VERBAL AND NON-VERBAL AUDITORY SEQUENTIAL MEMORY TEST: PERFORMANCE OF AN *APP*

Cláudia Reis[1], Cristina Nazaré[1], Luísa Passadouro[1], Carla Silva[1], Patrick Franco[2], Margarida Serrano[1]
[1]Instituto Politécnico de Coimbra, ESTeSC – Coimbra Health School, Audiology, Coimbra, Portugal
Evollu - Sensing Evolution, SA, Leiria, Portugal
mserrano@estesc.ipc.pt

INTRODUCTION

The development of innovations in digital services has currently been a bet for health technology manufacturers. The field of Audiology also benefits from the digital evolution that facilitates access to information for the public, but also for the audiologist himself. *Evollu - Sensing Evolution, SA* is a company that, together with the academy in Coimbra (Project A4A: Audiology for All), is developing apps that can be used both for self-care and by the audiologist as a counseling aid or even as information collection tools (Luengen et al., 2021; Murdin et al., 2022).

OBJECTIVE

Compare if the performance of tests of verbal and non-verbal sequential auditory memory performed with an *app* is identical to the performance of the same tests by the clinical method.

METHODS

- Normal hearing subjects of different age groups performed the verbal and non-verbal sequential auditory memory tests – subjects were evaluated using the clinical method (Pereira & Schochat, 2011) and/or the *app Evollu Hear*;
- **5 years old group**: were tested with 3 sequences of 3 verbal stimulus (pa, ta, ca) and 3 non-verbal (rattles, maracas, bell);
- **9 years old group** and **18-22 years old group (Young Adults)**: were tested with 3 sequences of 4 verbal stimulus (pa, ta, ca, fa) and 4 non-verbal (rattles, drum, bell and maracas).

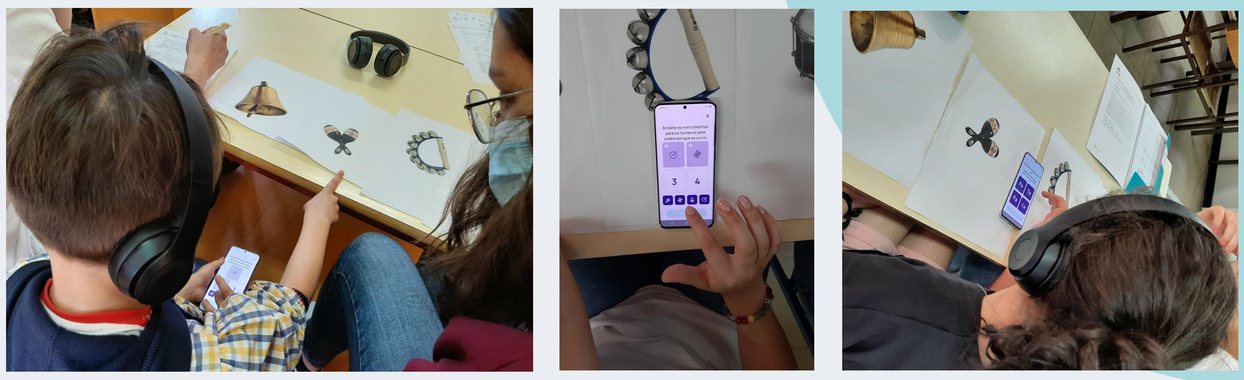

Fig. 1. Non-verbal and verbal sequential auditory memory tests

RESULTS

Table 1 and Table 2. Descriptive statistics of the performance of different age groups in non-verbal and verbal sequential auditory memory tests

Table 1. All subjects evaluated with the clinical method and/or with the app

Age		N	Minimum	Maximum	Mean	Std. Deviation
5 years old	Non Verbal Test	57	,00	3,00	1,9825	,85547
	App-Non Verbal Test	28	,00	3,00	1,3571	,95119
	Verbal Test	52	,00	3,00	,9231	,98710
	App-Verbal Test	27	,00	3,00	,5556	,93370
9 years old	Non Verbal Test	27	,00	3,00	2,0741	,87380
	App-Non Verbal Test	27	1,00	3,00	2,2593	,85901
	Verbal Test	27	,00	3,00	1,5185	1,01414
	App-Verbal Test	27	,00	3,00	1,6296	1,14852
Young Adults	Non Verbal Test	26	2,00	3,00	2,8462	,36795
	App-Non Verbal Test	26	,00	3,00	2,4231	,85665
	Verbal Test	26	1,00	3,00	2,5000	,76158
	App-Verbal Test	26	,00	3,00	2,3077	,88405

Table 2. Groups of subjects evaluated with the clinical method and with the app

Age		Mean	N	Std. Deviation	Std. Error Mean
5 years old	Non Verbal Test	2,0000	10	,81650	,25820
	App-Non Verbal Test	1,6000	10	,84327	,26667
	Verbal Test	1,0588	17	1,08804	,26389
	App-Verbal Test	,8235	17	1,07444	,26059
9 years old	Non Verbal Test	1,9375	16	,99791	,24948
	App-Non Verbal Test	2,5000	16	,81650	,20412
	Verbal Test	1,3750	16	1,02470	,25617
	App-Verbal Test	1,3750	16	1,20416	,30104
Young Adults	Non Verbal Test	2,8182	11	,40452	,12197
	App-Non Verbal Test	2,6364	11	,50452	,15212
	Verbal Test	2,5455	11	,82020	,24730
	App-Verbal Test	2,3636	11	,80904	,24393

There were identical results between the tests performed by the app and those performed by the clinical method, in the three age groups, and in both tests.
No significant differences were found between methods.

Table 3. Paired difference test for groups of subjects evaluated with the clinical method and with the app

Age		Paired Differences Mean	Std. Deviation	Std. Error Mean	Sig. (2-tailed)
5 years old	Non Verbal Test - App Non Verbal Test	,40000	,69921	,22111	,102
	Verbal Test - App Verbal Test	,23529	,75245	,18250	,206
9 years old	Non Verbal Test - App Non Verbal Test	-,56250	1,20934	,30233	**,075**
	Verbal Test - App Verbal Test	,00000	1,41421	,35355	,917
Young Adults	Non Verbal Test - App Non Verbal Test	,18182	,40452	,12197	,157
	Verbal Test - App Verbal Test	,18182	,87386	,26348	,480

DISCUSSION

This app proved to be valid for performing verbal and non-verbal sequential auditory memory tests in the age groups studied. The apps can be a reliable method of self-care and referral to the health professional and can also facilitate the clinical intervention by audiologists.

REFERENCES

- Luengen, M., Garrelfs, C., Adiloğlu, K., Krueger, M., Cauchi, B., Markert, U., Typlt, M., Kinkel, M., & Schultz, C. (2021). Connected Hearing Devices and Audiologists: The User-Centered Development of Digital Service Innovations. *Frontiers in digital health*, *3*, 739370. https://doi.org/10.3389/fdgth.2021.739370
- Murdin, L., Sladen, M., Williams, H., Bamiou, D. E., Bibas, A., Kikidis, D., Oiknonomou, A., Kouris, I., Koutsouris, D., & Pontoppidan, N. H. (2022). EHealth and Its Role in Supporting Audiological Rehabilitation: Patient Perspectives on Barriers and Facilitators of Using a Personal Hearing Support System With Mobile Application as Part of the EVOTION Study. *Frontiers in public health*, *9*, 669727. https://doi.org/10.3389/fpubh.2021.669727
- Pereira, L. D. & Schochat, E. (2011) *Testes Auditivos Comportamentais para Avaliação do Processamento Auditivo Central*. 1ª ed. Barueri (São Paulo): Pró-Fono, v. 1. 82p.

Cofinanciado por: