Supplementary file

Slovak database of speech affected by neurodegenerative diseases

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EWA-DB testing and recording protocol

Objective

The aim is to create a database of speech task recordings from patients with Alzheimer's disease (AD), Parkinson's disease (PD), mild cognitive impairment (MCI), and healthy individuals. This database will be used for future research purposes, including the development of diagnostic tools and the study of speech patterns related to neurodegenerative diseases.

Ethics approval

The creation of EWA-DB is a part of the EWA – Early Warning of Alzheimer (ITMS2014+ : 313022V631) research project. The EWA project was approved by the ethics committee of the Bratislava self-governing region (committee number 03187/2021/HF). The Ethics Committee approved to conduct the biomedical study and share the data to the extent of informed consent (i.e. using the data for scientific and commercial research and provision of data to third parties).

Funding

EWA-DB is created in relation to the EWA - Early Warning of Alzheimer (ITMS2014+ : 313022V631) project, which was funded by the European Regional Development Fund and the ALOIS - Diagnosis of Alzheimer's disease from speech using artificial intelligence and social robotics (APVV-21-0373) project, which was funded by the Slovak Research and Development Agency.

Participants

Participants include individuals diagnosed with AD, PD, MCI, and a control group of healthy individuals. Inclusion and exclusion criteria for each group as established as follows:

Inclusion criteria for MCI: Classification criteria according to the diagnostic criteria of Albert et al.[1], age 50-90 years, MoCA score 25-23, preserved activities of daily living measured by Barthel's Index for Activities of Daily Living[2], score in the Geriatric Depression Scale (GDS)[3] ≤ 9 b, General Anxiety Disorder-7 (GAD-7)[4] ≤ 9 b. Diagnosed by a psychiatrist or a neurologist according to the Albert et al.[1] criteria for a diagnosis of MCI.

Exclusion criteria for MCI: History of or current psychiatric disorder; history or neurological evidence of stroke, head injury, or neurodegenerative disorders that are known to influence cognitive functioning; medication for depression and/or Alzheimer's disease.

Inclusion criteria for AD: Diagnosis established according to the criteria of the International Classification of Diseases (ICD-10) or the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) and in all stages of the disease confirmed by a specialist (psychiatrist or neurologist), age 50-90 years, MoCA score between 22-18, capability to give informed consent.

Inclusion criteria for PD: Diagnosis of manifest PD based on the International Parkinson and Movement Disorder Society (MDS) clinical diagnostic criteria[5]. Prodromal PD based on the updated MDS criteria for prodromal Parkinson's disease[6]. Prodromal or early stage of the disease (Hoehn & Yahr stage I or II), duration of the disease less than 10 years, MoCA score >20 points, age over 18.

Inclusion criteria for all participants: Normal or compensated vision and hearing, native speaker of Slovak language, no clinical history of head injury or psychosis, no medical record of drugs or alcohol consumption, not being under pharmacological treatment affecting cognitive functions, absence of disorders with expected impact on language and speech.

Exclusion criteria for healthy participants: Self-reporting of a previous stroke, brain tumors or psychiatric disorders such as bipolar disorder or schizophrenia, current or past alcohol or drug abuse history, or under-corrected auditory or vision difficulties.

Testing and recording protocol

1. **Informed consent**

   - **Briefing**

   At the start of the meeting, the purpose of the study, its procedures, and the associated risks and benefits are explained.

   - **Signing**

   Participants are required to sign an informed consent form. The informed consent form was approved by the above mentioned ethics committee.

2. **Administration of the anamnestic questionnaire**

   An anamnestic questionnaire is administered to obtain descriptive characteristics of the participant, including age, education, gender, and lifestyle factors as smoking, alcohol and coffee consumption.

3. **Testing for inclusion and exclusion criteria**

   Administration of tests and assessments defined in the above mentioned inclusion and exclusion criteria.

4. **Recording setup and calibration**

   - **Environmental Check**

   Before starting the recording, it is necessary to ensure that environmental conditions are optimal. Minimalization of external noise. Adequate distance from the recording device.

   - **Calibration**

   Calibration is included in the EWA application. The usable screen size of the smartphone is determined. The functionality of the recording device is verified. The reliability of automatic speech recognition is tested and adjusted based on the participant's voice.

5. Recording of the speech tasks

- **Sustained Vowel Phonation**

Participants are instructed to take a deep breath and perform a sustained phonation of vowel /a/ as long and steadily until they run out of air or until the end of recording, which is set at 15 seconds.

- **Diadochokinesis**

Participants are instructed to take a deep breath and repeat the syllable sequence /pataka/ as quickly and accurately as possible, to pronounce continuously, intelligibly and to speak as quickly as they can without being imprecise. Duration is set at 8 seconds to allow for at least 12 sequence repetitions performed with one breath.

- **Object Naming**

Participants are instructed to name 30 colored photographs depicting different objects.

- **Action Naming**

Participants are instructed to name 30 colored photographs depicting different actions.

- **Picture description**

Participants are asked to describe three different pictures depicting different events.

6. Data entry

After the completion of recordings, all data are logged in the EWA application including data from the anamnestic questionnaire, results of the tests verifying inclusion and exclusion criteria, confirmation that informed consent was obtained.

The recording and task results are reviewed for completeness before proceeding.

7. Data saving and transfer

All collected data, including audio recordings and task performance results, are saved in the EWA application and consequently uploaded to a secure server for storage and further analysis.

8. Notes

If necessary, after each recording, notes are made and subsequently discussed within the interdisciplinary research team. These may concern issues such as whether the participant meets the inclusion criteria, the quality of the recording, interruptions or interference during the recording, etc.

References

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Corresponding English terms for the Slovak naming items

OBJECT		ACTION	
Slovak term	**English translation**	**Slovak term**	**English translation**
Akvárium	aquarium	bicykluje	to cycle
Autobus	bus	fotografuje	to photograph
bubon	drum	hádže	to throw
budík	alarm clock	horí	to burn
cesta	road	hrabe	to rake
cigarety	cigarettes	klope	to knock
domino	domino	krája	to cut
električka	tram	kúpe	to wash
fajka	pipe	lyžuje	to ski
hodinky	watch	maľuje	to paint
hríby	mushroom	meria	to measure
kaktus	cactus	natiera	to spread
kniha	book	pije	to drink
koleso	wheel	píli	to saw
koruna	crown	píše	to write
kotva	anchor	plače	to cry
kozmonaut	cosmonaut	polieva	to water
kráľ	king	šije	to sew
lavička	bench	skáče	to jump
lievik	funnel	smeje	to smile
metla	broom	spieva	to sing
most	bridge	štrikuje	to knit
ponorka	submarine	svieti	to shine
ťava	camel	ťahá	to pull
teplomer	thermometer	telefonuje	to call
topánky	shoes	varí	to cook
traktor	tractor	váži	to weigh
vešiak	coat hanger	veslujú	to row
žaluď	acorn	vŕta	to drill
zips	zipper	žehlí	to iron