QUANTUM – Quantitative and standardized imaging in daily clinical routine of multiple sclerosis patients

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Background and objective

- MRI analyses play a key role both in the diagnosis and in treatment monitoring of patients with MS.
- In MS clinical trials quantitative MRI analyses are carried out based on highly standardized protocols, comparable standards are yet to be implemented in clinical routine.
- Tools for quantitative data analysis including brain volumetry do exist, but are not yet commonly used in daily routine practice.\(^1\)\(^-\)\(^3\)

**Objective**

To evaluate whether standardization of MRI acquisition, volumetric quantification and computerized lesion evaluation of MRI data provides an additional benefit to neurologists working in day-to-day MS patient management.
Methods: Study design and outcomes

• From July 2016 until December 2019 297 neurological centers across Germany participated in the QUANTUM project

• In total 9,000 MRI data sets from 6,718 MS patients were acquired from 183 radiological centers which all underwent a qualification procedure

• Standardized MRI data (3D T1 gradient-echo sequence and 2D/3D FLAIR) were analyzed by a centralized automatic processing pipeline (Biometrica MS®, jung diagnostics GmbH)
  ▪ The analysis comprises volumetric quantification of brain volume, as well as T2 lesion load and number.
  ▪ Percentage brain volume change (using an optimized SIENA pipeline) and T2 lesion activity were computed if follow-up scans were available.

• Results were visualized and provided to the participating physicians as a report

• Benefit and feasibility were evaluated using questionnaires.
Project design and example report

Figure 1. Project overview

Figure 2. Example of a QUANTUM report indicating volumetric data referenced to a healthy cohort and brain volume change over time
At project start neurologists rated relapses and new MRI activity with non-matching clinical symptoms as the main drivers for therapy switch.
Feasibility of additional MRT analyses

- 80.13% of neurologists report that additional volumetric MRI analyses are feasible in daily clinical routine
High acceptance and usability rates

- Analysis of 7775 questionnaires revealed good acceptance and usability of the QUANTUM reports among neurologists:

  - 76.0% of the neurologists discussed or handed out the report to patients
  - 74.5% of the neurologists state that the report was very helpful to classify the patient’s disease activity
  - 34.8% of the neurologists state that the report helped with their patient consultation
  - 70.0% of the neurologists report a strong or very strong correlation between the quantitative MRI parameters in the QUANTUM report and the clinical presentation of the patient
  - 74.0% of the neurologists rate the additional benefit of quantitative MRI parameters in the context of assessing all four NEDA-criteria as high or very high

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Impact of MRI activity on treatment decisions

- At the end of the project QUANTUM the impact of “new MRI activity” was rated:
  - higher in 24.42% of neurologists
  - lower in 11.63% of neurologists
Conclusions

- With QUANTUM standardization of MRI acquisition and MRI evaluation was transferred into daily clinical practice

- Volumetric quantification and computerized lesion evaluation can be provided reliably if standardized MRI protocols are used

- Quantification of lesion load and volume and visualization of MRI abnormalities might be beneficial for the use of MRI data by neurologists in general and support the individual patient management.
Thank you