ONLINE SUPPLEMENT

Appendix 1

Research Strategy

General
(Cystic fibrosis OR pulmonary cystic fibrosis) AND imaging AND (Randomized controlled trial OR controlled clinical trials, non-randomized OR clinical trials, non-randomized OR Systematic review OR review, systematic OR meta-analysis OR Network meta-analysis OR Guideline OR Clinical practice guideline OR Consensus OR Protocol)

(Generates 153 hits)

(Cystic fibrosis OR pulmonary cystic fibrosis) AND imaging AND (pulmonary disease OR lung disease) AND (Randomized controlled trial OR controlled clinical trials, non-randomized OR clinical trials, non-randomized OR Systematic review OR review, systematic OR meta-analysis OR Network meta-analysis OR Guideline OR Clinical practice guideline OR Consensus OR Protocol)

(Generates 119 hits)

(Cystic fibrosis OR pulmonary cystic fibrosis) AND imaging AND (pulmonary disease OR lung disease) AND (Patient compliance OR patient cooperation)

(Generates 1 hit)

Lung ultrasound
(Cystic fibrosis OR pulmonary cystic fibrosis) AND (imaging OR radiology OR radiology department, hospital OR Radiologists OR radiography) AND (Ultrasonography OR Diagnostic ultrasound OR Ultrasound imaging OR Ultrasonography, Doppler OR) AND (Disease progression OR Disease exacerbation OR Acute lung injury OR Respiratory function tests OR Interstitial syndrome OR Pleural effusion OR Emphysema OR Pulmonary emphysema) AND (Randomized controlled trial OR controlled clinical trials, non-randomized OR clinical trials, non-randomized OR systematic review OR review, systematic OR meta-analysis OR Network meta-analysis OR Guideline OR Clinical practice guideline OR Consensus OR Protocol)

(Generates 49 hits)

Chest Radiographs
(Cystic fibrosis OR pulmonary cystic fibrosis) AND (imaging OR radiology OR radiology department, hospital OR Radiologists OR radiography) AND (Chest X-ray OR Chest radiography) AND (Randomized controlled trial OR controlled clinical trials, non-randomized OR clinical trials, non-randomized OR systematic review OR review, systematic OR meta-analysis OR Network meta-analysis OR Guideline OR Clinical practice guideline OR Consensus OR Protocol)

(Generates 65 hits)
systematic OR meta-analysis OR Network meta-analysis OR Guideline OR Clinical practice guideline OR Consensus OR Protocol)

(Generates 38 hits)

**Computed tomography**

(Cystic fibrosis OR pulmonary cystic fibrosis) AND (imaging OR radiology OR radiology department, hospital OR Radiologists OR radiography) AND (Tomography, X-ray computed OR Tomography, spiral computed OR Cone-Beam Computed Tomography OR Positron emission tomography computed tomography OR Tomography, emission-computed, single-photon OR Radiation dosage OR Dose fractionation, radiation) AND (Disease progression OR Disease exacerbation OR Acute lung injury OR Respiratory function tests) AND (Randomized controlled trial OR controlled clinical trials, non-randomized OR clinical trials, non-randomized OR systematic review OR review, systematic OR meta-analysis OR Network meta-analysis OR Guideline OR Clinical practice guideline OR Consensus OR Protocol)

(Generates 34 hits)

(Cystic fibrosis OR pulmonary cystic fibrosis) AND (imaging OR radiology OR radiology department, hospital OR Radiologists OR radiography) AND (Tomography, X-ray computed OR Tomography, spiral computed OR Cone-Beam Computed Tomography OR Positron emission tomography computed tomography OR Tomography, emission-computed, single-photon OR Radiation dosage OR Dose fractionation, radiation) AND (Tomography scanners, X-ray computed OR Multidetector computed tomography OR Image processing, computer-assisted OR Image acquisition OR Image interpretation, computer-assisted OR Radiographic image interpretation, computer-assisted OR Radiographic image enhancement) AND (Randomized controlled trial OR controlled clinical trials, non-randomized OR clinical trials, non-randomized OR systematic review OR review, systematic OR meta-analysis OR Network meta-analysis OR Guideline OR Clinical practice guideline OR Consensus OR Protocol)

(Generates 68 hits)

**Magnetic resonance imaging**

(Cystic fibrosis OR pulmonary cystic fibrosis) AND (imaging OR radiology OR radiology department, hospital OR Radiologists OR radiography) AND (Magnetic resonance imaging OR Diffusion magnetic resonance imaging OR Functional magnetic resonance imaging OR Contrast media OR Image processing, computer-assisted OR Image acquisition OR Image interpretation, computer-assisted) AND (Disease progression OR Disease exacerbation OR Acute lung injury OR Respiratory function tests) AND (Randomized controlled trial OR controlled clinical trials, non-randomized OR clinical trials, non-randomized OR systematic review OR review, systematic OR meta-analysis OR Network meta-analysis OR Guideline OR Clinical practice guideline OR Consensus OR Protocol)

(Generates 41 hits)

**Cooperation between radiologists and clinicians**

(Cystic fibrosis OR pulmonary cystic fibrosis) AND (imaging OR radiology OR radiology department, hospital OR Radiologists) AND (Multidisciplinary OR Interdisciplinary communication)

(Generates 26 hits)

(Cystic fibrosis OR pulmonary cystic fibrosis) AND (imaging OR radiology OR radiology department, hospital OR Radiologists) AND (Multidisciplinary OR Interdisciplinary communication) AND
Online Supplement

Title: Lung imaging in Cystic Fibrosis: consensus statement and recommendations for pulmonologists and radiologists from the “iMAging managEment of cySTic fibROsis” (MAESTRO) consortium

1E List of selected articles


https://doi.org/10.1371/journal.pone.0240898

https://doi.org/10.1007/s00247-014-2964-6


https://doi.org/10.1371/journal.pone.0199148


https://doi.org/10.1183/13993003.00748-2019


https://doi.org/10.1002/ppul.21526

https://doi.org/10.1136/thoraxjnl-2017-210496


### Table 2E Radiologist-Clinician cooperation:

<table>
<thead>
<tr>
<th>Statement number</th>
<th>Statement</th>
<th>Type of statement</th>
<th>Strength of recommendation</th>
<th>Quality of evidence</th>
<th>Most relevant supporting articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2E.1</td>
<td>There are no studies addressing optimal collaboration strategies between clinicians and radiologists as members of CF multidisciplinary teams. Research should be addressed to answer this topic</td>
<td>Statement of fact</td>
<td>Best Practice</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>2E.2</td>
<td>At least a radiologist, with experience in CF lung disease, should be part of the CF multidisciplinary team. This radiologist should periodically attend multidisciplinary team meetings to discuss CF patients</td>
<td>Recommendation</td>
<td>Grade A</td>
<td>Best Practice</td>
<td>n/a</td>
</tr>
</tbody>
</table>

n/a=not available.

### Table 3E. Structured report:

<table>
<thead>
<tr>
<th>Statement number</th>
<th>Statement</th>
<th>Type of statement</th>
<th>Strength of recommendation</th>
<th>Quality of evidence</th>
<th>Most relevant supporting articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>3E.1</td>
<td>More research is needed to fully understand the benefits of STR (Structured Radiological Report) for CF patients</td>
<td>Statement of fact</td>
<td>Best Practice</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>3E.2</td>
<td>STR specific for CF should be validated for use in clinical practice and as research outcome</td>
<td>Recommendation</td>
<td>Grade A</td>
<td>Best Practice</td>
<td>n/a</td>
</tr>
</tbody>
</table>

n/a=not available.
Table 4E. Statements related to imaging modality

<table>
<thead>
<tr>
<th>Statement number</th>
<th>Statement</th>
<th>Type of statement</th>
<th>Strength of recommendation</th>
<th>Quality of evidence</th>
<th>Most relevant supporting articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>4E.1</td>
<td>Spirometry assisted CT improves lung volume standardization and air trapping detection, but no appreciable difference in image quality is detected in terms of presence of motion artifact or atelectasis, especially in inspiratory scan. Therefore, in the appropriate clinical setting spirometry controlled CT is favourable for CF imaging in cooperative patients, but not mandatory.</td>
<td>Recommendation</td>
<td>Grade B</td>
<td>Moderate</td>
<td>[Online supplement reference list 91,118]</td>
</tr>
<tr>
<td>4E.2</td>
<td>In uncooperative children (younger than 6 years), CTs can be acquired during free breathing with fast multi-slice CT-scanners, in order to avoid risks related to general anaesthesia and sedation.</td>
<td>Recommendation</td>
<td>Grade B</td>
<td>High</td>
<td>[Online supplement reference list 64, 92]</td>
</tr>
<tr>
<td>4.E3</td>
<td>Image quality of MRI varies between MR brands and full clinical implementation will require further development and validation work through multicentre standardization to support its use as radiation-free outcome measure of lung disease.</td>
<td>Recommendation</td>
<td>Grade C</td>
<td>High</td>
<td>[Online supplement reference list 145, 160]</td>
</tr>
<tr>
<td>4E.4</td>
<td>To maximize the potential of CT and MRI markers in clinical studies and advance treatment of CF disease progression, efforts should be made to develop data repositories, promote standardization and conduct reproducible research.</td>
<td>Recommendation</td>
<td>Grade I</td>
<td>Moderate</td>
<td>[Online supplement reference list 135]</td>
</tr>
</tbody>
</table>
### 4E.5 Inflammation MRI

- **A.** Quantification of volume of high T2-weighted signal is a promising quantitative outcome measure of lung inflammation.

- **B.** Diffusion weighted Magnetic Resonance Imaging (DWI-MRI) is a promising imaging method for non-invasive detection of pulmonary inflammation during pulmonary exacerbation, and might be used to monitor treatment efficacy of anti-inflammatory treatment.

| Statement of fact |  /// | Low | [Online supplement reference list 8, 24, 25] |

### 4.E6 Ventilation/Perfusion MRI

- **A.** SI and lung volumes are potential MRI quantitative parameters to detect lung impairment, as expressed by low intensity region.

- **B.** Fourier Decomposition MRI is a reliable quantitative parameter of ventilation (and perfusion) in CF lung disease.

- **C.** Hyperpolarized gas quantitative ventilation MRI parameters correlate with amount of trapped air in early CF lung disease as expressed by lung function and can have an impact on therapy management.

- **D.** Ventilation MRI with Fluorinated gas technology is not currently as well developed as hyperpolarized gas MRI, but there is a strong potential for using it in similar conditions.

| Statement of fact |  /// | Moderate | [Online supplement reference list 9, 45, 52, 102, 110] |

And [Online supplement reference list 31, 49, 50, 152]
<table>
<thead>
<tr>
<th>applications in the future</th>
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<tbody>
<tr>
<td>E. Limited post-processing tool hamper translation of this techniques in clinical practice.</td>
</tr>
</tbody>
</table>