2022). Due to limited human and technical resources, accessing audiological management for especially infants is limited. The Auditory Brainstem Response Test (ABR) is a valuable neurologic test of auditory brainstem function that is used to assess hearing in those patients who are unable to reliably participate in behavioral hearing assessments. Access to this test is limited in rural and remote areas. Successful use of telehealth can expand the range of hearing healthcare services to patients by providing decentralized care within mobile structures such as in a mobile van. Telehealth services can also mitigate troubles associated with the lack of practitioners and equipment in far-off areas.

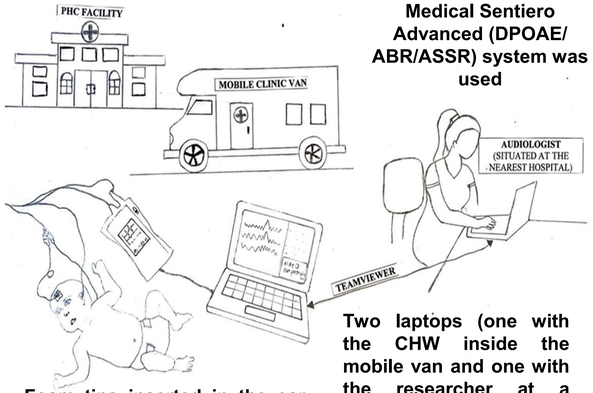
Objectives

This study aimed to determine whether, for infants, mobile tele-diagnostic ABR assessment results conducted within a mobile clinic van are comparable to face-to-face diagnostic ABR results in rural Winterveldt, Pretoria North, South Africa. The population was inclusive of all infants receiving care at rural clinics in Winterveldt.

Methods

A prospective cross-sectional comparative within-subject design was used. A standard conventional diagnostic ABR test and a mobile synchronous tele-diagnostic ABR test was conducted on each infant. A trained community Health worker (CHW) was used to set up the patient in the mobile van. The Audiologist tested from a remote location. A total of 40 infants (80 ears) participated.

A calibrated PATH Medical Sentiero Advanced (DPOAE/ ABR/ASSR) system was used



Foam tips inserted in the ear canals were used and electrodes were placed on the forehead, the nape of the neck and cheek to record brain activity in response to clicks.

Two laptops (one with the CHW inside the mobile van and one with the researcher at a nearby hospital) were synchronized via the TeamViewer App.

Results

There was no statistically significant differences between the median difference of face-to-face and mobile tele-diagnostic and there was a strong correlation between the face-to-face and mobile tele-diagnostic ABR for both neurological and audiological ABR test results. The agreement between the two methods was depicted using the Bland-Altman technique, which shows that almost all points were within the limits of agreement for all responses, suggesting comparability between both face-to-face and tele-diagnostic ABR measurements.

Table 1: Summary Neurological ABR I–III-V

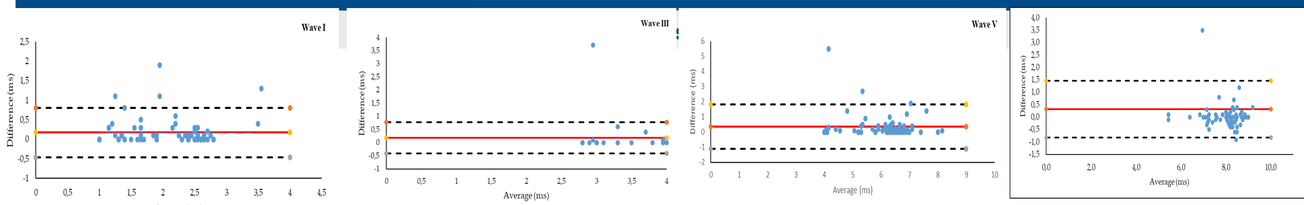
		Face-to-Face Diagnostic ABR	Mobile Tele-Diagnostic ABR	Mean Difference
	No of ears	80	80	
Wave I	Mean (SD)	2.01(0.78)	2.09(0.82)	0.17(0.49)
	Median (IQR)	2.40(1.15)	2.35(0.95)	0.01(0.20)
	Shapiro-Francia	<0.001	<0.001	<0.001
Wave III	Mean (SD)	4.23(0.67)	4.13(0.77)	0.10(0.52)
	Median (IQR)	4.4(0.50)	7.3(0..40)	0.01(0.09)
	Shapiro-Francia	<0.001	<0.001	<0.001
Wave V	Mean (SD)	6.11(0.97)	6.05(1.19)	0.07(0.81)
	Median (IQR)	6.4(0.89)	6.4(1.2)	0.02(0.02)
	Shapiro-Francia	<0.001	<0.001	<0.001

Table 2: Summary of IPL values

		Face-to-Face diagnostic ABR	Mobile Tele-Diagnostic ABR	Mean Difference
	No of ears	80	80	
Wave I and III	Mean (SD)	2.12(0.50)	2.03(0.53)	0.09(0.38)
	Median (IQR)	2.0(0.65)	2.0(0.70)	0.1(0.55)
	Shapiro-Francia	<0.001	<0.001	<0.001
Wave III and V	Mean (SD)	1.89(0.58)	1.93(0.63)	0.03(0.57)
	Median (IQR)	1.9(0.7)	2.0(0.83)	2.0(0.76)
	Shapiro-Francia	<0.001	<0.001	<0.001
Wave I and V	Mean (SD)	4.01(0.75)	3.95(0.88)	0.06(0.65)
	Median (IQR)	4(0.83)	4.1(0.82)	4.1(0.80)
	Shapiro-Francia	<0.001	<0.001	<0.001

Table 3: Summary Statistics for Audiological ABR – V

	Face-to-Face diagnostic ABR	Mobile Tele-Diagnostic ABR	Mean Difference
No of ears	80	80	
Mean (SD)	7.99(0.775)	7.95(0.824)	0.04(0.490)
Median (IQR)	8.1(0.850)	8.1(0.950)	0.04(0.02)
Shapiro-Francia	<0.001	<0.001	<0.001



FIGURES 1-4 : Bland Altman plots showing agreement face-to-face and mobile tele-diagnostic ABR.

Conclusion

The findings indicated no statistically significant difference between face-to-face and tele-diagnostic ABR testing, and the results were within clinically acceptable and normative measures. The findings of this study suggest that diagnostic ABR testing can be conducted from a mobile clinic van using a CHW to set up the patient. This has benefits for early detection and intervention by increasing service delivery to patients in rural and remote areas. Noise control was a primary challenge and acoustic adjustments of the mobile van may optimise testing outcomes. In countries where space and fixed infrastructure is limited, the use of mobile clinic vans can be practical, efficient, and cost effective. Ongoing research to refine tele-ABR testing can improve audiological service delivery, promoting decentralised care.

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