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Structured Reporting and Semi-Automated rule based TNM-classification for NSCLC staging in a multicenter feasibility study

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Purpose

- the European Society of Radiology (ESR) and the Radiological Society of North America (RSNA) advocate **structured reporting as a key element in advancing value-based radiology**

- beyond structuring of report input and output, software-based solutions promise to facilitate automated **report enrichment** and enable **secondary data capture**

Aims:

1. to **benchmark reporting standards** in participating hospitals and to assess radiologists' perceptions towards structured reporting in NSCLC

2. to **harmonize image acquisition** and **reporting standards** in participating institutions in Bavaria

3. to assess the **effectiveness of a collaboratively developed structured reporting framework** featuring **semi-automated TNM-classification** of NSCLC in a software-based framework

Methods

BZKF BORN-Project

Bavaria-wide oncological radiology network

The Bavarian Oncology Radiology Network (BORN) has evolved as **regional platform** for **protocol** and **reporting harmonization** in Bavaria, Germany

Source: BZKF

- participating institutions **collaboratively developed an interactive image-based template for NSCLC** using a **CE-certified structured reporting software** (Mint Medical GmbH, Heidelberg, Germany)
- the template was enriched with a **semi-automated rule-based TNM** (8th edition) **classification system** for lung cancer based on detailed annotations and descriptions
- the template was tested during a **controlled on-premise validation trial** under standard conditions providing radiology work-stations for all participants

This work is supported by BZKF (Bavarian center for cancer research)

Methods

Survey

- physician survey **participants (n=10)** were selected by their respective institution, representing all contributing centers. The questionnaire included the following sections, a **7-point Likert scale** was used:
  - demographic questions including professional experience and previous exposure to lung cancer imaging
  - comprehensiveness of radiology reports in the participants' institutions
  - preferences and perceptions to barriers concerning SR implementation

Validation Study

- physician radiologists (n=9) assessed **n=20 representative [18F]FDG PET/CT studies** and documented **TNM 8th edition** classification **based on simulated multidisciplinary team (MDT) lesion detection** using both free text reporting (FTR) and a semi-automated rule-based classification derived from structured reporting

- classification results were **compared to a multidisciplinary team reference** using generalized linear mixed model (GLMM) and assessed for correctness with regard to overall TNM output and individual classifiers.

- participants were surveyed on their **perception regarding structured reporting** and its potential before and after the validation study

Results
Survey

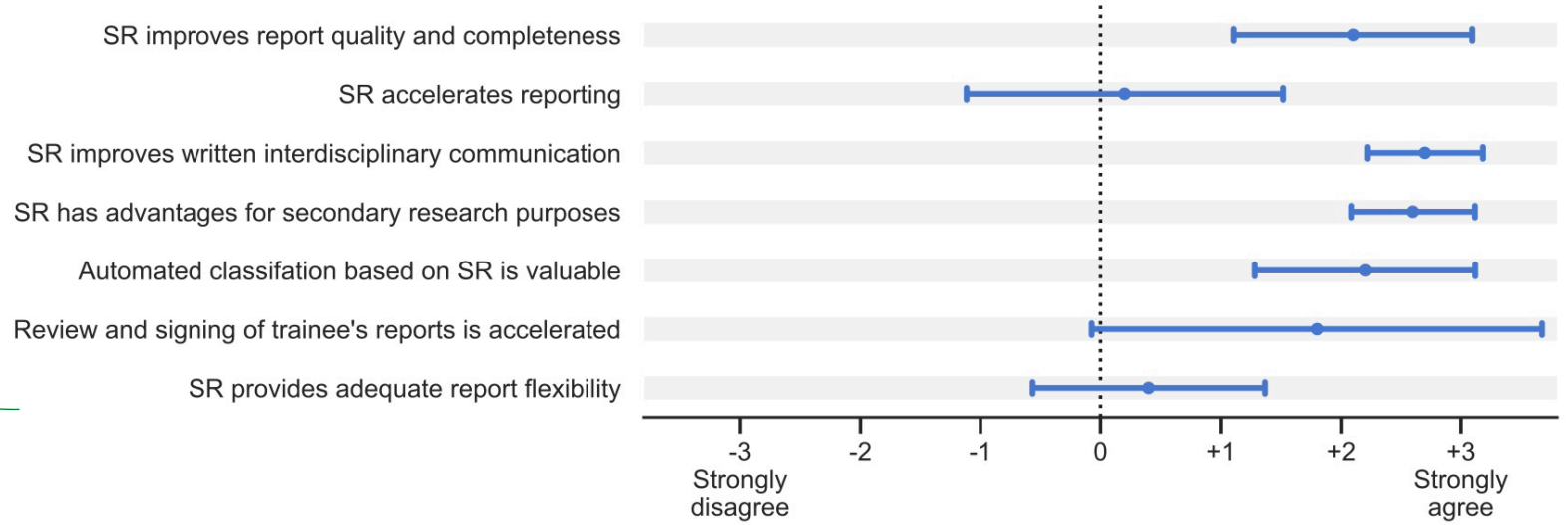
- **n = 10 radiologists** from all participating institutions completed the demographic and exploratory survey with an average of 6.3 years (range 2 - 12 years) of experience and self-estimated previous 423 ± 351 reported lung cancer staging examinations per reader

- **none of the institutions** (0/6) had **implemented structured reporting in clinical routine** lung cancer staging prior to the study, with participants from two institutions (2/6) reporting some previous exposure to SR in lung cancer

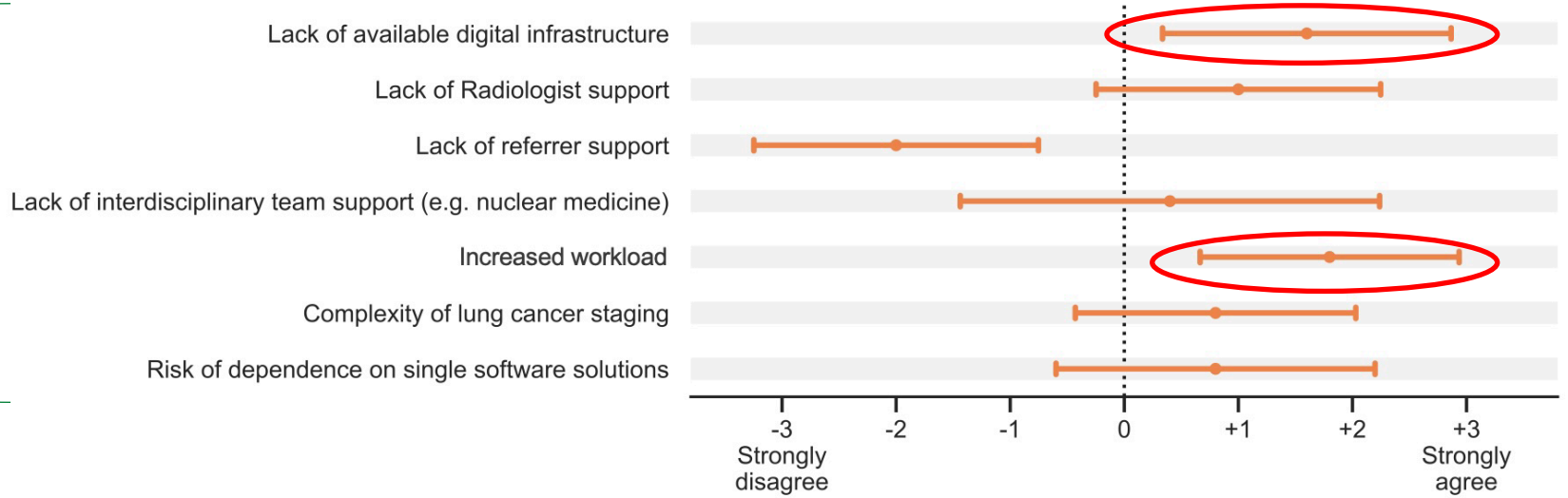
- across institutions, participants responded that to their **perception TNM-classification is reported infrequently in approximately 9.2%** (range 0 - 30%) of cases

Results
Survey

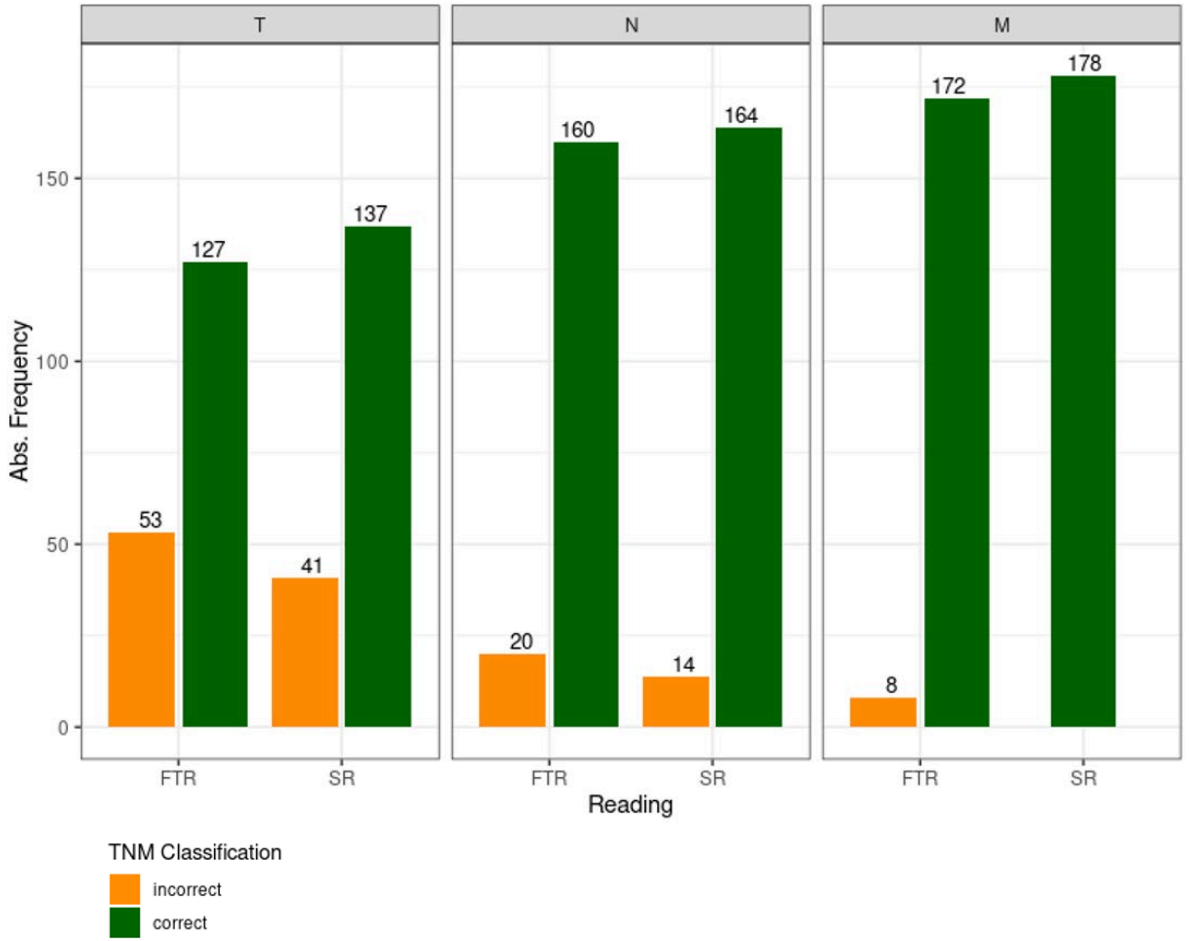
Structured Reporting Potential



Structured Reporting Obstacles



Results
Validation study

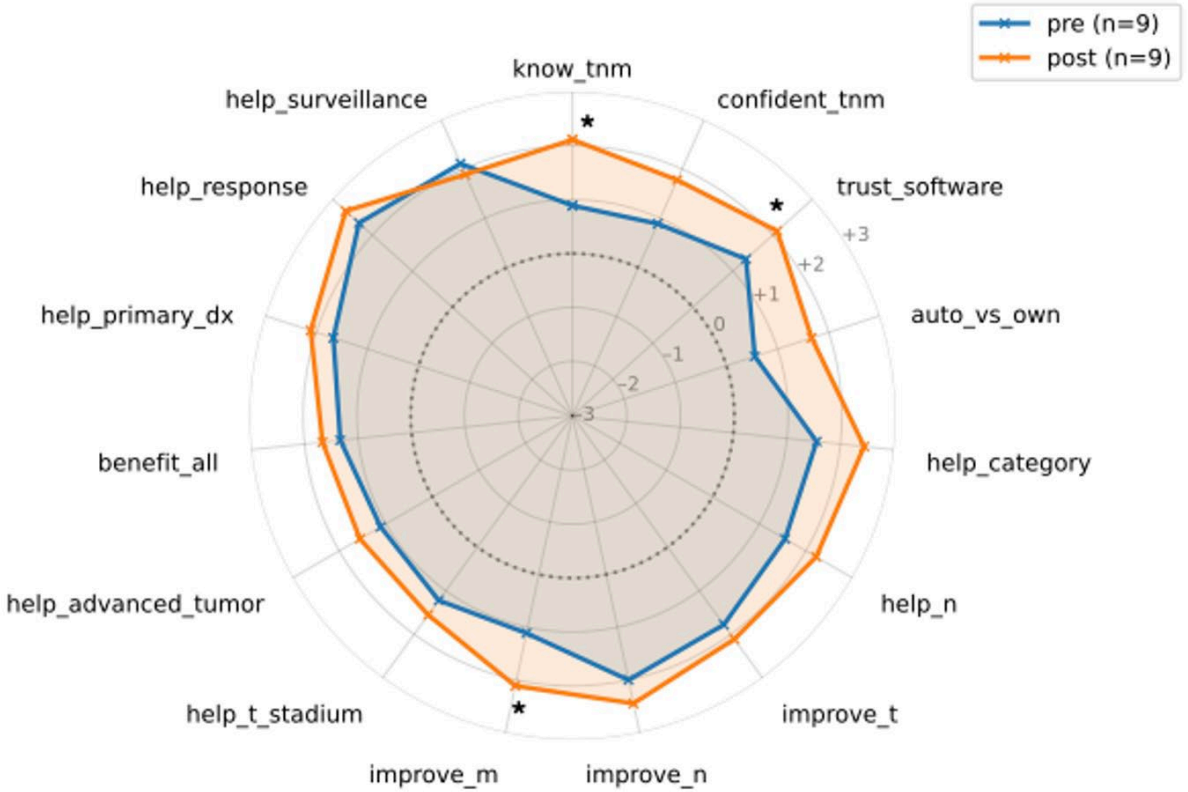


- image based annotations serve as **robust data input** for semi-automated rule-based TNM classification

- the GLMM revealed a significant difference (p = 0.01) in overall TNM correctness between SR and FTR, with readers using SR having a **1.7** (CI 1.2 - 2.6) times **higher chance of correctly classifying TNM status** compared to those using FTR

- there was no relevant correlation between clinical experience and classification errors in FTR (ρ = 0.21; p = 0.96) and SR (ρ = -0.142; p = 0.71)

Results
Validation study



- The pre- and post-validation survey revealed an **overall positive attitude towards SR** across categories

- Radiologist physicians perceived that after the validation study their **knowledge on TNM classification** was improved, that **M-stage classification** was improved and that they would **trust semi-automated TNM classification** based on their own structured report

Conclusion

Limitations

- The impact of structured reporting and semi-automated TNM classification was based on simulated MDT decisions and **not assessed in the context of lesion detection**
- The **magnitude and clinical impact** of TNM misclassification on clinical management was not assessed.

Conclusion

- **Structured reporting and TNM classification are underutilized** in NSCLC staging in clinical routine.
- **Software-assisted structured reporting** provides **robust input** for semi-automated rule based TNM classification, **improves TNM correctness** and is **perceived as valuable** by radiology physicians.
- Reports will be used in clinical routine in all participating centers and evaluated in **real world application**

THANK YOU

FOR YOUR ATTENTION

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