



# TASK AREA 5: CLINICAL NEUROSCIENCE

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DEUTSCHE GESELLSCHAFT FÜR KLINISCHE NEUROPHYSIOLOGIE  
UND FUNKTIONELLE BILDGEBUNG – DGKN  
DEUTSCHE SEKTION DER INTERNATIONAL FEDERATION OF CLINICAL NEUROPHYSIOLOGY

Who we are:

**National Society**, 3600 members, with members in most university hospitals

**Topics:** EEG, MEG, nerve conduction studies, EMG, tele-medicine, functional and structural brain imaging, ultrasound, (combination with -omics data, with clinical data, ...)

**Disciplines:** Neurology, Psychiatry, Psychology, Basic Neuroscience, Neuroradiologists, ...

**Subjects:** patients and healthy volunteers; research and clinical practise

**Tasks:** Research (meetings etc.), education (courses, certificates, ...), quality control (white papers ...)

## Specific applications

Brain-Computer Interfaces

Targeted closed-loop Stimulation

BrainAge and other methods for volumetric and quantitative brain imaging

Person2Person Communication

Deep brain stimulation

Multi-channel magnetoencephalography and EEG with invers routines

fMRI

....

## State of RDM in Clinical Neuroscience:

- Electrophysiology and functional- and structural brain imaging are multidisciplinary methods and concern a broad spectrum of scientific disciplines
- Vast amounts of heterogeneous data which lends itself to collaborative exploration
- Yet, relevant exchange is currently in its infancy
- In particular, clinical research is severely hampered by the scarcity of systematic data sharing

## The Problem:

- Heterogeneity of data formats
  - Different methodological procedures and the
  - Lack of uniformly used repositories for electrophysiology and functional brain data
- do not meet any of the FAIR principles - not findable, not accessible, not interoperable, and not re-usable
- Especially true for electrophysiological data and to a lesser extent for collected MRI data
  - For example, EEG data is stored in more than 20 different data formats in Germany. These formats are essentially incompatible with each other.

Our vision:



Particularly experimental and empirical research will be greatly stimulated by the consistent use of a comprehensive research data management framework.

## Overarching Aims:

- To establish uniform standard (throughout Germany), for the exchange and storage of all scientifically collected electrophysiological and MRI data along with behavioral and clinical data
  - as well as
    - the legal and informed consent limits governed by the German DGSVO (Datenschutzgrundverordnung)
- To build up a higher-level meta data platform for data exchange
- To establish methods for the automated assessment of data quality

## Measures Required to Improve RDM in Clinical Neuroscience

### □ **Development of standards for the formalization and annotation of data, metadata and derived data from different modalities**

#### **Objective:**

- Development of a MarkupLanguage e.g. NeuroML (based on XML), which is suitable to cover all aspects of neuroscientific data, which is extensible, but also tailored to specific needs of this research area
- Set up a platform for community driven but guided consensus-building
- Development of DICOM Service-Object-Pairs for electroneurography, electromyography, somatosensory evoked potentials, motor evoked potentials. The SOP contains the rules and semantics, which may restrict the use of the service and unifies the Information Object Definition (IOD) and a DICOM Service Element (DIMSE)

## Measures Required to Improve RDM in Clinical Neuroscience

### **Development of a Platform which allows search and exploration of data sets**

#### **Objective:**

- To monitor data exchange
- To uncover data abuse
- To promote reproducibility of results

### **Development of meta standard to describe clinical neuroscience findings**

#### **Objective:**

- To monitor current status and to identify future needs or research questions (find blind spots)
- Meta data need to include descriptive meta data, structural meta data and administrative meta data

## Measures Required to Improve RDM in Clinical Neuroscience

### **Development of a meta-data standard for recording and documentation of electrophysiologic data**

#### **Objective:**

- To get information not only on the results of measurements but also on the process of data acquisition
- Meta-set should include descriptive, structural, administrative, reference and statistical metadata

### **Development of meta standard for documentation of clinical examination results in humans**

#### **Objective:**

- These metadata should be flexible to represent detailed clinical examinations but should also include a minimal applicable information standard



## Measures Required to Improve RDM in Clinical Neuroscience

### □ **Development of a Web-Interface for the interchange of clinical meta information and the DICOM standard**

#### **Objectives:**

- This module serves as a bridge between the clinical standard of electrophysiological data and the DICOM standard to be developed for this electrophysiological data
- The web viewer is able to read from both formats and convert the formats. The available components of the meta standard are brought together here.

## Measures Required to Improve RDM in Clinical Neuroscience

### □ **Training in using the new standards, data structure, converters and tools while strictly adhering to legal requirements**

#### **Objective:**

- Generation of video tutorials how to handle the data and how to work with the data formats

### □ **Provide recommendations and inform about best-practices on legal aspects of acquiring and exchanging data of human subjects/animals**

#### **Objective:**

- Facilitate sharing of ethics votes between sites participating in the same study/project

## Measures Required to Improve RDM in Clinical Neuroscience

□ **Free implementation of a DICOM server for storing findings of clinical examinations as well as electrophysiological data**

### **Objectives:**

- Develop a flexible and modular open source solutions of an implementation for a local DICOM server supporting all SOPs defined for electrophysiologic data and also supporting basic DICOM transfer protocols and dimse-services for the potential data transfer
- The developments should be available in all research institutes
- Since storage and transfer protocols take place within the framework of the DICOM standard, data exchange between all these devices is potentially possible

## Measures Required to Improve RDM in Clinical Neuroscience

### □ **Development of a Platform that provides a reference space on the cortical surface for data from different modalities**

#### **Objectives:**

- Joint analysis of data from different modalities, EEG/MEG and structural and functional MRI data
- Facilitated exchange and sharing of data in a clinical context
- Definition of reference space for the analysis of electrophysiological brain data also offers use of Activation Likelihood Estimation (ALE) meta-analyses of new but also existing data, where currently no standard is yet defined

## Collaborations

International Federation of Clinical Neurosciences IFCN

Human Brain Mapping Society HBM

Austrian and Swiss Societies for Clinical Neurophysiology

German Society for Neurology (DGN)

German Stroke Society (DSG)

German Society for Epileptology (DGfE)

DGTelemed

Medical Informatics Initiative, e.g. SMITH

Collaborations/interactions:

Nfdi4health, GHGA, (nfdi4Chem, nfdi4biodiversity)

## Collaborators

**UKJ Jena:** Stefan Brodoehl, Christian Gaser, Julian Großkreutz,  
Daniel Güllmar, Carsten Klingner, Jürgen Reichenbach,  
Andre Scherag, Cord Spreckelsen, Brigitta König-Ries

**UMG Göttingen:** Dagmar Krefting, Walter Paulus

**UKW Würzburg:** Philip Tovote, Jens Volkmann

**UKF Frankfurt:** Jochen Triesch, Felix Rosenow

**UKK Cologne:** Christian Grefkes

Further collaborators welcome