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- By convention, radiologists use a combination of training, experience and judgement to diagnose images produce reports.
- Current reporting methods result in free-text based reports. Associated problems include inconsistency, ambiguity, error & variable quality.
- Structured reporting could improve classification of disease phenotype, severity and onward recommendations, & improve interface with clinicians
- 'Structured Reporting Forms' (SRFs) seem especially appropriate in interstitial lung disease (ILD), where recognizing specific interstitial signs or patterns on chest CT images forms the current basis of the diagnosis.
- SRFs may then facilitate both clinical service around ILD, and improve audit and research capabilities.
- To our knowledge, no structured imaging reporting process in ILD has been implemented and published in the UK.
- We sought to develop the SRF idea, and then begin work on a prototype.

- There are 2 broad themes here – firstly, the creation of a SRF that is fit for purpose, and secondly, the greater task, the infrastructure to support this within existing NHS IT services.
- After informal discussions within local, regional and national ILD/IPF multidisciplinary groups, such as the Scottish ILD Group, we went on to gather further support from Information Technology (IT), Picture Archival & Communication System (PACS)
- Healthcare managers, National PACS representatives from Carestream, and Health Board Directorate managers to consider the overall feasibility and integration capabilities both within our own Board and nationally for Scotland.
- A brief questionnaire study was issued to all members of the Scottish ILD Group regarding SRF as a concept, and their views on application were sought.
- The Royal College of Radiologists (RCR) has been informed and has manifested his support eliciting fruitful contacts with radiologists involved in RCR Working Party on Structured Reporting and RCR Radiology Informatics Committee. The concept was taken to the Scottish Clinical Imaging Network Quality and Improvement Working Group, a national strategy imaging network, and they recognised this to be a potentially valuable tool.
- A pilot study was discussed with experts and postgraduate students at the University of St Andrews Computer-Human Interaction ('SACHI') labs. The study was to begin with a user-centred project, followed by further development of a prototype to work alongside NHS IT systems. The agreed early requirements were as follows:
 - 2 themes of 'descriptors' of pre-defined signs such as reticulation and honeycombing, and of suggested diagnoses
 - Links to other data, including images, waveforms, spatial/temporal co-ordinates
 - Use of decision trees, drop-down menus, algorithms to inform and advise, 'smart'/preset tools
 - Estimate of confidence in reporting
 - Potential pairing with metadata, including clinical features and spirometry
- These forms will be stored and exported in appropriate format such as HTML5, JavaScript among other web based languages, and made to be in accordance with standards such as DICOM or HL7 needed to standardise information retrieval and facilitate its collation into bona-fide databases that could further be integrated into both PACS and Electronic Patient Record (EPR).
- Note some of the varied CT imaging appearances in Figure 3.

Several challenges have already been posed in this developmental phase through such scoping exercises.

These are challenges both human and systemic.

Several outcomes have emerged after early discussion with local, regional and national bodies.

Several other outcomes have emerged from early review of the user-centred study.

Common concerns voiced through informal/formal questionnaire study include:

- possible restrictions in freedom of reporting
- risk of oversimplification
- risk of adding complexity to the current system
- potential marginalisation of general radiologists or outsiders to the launching project
- adding time to the reporting process
- IT security issues and integration with electronic health records



Further outputs from discussions

Some reporting templates are now being defined by the RCR, UK, in order to become available on PACS systems in the future. Our SRF should be viewed as a dedicated tool to assess a specific condition, namely ILD. Therefore, specific semantics is absolutely mandatory (eg RadLex = lexicon created by RSNA) to allow:

- **Multidisciplinary** approach to set the right (flexible) template from the start
- Template library set by a **panel of users**
- Data collection via online SRF integrated to **IHE systems**
- Vendors support (workstations, RIS, PACS, EMR)
- PACS/RIS **storage** alongside radiological exam or EMR
- **Data mining** capability to generate ad-hoc database
- **Data analysis** capability to exploit SRF information alongside other metadata

Interoperability is crucial between radiology information systems (RIS), PACS and hospital information systems (HIS), which are core components for electronic radiology.

Fixed/context-dependent format with itemised report and standard language, organised as checklists having a definite tree structural pattern should allow both humans and machines to read it. Some limited free text field have been considered acceptable.



Figure 5. Underlying tree structure

Although the first radiological report is said to have been made by William James Morton, MD in May 1896, ***“most radiologists continue to create reports in a manner strikingly similar to that of their predecessors practising 100 years ago.”*** Bruce I. Reiner, MD, director of research, VA Maryland, Health Care System, Baltimore

Traditional reporting mechanisms need to be updated and redefined in this digital and more sophisticated environment. Industry is doing this in imaging processing, and the same must be done in clinical reporting.

SRF – the concerns

Convincing (experienced) radiologists to give up their traditional reporting style remains one of the major challenges.

Improved accuracy often claimed as a benefit of structured reporting, remains controversial. The evidence is mixed. Our study would require careful planning of outcomes unique to ILD.

Fragmentation of findings may lead to loss of overview. The concept of a 'second read', already considered at the outset, has become more important in this context, **as part of the MDT process critical to ILD care pathways.**

Sense of over-completeness or over-assurance of the reporter, impossibility for the referrer to judge the quality of the report as the result of thoughtful introspection

SRF – the gains

- Reduce reporting errors, improve consistency
- Data can be mined and analysed more effectively
- Reduce ambiguity and misunderstanding
- More useful/meaningful initial reports
- Can promote adherence to guidelines through prompting, guidance
- Can link to embedded selected images, waveforms data, other pertinent clinical data

Even relatively well-known and simple existing guidelines are difficult to follow. In one study of a major academic centre there was just 60.8% conformity to Fleischner Society pulmonary nodule guidelines.

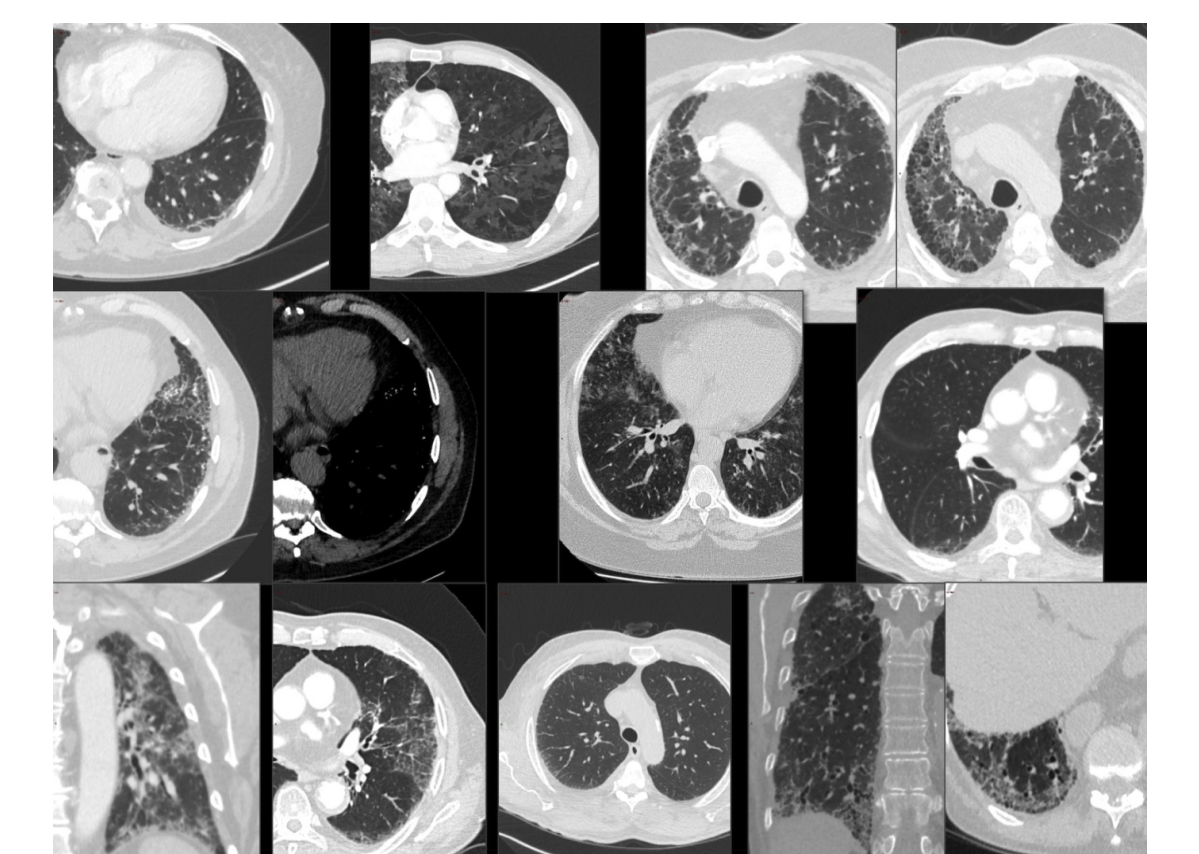


Figure 3.

- We have completed scoping exercises locally and nationally, discussed NHS/IT infrastructure and pilot projects, and have embarked upon a first prototype for a SRF in ILD in Fife.
- SRFs should improve global quality, communication and productivity in terms of time cost. They should reduce inappropriate practice and inconsistency, and also the negative impact and potential costs of stress or fatigue.
- SRFs should enhance existing MDT pathways in ILD care, leading to earlier and more robust treatment strategies, including continuous feedback as treatments are initiated.

References

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