Study Design: The impact of quantitative structured MRI reports on clinical decision making in MS

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INTRODUCTION

It is known that there is variability amongst neuroradiologists in their interpretation and reporting of brain magnetic resonance imaging (MRI) exams in patients with multiple sclerosis (MS) [see poster 224], but how that variability translates to clinical decision-making by MS Specialist Neurologists (MSNs) is unclear. Objective measurements of brain features such as lesion counts, brain volumes, and change over time can reduce variability of MRI reports, but the impact of these metrics on clinical decision-making has not yet been fully explored.

OBJECTIVE

This study aims to investigate the clinical impact of structured MRI reports containing quantitative brain data in patients with MS on MSNs' understanding, reporting, satisfaction, and clinical decision making relative to standard-of-care MRI reports. Preliminary results from MS Specialty Neurologists' ratings of standard-of-care MRI reports are discussed below.

METHODS

- 90 de-identified MS subjects with 2 (median 1 year apart) MRI exams from 2012 to 2019 were retrospectively enrolled from the University Hospital Basel. Enrolled subjects were randomly selected to represent varying levels of disease activity.
- Within the included subjects, 64.4% were female and the mean age was 51.7 ± 10.4 years old. Patients had an average EDSS score of 3.3 ± 1.7.
- Three board-certified neuroradiologists (NRs) visually interpreted raw images to provide a standard of care structured report.
- The 270 reports prepared by the NRs were randomized 1:1:1 to 3 groups of 2 MSNs. To measure intra-rater variability, 30 of the 90 patient reports were repeated for a total of 120 report ratings per MSN (*Figure 1*).
- MSNs used a web-based portal to review the standard of care MRI report alongside a brief clinical summary of the patient and the survey questions.
- The clinical summary included Age, Sex, Current DMT, Disease Duration, Disease Course, EDSS, EDSS change from previous year, Time to last relapse on MRI, Relapse within 120 days, Number of clinical relapses in the past year, Number of clinical relapses in the past 2 years, and Current & Prior MRI dates.
- MSNs completed the first section of the survey rating the clarity, completeness, usefulness, & satisfaction for each report. The second section of the survey addressed clinically impactful treatment decisions, such as the MSNs' comfort and confidence in the MRI report for decision making, the MSNs impression of disease activity, level of concern for the patient, potential treatment changes, test orders, time to next visit, and follow-up communication (see *Results*).
- Descriptive statistics were reported as frequency and percentage for the responses of all survey questions (*Figure 2*).
- Inter- and intra-rater agreement analysis evaluated the variability between MSNs and the self-consistency of each MSN, using Cohen's Kappa statistic.
- A Kappa value of ≤ 0 indicated no agreement, 0.01–0.20 as none to slight, 0.21–0.40 as fair, 0.41–0.60 as moderate, 0.61–0.80 as substantial, and 0.81–1.00 as almost perfect agreement.
- Results from 5 MSNs were complete at the time of this analysis.

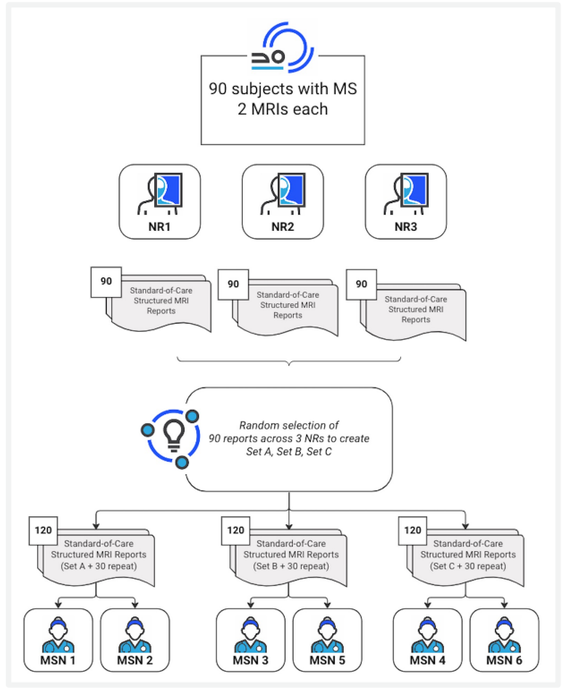

Figure 1. Flow Diagram of Study Design.

RESULTS

- Rankings of the overall MRI report as satisfied or very satisfied ranged from 0% to 68% depending on the MSN. In total, MSNs rated 37% of reports as neutral to very unsatisfied. (Section 1 –Q6)
- MSNs reported that all the information expected from a high-quality report was not present 69% of the time on average, with MSNs 2 & 3 reporting less than 5% of reports as high-quality (Section 1- Q3).
- Confidence in the report without reviewing images showed a variance between MSNs, in total 58% of reports were rated as low confidence without MRI review (Section 2 – Q3).
- Across MSNs, patient current disease status was reported as stable 61-76% of the time (Section 2 – Q5).
- Changes to a patient's treatment plan were considered 23-47% of the time based on the MRI report and clinical history provided (Section 2 – Q8).

Section 1 - Overall usefulness of the patient's MRI report

Section 2 – Clinical decision making for the patient based on the MRI report

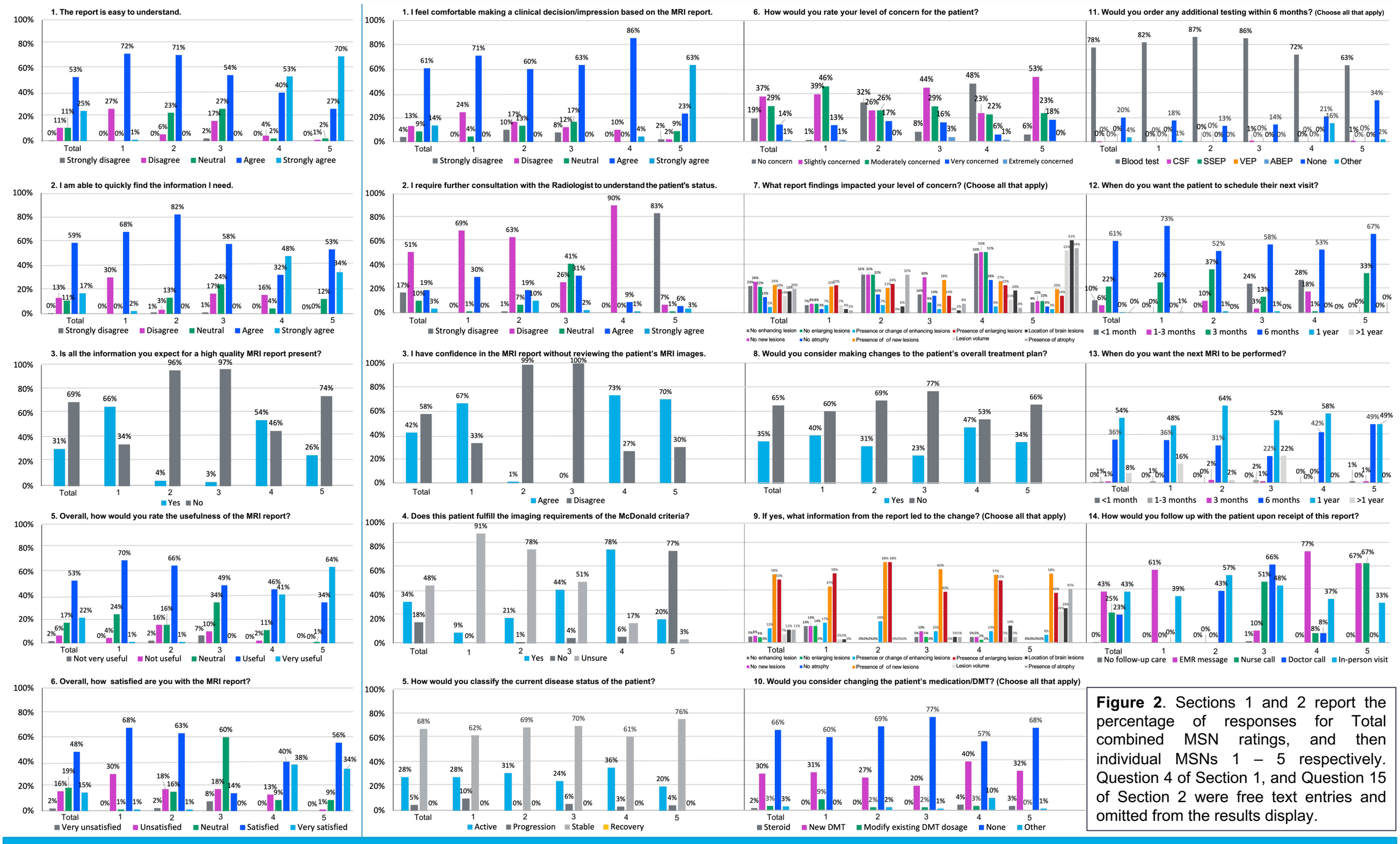

Figure 2. Sections 1 and 2 report the percentage of responses for Total combined MSN ratings, and then individual MSNs 1 – 5 respectively. Question 4 of Section 1, and Question 15 of Section 2 were free text entries and omitted from the results display.

CONCLUSIONS

Descriptive statistics of preliminary study data show mixed responses between MSNs in the evaluation of standard-of-care MRI reports and their resulting clinical decisions. Preliminary results suggest that MSNs may fall into a spectrum of comfort and confidence in interpreting radiology reports; future studies will examine differences in MSN demographics to understand practice patterns. In addition, report content and quality may be contributing to differences in clinical management of patients with MS. This study will evaluate inter- and intra-rater variability among MSNs when evaluating standard of care MRI Brain reports in MS and will aim to demonstrate whether quantitative MRI reports can improve intra- and inter-rater agreement across MSNs clinical decisions. Finally, the study will examine whether the clinical impression and treatment plan for the patient changes when MSNs are presented with quantitative lesion and brain metrics.

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