



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

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Poster Session: Sat, September 26, 2020, 14:00 - 16:30; P0629

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Poster Presentation at the 8th Joint ACTRIMS-ECTRIMS Meeting, MSWashingtonDC Virtual 2020

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M. Jankovic has participated as a speaker in meetings sponsored by Roche

R. Opfer and L. Spiess are employees of jung diagnostics GmbH

K. Schuh is an employee of Novartis.

The study was funded by Novartis Pharma GmbH Germany

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 practice¹⁻³

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.

MRI, magnetic resonance imaging; MS, multiple sclerosis

1. Rovira et al Nat Rev Neurol. 2015 Aug;11(8):483 2. Arnold DL, Li D, Hohol M, et al Mult Scler J Exp Transl Clin 2015;1:2055217315589775. 3. Filipi et al Lancet Neurol. 2016 Mar;15(3):292-303

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

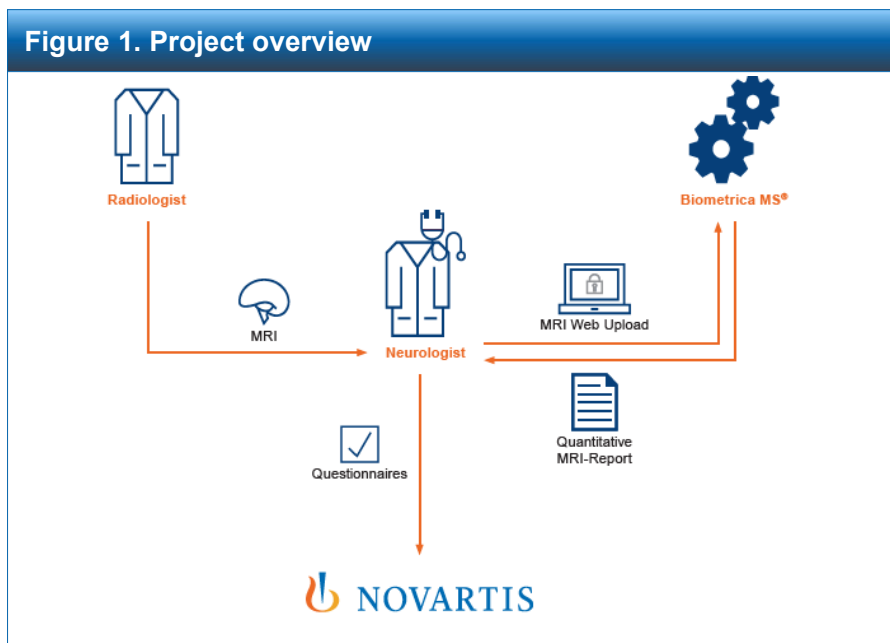
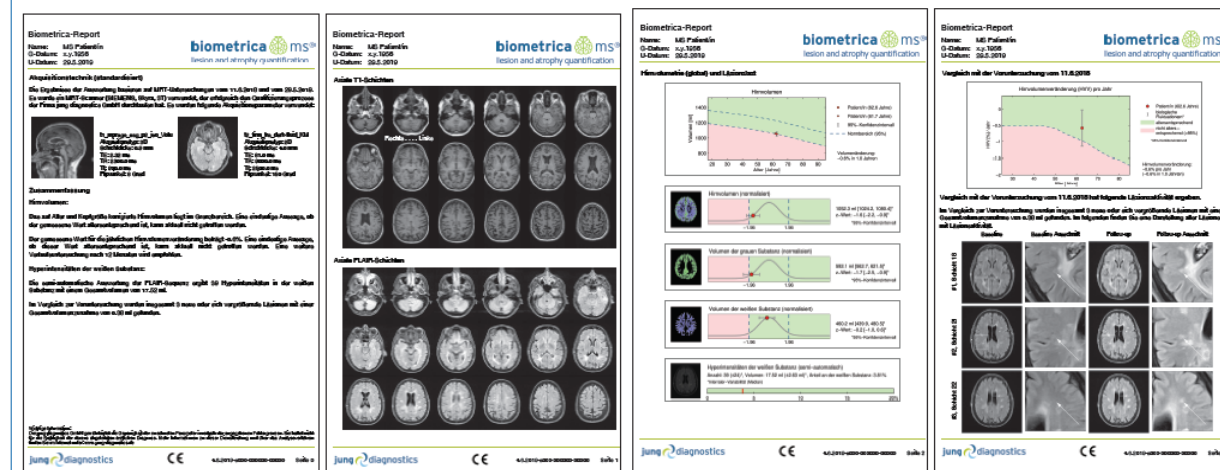


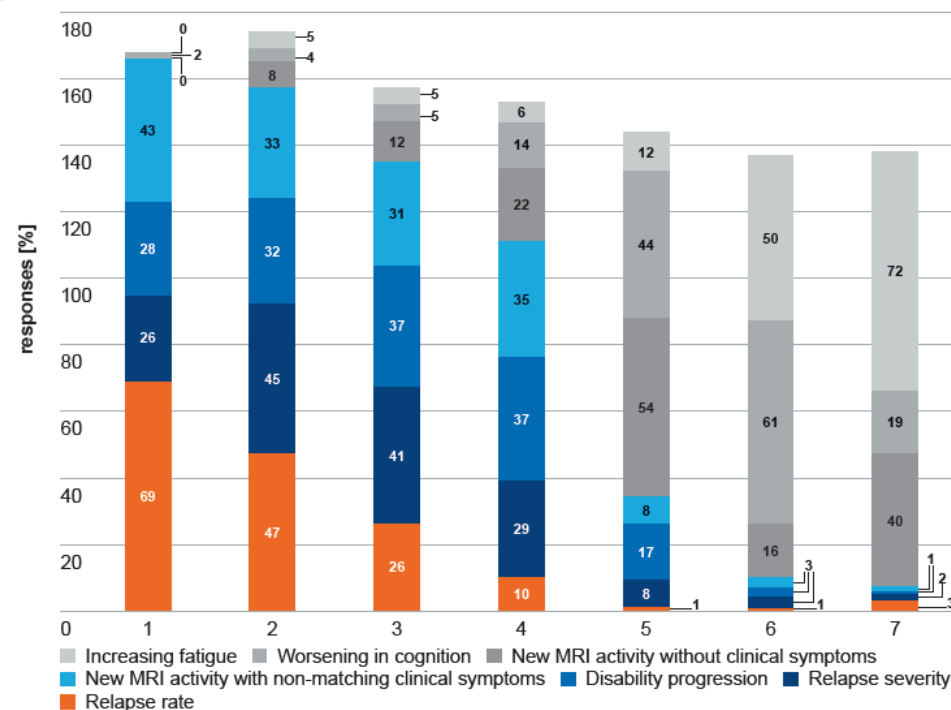
Figure 2. : Example of a QUANTUM report indicating volumetric data referenced to a healthy cohort and brain volume change over time



Reasons for treatment switch

- At project start neurologists rated relapses and new MRI activity with non-matching clinical symptoms as the main drivers for therapy switch

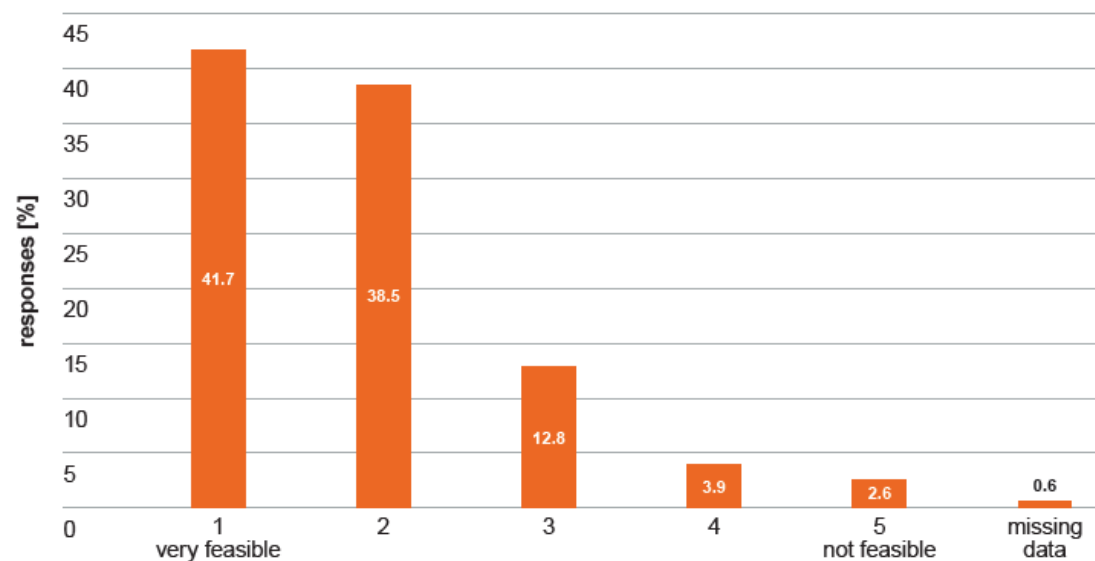
Figure 3. Reasons for treatment switch 1 – 7; 1=highest importance



Feasibility of additional MRT analyses

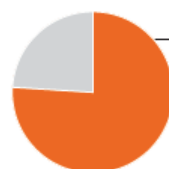
- 80.13% of neurologists report that additional volumetric MRI analyses are feasible in daily clinical routine

Figure 5. Feasibility of quantitative MRI analyses in daily routine



High acceptance and usability rates

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



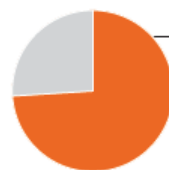
76.0%

of the neurologists discussed or handed out the report to patients



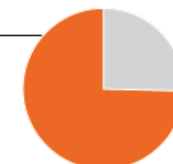
34.8%

of the neurologists state that the report helped with their patient consultation



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



74.5%

of the neurologists state that the report was very helpful to classify the patient's disease activity



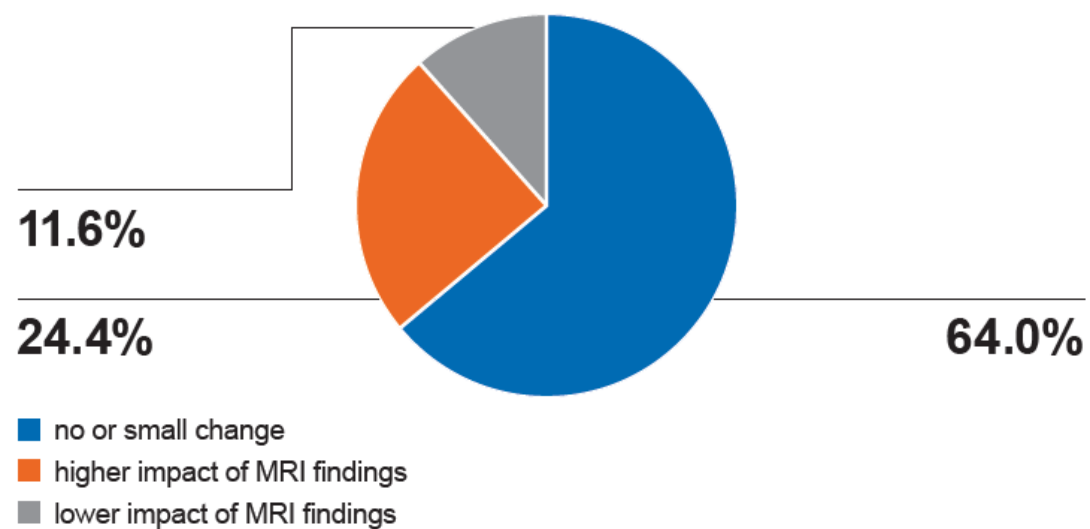
70.0%

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

Impact of MRI activity on treatment decisions

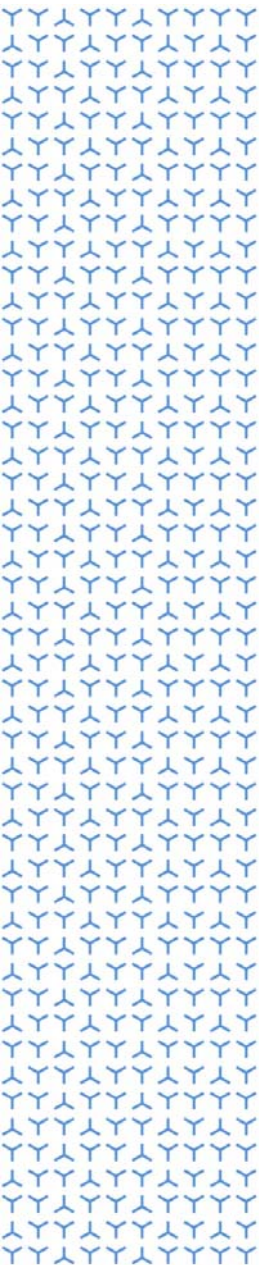
- At the end of the project QUANTUM the impact of “new MRI activity” was rated
 - higher in 24,42% of neurologists
 - lower in 11.63% of neurologists

Figure 4. Change of impact of “new MRI activity with non-matching clinical symptoms” on treatment decisions



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