PRESS RELEASE

A Computer-assisted Procedure Classifies Ataxia-related Speech Disturbances
Digital technology automates assessment of severity

Bonn/Germany, April 18, 2023. Researchers at DZNE and the University Hospital Bonn, together with the Berlin-based company PeakProfiling GmbH, have developed a computer-assisted method that recognizes the severity of speech disturbances resulting from ataxia, a brain disease, with great accuracy. They report on this in the scientific journal "npj digital medicine". In the long term, the new methodology, which leverages artificial intelligence, could be used in science as well as in clinical routine.

The term "ataxia" refers to a group of rare, neurodegenerative brain diseases that manifest as gait insecurity, impaired swallowing and speech disorders, among other symptoms. "Pronunciation becomes slurred, speech rhythm irregular. The pace of speech is usually slowed and sluggish, but can suddenly accelerate. All of this impairs the ability to communicate," explains Dr. Marcus Grobe-Einsler, clinician in the Department of Neurology of the University Hospital Bonn (UKB) and DZNE researcher. "For the assessment of the severity of speech disturbance, there is an established classification system with six levels. Up to now, this classification has been done by hand, so to speak, by clinical professionals. This is time-consuming and to a certain extent subjective. In a proof-of-concept study, we have now been able to show that it is possible to automate and objectify the established classification by means of computer technology. Our approach could greatly simplify the procedures for determining the severity of ataxia."

Cooperation with Industry

For these studies, Grobe-Einsler and colleagues' cooperated with PeakProfiling GmbH (http://www.peakprofiling.com). The Berlin-based company specializes in the analysis of voices and noises. For the current study, voice recordings of 67 patients with predominantly mild or moderate ataxia were used. The statements were responses to standardized questions. For example, the study participants were asked to talk about their hobbies and to

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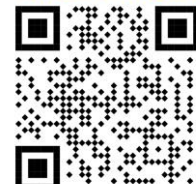wolfgang.holzgreve@ukbonn.de

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count aloud from 1 to 10 and back again. With the help of dedicated sound analysis software and "machine learning" algorithms - a variety of artificial intelligence - the researchers were able to identify more than one hundred characteristic features inter alia in the volunteers' speech rhythm and in modulations of their loudness.

A High Hit Rate

Based on these parameters, in a next step, the digital analysis system was trimmed in such a way that the computed severity matched as closely as possible the rating given by a panel of three experts who had examined the voice samples. The experts' vote was taken as a reference. In the end, the computer-assisted approach achieved a hit rate of 80 percent on a sample of recordings that had been excluded from the software's optimization process and was therefore independent of it.

Potential Applications

"We now intend to further refine our method in larger studies and transfer it from German to other languages in international cooperation," says Prof. Thomas Klockgether, head of the Department of Neurology of UKB and also Director of Clinical Research at DZNE. The degree of speech impairment is an essential criterion for evaluating the health condition of a person with ataxia, the neurologist explains. A method that objectifies and automates this assessment would therefore have great potential for both research and clinical practice. "Our technique could help with monitoring the course of the disease, and in addition, because of its degree of automation, it can be used efficiently in studies with many individuals. This is very valuable especially in the context of drug trials. In this respect, there has recently been a lot of momentum in the field of ataxia, because there are new, albeit still experimental, therapeutic approaches."

In addition, he notes, it is conceivable to integrate appropriate software into a smartphone app. "With ataxia, there are often fluctuations in health status that can only be mapped sporadically through clinic visits. Using smartphones and digital technology, this could be done much more precisely - and the software could also tell patients about the effect of logopedics or other treatment measures on their speech. Many patients want such direct feedback," says Klockgether.

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About the University Hospital Bonn: The UKB cares for about 500,000 patients per year, employs 8,800 people and has a balance sheet total of 1.5 billion euros. In addition to the more than 3,300 medical and dental students, a further 580 people are trained each year in numerous healthcare professions. The UKB is ranked first among university hospitals in NRW in the science ranking and in the Focus clinic list and has the third highest case mix index in Germany.

**About the Deutsches Zentrum für Neurodegenerative Erkrankungen, DZNE
(German Center for Neurodegenerative Diseases)**
The DZNE is a research institute funded by the German federal and state governments, comprising ten sites across Germany. It is dedicated to diseases of the brain and nervous system, such as Alzheimer's, Parkinson's, and ALS, which are associated with dementia, movement disorders and other serious health impairments. To date, there are no cures for these diseases, which represent an enormous burden for countless affected individuals, their families, and the healthcare system. The aim of DZNE is to develop novel strategies for prevention, diagnosis, care, as well as treatment, and to transfer them into practice. To this end, DZNE cooperates with universities, university hospitals, research centers and other institutions in Germany and abroad. The institute is a member of the Helmholtz Association and belongs to the German Centers for Health Research. www.dzne.de/en