Applicant name: Yashwin Ram Nair Sredharan
Grade: Foundation Year 2 Doctor
Hospital: Aberdeen Royal Infirmary, Scotland, UK
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How could the Covid-19 pandemic change the way Radiologists work in the future?

In December 2019, the first case of Coronavirus 2019 (COVID-19) was reported in Wuhan, China. An infectious disease caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), it spread rapidly and was officially declared a pandemic by the World Health Organisation (WHO) on 12 March 2020.[1] A primarily respiratory illness, radiologists worldwide were called upon to uncover and analyse the diagnostic role of chest imaging in COVID-19 disease. Patients with any respiratory symptom was suspected of COVID-19, leading to an influx in chest imaging requests and pressure on imaging departments to characterise the changes seen in COVID-19 disease. The collective effort to understand and adapt to the disease along with the social circumstances brought on by it has certainly changed the way radiologists work.

One of the key changes due to the pandemic was the increased use of home stations for radiologist. The teleradiology model for home reporting was well established prior to the pandemic.[2] Teleradiology service providers such as Medica Group that was established over a decade ago have already been employed by the National Health System (NHS) to assist in reporting imaging backlogs and provide out of hours' acute reporting services to NHS Trusts and Health Boards. However, as the pandemic unfolded and social restrictions came into force in UK, imaging departments needed to re-organise their physical space to meet with social distancing requirements. As numerous imaging departments have shared reporting rooms, the physical distancing measures meant that there was a reduction in number of available work stations, directly reducing their reporting capacity. Furthermore, there was an anticipation of staffing shortages as clinically vulnerable staff members were shielding at home while those that were in close proximity to individuals with COVID-19 symptoms had to self-isolate for up to 14 days. The limitation in resource seriously questioned the capability of radiology departments to continue to work at full capacity through hospital-based service alone. Unsurprisingly, there was an increased demand and desire for work at home arrangements which consequently led to the Royal College of Radiologist (RCR) issuing guidance to support prompt distribution of home-reporting systems during the pandemic.[3]

A survey of UK radiology departments by Callaway et al. revealed an increase of 147% in remote access viewing and reporting systems with 578 consultant radiologists having remote access pre-pandemic to 1431 during the first wave. [4] The authors approximate 50-53% of all UK radiologist now have home reporting access as opposed to the 19-22% prior to the pandemic, representing the efforts by NHS Health Boards to deal with the circumstances brought by the first wave of the pandemic. This move not only allows imaging departments to meet the demand of emergency and elective reporting, but also provides added flexibility in the working life of a radiologist. While lack of funding is noted to be a barrier of further expansion of home-reporting services, it could be addressed with demonstration of sustained reporting capacity despite the physical limitations necessitated by the pandemic. Home work stations could potentially be cost-effective as the increase in reporting capacity and flexibility might reduce the reliance of NHS Trusts on teleradiology providers to fulfil their reporting obligations. While it is unclear how long social and physical distancing measures will be in place, the ability for a radiologist working at home to not only fulfil their reporting obligations,

but also participate in virtual multi-disciplinary team meetings is an attractive option which is likely to expand following the pandemic.

While the use of artificial intelligence (AI) in radiology is still a highly contested topic, the role of AI seen in various other countries to deal with the circumstances brought on by the pandemic highlights the impact and the likelihood of contributions of AI in the future. At the start of the pandemic in Italy, the Society of Medical and Interventional Radiology (SIRM) issued a statement supporting research on the use of AI as a predictive and prognostic tool but disapproved of the use of chest CT with AI as a first-line or screening measure to diagnose COVID-19.[5] As part of the European response to the pandemic, an "AI-ROBOTICS vs COVID-19 initiative" was launched by the European AI alliance, indicating the expectations the commission towards artificial intelligence.[6] A retrospective and multi-centre study by Li et al.[7] applying a deep learning model called COVID-19 detection neural network (COVNet) concluded that the deep learning model could effectively assist in the differential diagnosis and accurately detect COVID-19 disease. Additionally, another study by Mei et al.[8] used AI algorithms to consolidate chest CT findings with clinical features, laboratory results, and exposure history to swiftly diagnose COVID-19 positive patients. The authors compared the detection rate of the AI system to a senior thoracic radiologist and concluded there was similar accuracy, further illustrating the potential role of AI as a screening tool for COVID-19.

In Brazil, the Hospital das Clínicas innovation centre in partnership with the federal government and private sector created RadVid-19 project to enable faster diagnosis and provide assistance to hospitals without chest radiologists during the pandemic.[9] Forty-seven hospitals from all Brazilian states could transmit CT chest images to the central database using this AI platform (Fig 1) in which two AI algorithms (Huawei and Siemens) returns a report after analysing the probability of COVID-19 along with the degree of affected lung parenchyma (Fig 2)[10]. The service is operational and accessible at all times with a report being deliver within 10 minutes. An important lesson from RadVid-19 is that the use of artificial intelligence has the potential to democratise knowledge and reduce health inequality by providing imaging interpretation from rural parts of the country.

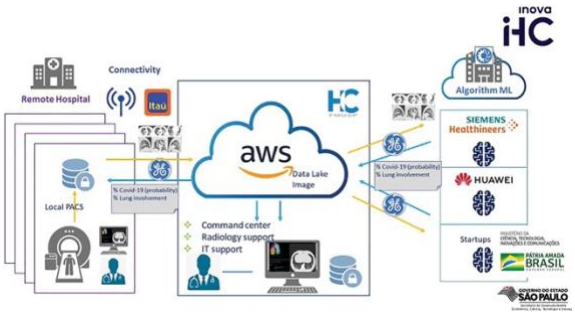

Figure 1: Diagram of the COVID-19 chest artificial intelligence workflow in RadVid-19

Figure 2: Screenshot from the Brazilian coronavirus disease 2019 (COVID-19) chest CT database

In the UK, the Getting It Right First Time (GIRFT) national report published in November 2020 acknowledged that there is a growing recognition across the whole NHS of the potential impact of AI particularly in radiology for automated image interpretation. While the author suggest that AI still requires further development and testing before it can be part of everyday radiology, the Topol Review[11] predicts that around 50% of radiology reporting could be supported by AI within the next decade. The pandemic has certainly influenced AI research so radiologist should expect that AI would have clinical use in the near future.

Another key takeaway from the COVID-19 pandemic from a radiologist perspective was the increased use of structured reporting templates. As radiology reports form part of a patient's health record, there is a shift from traditional format of free-text reporting to more structured reporting. Many international radiology societies recognise the benefit of uniform language and structure for the accurate description of radiological findings. Standardisation of structure ensures all relevant areas are addressed, while standardisation of terminology eliminates ambiguity in imaging reports, reducing discrepancies and thus facilitating comparability of reports. The European Society of Radiology (ESR) endorses the move away from conventional prose reporting to more structured reporting, recognising that global collaboration is required to adopt international designs of structured reporting templates which are readily translated and adapted to different health care systems.[12]

The global effort to deal with the pandemic has led to the development and widespread use of COVID-19 specific reporting templates to enable data collection and analysis. For example, the Society of Medical and Interventional Radiology (SIRM) in Italy released chest X-ray and CT reporting templates available in multiple languages, to standardise the reporting of features in COVID-19 disease.[13] Similarly in the UK, the British Society of Thoracic Imaging (BSTI) released CT and CXR proformas along with baseline and follow up reporting codes to aid in standardisation of reporting and enable data comparability.[14] In addition to COVID-19 related templates, the Radiological Society of North America (RSNA) have released an online free library consisting of various structured imaging templates designed by experienced radiologists, and reviewed by an international panel from the RSNA and ESR.[15] While some forms of dedicated terminology have become common practice such as the use of ultrasound "U" classification for thyroid nodules or TNM staging for malignancy, the benefit of a structured reporting template to reduce ambiguity and aid in future research highlighted by COVID-19 suggests that radiologist should welcome the idea of such templates.

The dwindling of cases with vaccination and easing of social restrictions are hopeful signs for the future. However, the delay in procedures for non-COVID-19 patients due to diversion of resources to deal with the pandemic has yet to be addressed. While it can appear daunting for imaging departments to deal with the expected increase in workload due to the backlog, the strategies employed in the pandemic such as the use of teleradiology, AI technology and structured reporting template are among the necessary steps to overcome the challenge. Traditional radiologists might struggle with the idea of such drastic changes but a key trait highlighted by the pandemic is adaptability. Radiologists need to learn from the pandemic and be receptive to future changes, by adapting their practice with the aim of increasing capacity and improving patient outcomes.

1. World Health Organization. WHO announces COVID-19 outbreak a pandemic. http://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/news/news/2020/3/who-announces-covid-19-outbreak-a-pandemic. Published March 12, 2020.
2. European Society of Radiology (ESR) ESR white paper on teleradiology: an update from the teleradiology subgroup. Insights Imaging. 2014; 5: 1-8https://doi.org/10.1007/s13244-013-0307-z
3. Interim R.C.R. Guidance to enable remote reporting during the pandemic. https://www.rcr.ac.uk/sites/default/files/interim-guidance-to-enable-remote-reporting-during-the-pandemic.pdf. Date accessed: April 29, 2021
4. Callaway M et al., Accelerated implementation of remote reporting during the COVID-19 pandemic, Clinical Radiology, https://doi.org/10.1016/j.crad.2021.01.004
5. Neri, E., Miele, V., Coppola, F. et al. Use of CT and artificial intelligence in suspected or COVID-19 positive patients: statement of the Italian Society of Medical and Interventional Radiology. Radiol med 125, 505–508 (2020). https://doi.org/10.1007/s11547-020-01197-9

6. https://ec.europa.eu/futurium/en/ai-robotics-vs-covid19/join-ai-robotics-vs-covid-19-initiative-european-ai-alliance. Accessed 23 Apr 2021
7. Li L, Qin L, Xu Z et al (2020) Artificial intelligence distinguishes COVID-19 from community acquired pneumonia on chest CT. Radiology. https://doi.org/10.1148/radiol.2020200905
8. Mei, X., Lee, HC., Diao, Ky. et al. Artificial intelligence–enabled rapid diagnosis of patients with COVID-19. Nat Med 26, 1224–1228 (2020). https://doi.org/10.1038/s41591-020-0931-3
9. RadVid19. https://radvid19.com.br/. Date accessed: April 29, 2021
10. RSNA International Trends: A Global Perspective on the COVID-19 Pandemic and Radiology in Late 2020 Bien Soo Tan, N. Reed Dunnick, Afshin Gangi, Stacy Goergen, Zheng-Yu Jin, Emanuele Neri, Cesar Higa Nomura, R. D. Pitcher, Judy Yee, and Umar Mahmood. Radiology 2021 299:1, E193-E203
11. https://topol.hee.nhs.uk/the-topol-review/
12. European Society of Radiology (ESR). ESR paper on structured reporting in radiology. Insights Imaging. 2018;9(1):1-7. doi:10.1007/s13244-017-0588-8
13. https://www.sirm.org/en/2020/03/31/covid-19-structured-report/. Date accessed: April 29, 2021
14. https://www.bsti.org.uk/covid-19-resources/covid-19-bsti-reporting-templates/. Date accessed: April 29, 2021
15. https://radreport.org/. Date accessed: April 29, 2021