Justification of radiological procedures in COVID-19 pandemic based on radiation risk only

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Purpose. Radiologic procedures are recommended based on benefit-to-risk justification. In X-ray imaging, while the benefit is often immediate for the patient, the associated radiation burden risk is a longer-term effect. Such a temporal gap can bias the justification process in imaging utilization, particularly during a spreading pandemic like COVID-19 in which fast and accurate diagnostic tools are highly needed. Chest CT and chest radiography (CXR) have shown promising results in the diagnosis and management of COVID-19, providing support to the standard RT-PCR test. However, several institutions are discouraging the use of imaging for this purpose, partly due to radiation risk. This study aims to provide quantitative data towards an effective risk-to benefit analysis for the justification of radiological studies in the diagnosis and management of COVID-19 to guide clinicians and decision making.

Materials and Methods. The analysis was performed in terms of mortality rate per age group. COVID-19 mortality was extracted from epidemiological data across 159,107 patients in Italy. For radiological risk, the study considered 659 Chest CT scans performed in adult patients. Organ doses were estimated using a Monte Carlo based method and then used to calculate a risk index that was converted into a related 5-year mortality rate (SEER, NCI).

Results. COVID-19 mortality showed a rapid rise for ages >30 years old (min: 0.30%; max: 30.20%). Only 1 death was reported in the analyzed patient cohort for ages <20 years old. The mortality rates based on radiation exposure decreased across age groups. The median mortality rate across all ages for Chest CT and CXR were 0.72% (min: 0.46%; max: 1.10%) and 0.03% (min: 0.02%; max: 0.04%), respectively.

Conclusions. Radiation risk is not the only factor that should be taken into account for justifying the use of imaging in COVID care; nonetheless, it is an essential factor of consideration. The risk associated with COVID-19, CT, and CXR exhibited different magnitudes and trends across age groups. In higher ages, the risk of COVID-19 far outweighed that of radiological exams. Based on risk comparison alone, CXR and Chest CT are justified for COVID-19 care of patients older than 30 and 50 years old, respectively.

Clinical Relevance statement

Towards a comprehensive radiological procedures risk-to-benefit assessment, CT and CXR should not be *a priori* excluded in the diagnosis and management of the COVID-19.

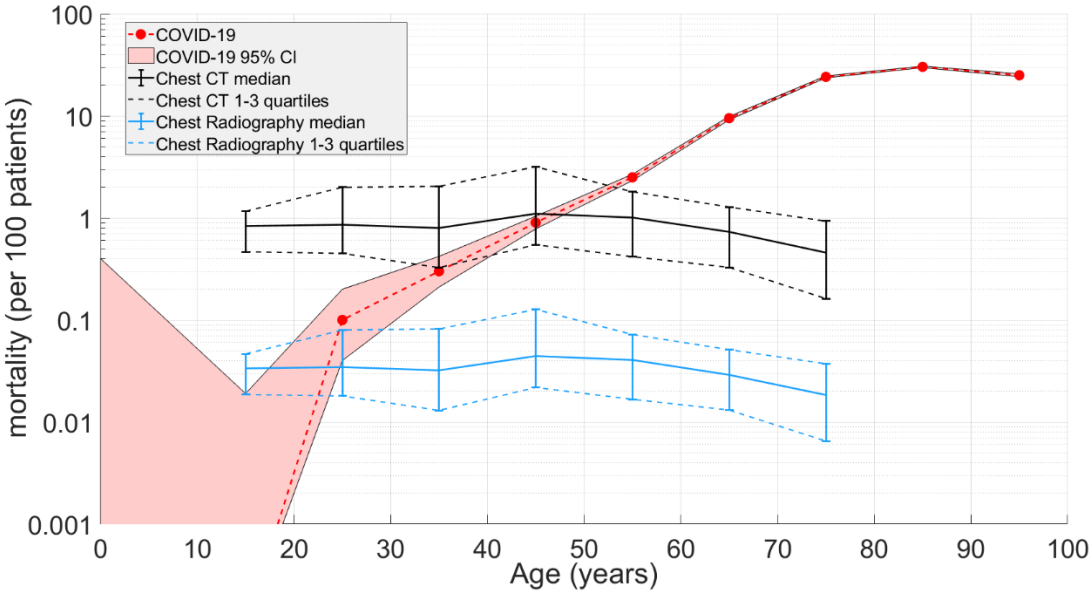

Figure 1. COVID-19 mortality per age (red) compared to those from radiation used in Chest CT (black) and Chest radiography (blue).