




Teleworking beyond teleradiology: managing radiology departments during the COVID-19 outbreak

Teodoro Martín-Noguerol¹ · Rafael Lopez-Ortega¹ · Pablo R. Ros² · Antonio Luna¹ 

Received: 29 June 2020 / Accepted: 19 August 2020 / Published online: 2 September 2020
© European Society of Radiology 2020

Abstract

Teleradiology solutions are playing an essential role during the COVID-19 outbreak. Activity at radiology departments must be maintained and adapted to this new situation beyond teleradiology. Teleworking should be extended to the rest of non-medical radiology department areas. A comprehensive perspective based on our own experience during the COVID-19 outbreak has been performed highlighting the value of teleworking for almost all areas implied in the workflow of radiology departments beyond radiologists. Personal and technical requirements for successfully adapting to this new scenario are discussed including the opportunities that this unprecedented situation is bringing for reorganizing workflow and developing new projects.

Key Points

- *Teleradiology solutions are playing an essential role during the COVID-19 outbreak.*
- *Teleworking should be extended to the rest of non-medical radiology department areas whenever possible.*

Keywords Teleradiology · Teleworking · COVID-19

Healthcare is one of the most important services to preserve in the COVID-19 pandemic. Along with personal hygiene measures, social distancing, lockdowns, and isolation strategies, the implementation of teleworking is helping minimize the expansion of COVID-19 [1]. Invaluable efforts are being made using telemedicine solutions attempting to monitor, keep in contact, and perform surveillance tasks in both symptomatic and asymptomatic COVID-19 patients, as well as follow-up of recovered patients in their homes [2, 3].

Radiology is playing a key role in this pandemic, particularly with the use of X-ray and computed tomography to assess lung involvement by COVID-19 [4]. Nevertheless, radiologists, radiographers, and nursing staff need to be protected from COVID-19. Radiology departments (RDs) are implementing several protective measures focusing on personal protective equipment, differentiating clean and dirty scanning rooms, distinct patient circuits for suspicious and non-suspicious COVID-

19 patients, sending external patients to other centers, reinforced disinfection protocols, and even new personnel policy, such as decentralized and alternating shifts among staff or establishing parallel teams where possible [4–7].

In this scenario, the use of teleradiology and the boost of teleworking solutions are helping to cope with the new paradigm imposed by COVID-19. Radiology is one of the medical specialties with a greater degree of digitalization, and teleradiology is commonly used in many RDs and practices (Table 1) [8, 9]. Imaging sharing has reduced costs and has granted electrical access to medical images to both referring physicians and patients, without needing to carry and store traditional physical media [10]. Teleradiology functions include remote access to radiology information system (RIS) and Picture Archive and Communication System (PACS), Web visualization of clinical history and prior imaging studies, and reporting capabilities to radiologists. Moreover, continuous contact with clinicians for solving specific questions about radiological exams and reports can be maintained by using telecommunications solutions. Teleradiology allows preserving a small group of radiologists on site and the rest of the group safely working from home in order to minimize the risk of cross infections [11]. Highly demanding laws on patient data confidentiality and privacy require the highest level of security and appropriate training to all users. To

✉ Antonio Luna
aluna70@htmedica.com

¹ MRI Unit, HT Medica, Carmelo Torres 2, 23007 Jaén, Spain

² Department of Radiology, Stony Brook University, Stony Brook, NY, USA

Table 1 Main features of teleradiology for a radiology department

Feature	Commentary
Staff	Radiologists
Required infrastructure	Encrypted protocols for safe sending and receiving radiological images and patient's data. Regular home fiber connections Server-based or cloud-based solutions (VPN) IT support Remote access to RIS and PACS from radiologist's PC.
Activity	Control radiological exam quality Resolve technical and clinical queries Perform and sign radiological reports
Advantages	Remote access to medical images and clinical history Cost savings Risk reduction Productivity increases Improve after-hours coverage Subspecialty reads
Disadvantages	No physical or geographical barriers Depersonalizes radiology and medicine Dependence on IT and telecommunications

VPN Virtual Private Network, IT information technology, RIS radiology information system, PACS Picture Archiving and Communication System, PC personal computer

achieve this goal, several answers have been proposed, such as server-based and cloud-based solutions including the use of safety Virtual Private Networks (VPN) using safe encrypted protocols. In this setting, information technology (IT) continuous remote technical support is essential for solving teleradiology issues [12]. Finally, specific training not only must include technical aspects of teleradiology, but also must incorporate legal and ergonomics features.

With the advent of COVID-19 crisis, governments and healthcare institutions are requiring shifting non-essential on-site work to telework. It is obvious that ultrasound and interventional procedures as well as nursing or reception staff will hardly be able to take account of these recommendations. We are also aware that workflow and staff requirements may vary depending on private practice or RDs of university or academic hospitals. Nevertheless, RDs go beyond the classical clinical activity. IT, administrative (including scheduling, operations, human resources, marketing, and billing), and research staff must also keep operating. Transition of all operative areas to a full teleworking experience is not easy and needs a strong IT infrastructure, including remote connection to the electronic health record (EHR) or hospital information system (HIS). There is also a need to provide access to Admission, Discharge, and Transfer (ADT) systems, and billing and auditing systems to maintain the basic functions of a RD, particularly processes linked to patient throughput, safety, and experience (Table 2).

Another important requisite for successfully implementing teleworking is the collaboration of all the RD members. First, direct communication will help in this task, being important to establish solid networks between all the personnel involved in telework in an intent to minimize disinformation or isolation. Furthermore, an essential point to maintain telework effectiveness is to allow a flexible schedule for teleworking people. This approach can facilitate an easier combination of telework with new family situations, as having children at home around the clock, and personal life, considering that now both occur in the same scenario and at the same time.

The use of Web-based scheduling solutions helps protect the patient's health minimizing the risk of potential new infections and plays an important role in preparing safe worklists. In this sense, it is critical to minimize the stay of patients in the RD, which can be achieved by solving all the administrative duties during the on-line scheduling process. Another key measure we strongly recommend is to increase the time slots between radiological exams to facilitate proper equipment cleaning between patients [1].

Education and continuous training during COVID-19 outbreak also must continue. To invest resources in these areas as well as in researching may be one of the best decisions in the current situation, making them stronger to face the current COVID-19 outbreak and other related future challenges. Due to the inherent changes on workflow and workload, radiologists can spend more time helping research groups to

Table 2 Main features of teleworking for a radiology department

Feature	Commentary
Staff	IT BME and Physicists Administrators Maintenance Billing office HR specialists Scheduling Researchers
Required infrastructure	Encrypted protocols for safe sending and receiving patient's data. Regular home fiber connections Server-based or cloud-based solutions (VPN) IT support Remote access to RIS, HIS or EHR from staff's PC Specific software platforms for research, education, analytics, and team collaboration
Activity	IT: technical support to the rest of staff BME: Development and implementation of AI solutions Administrators: regulate internal and external workflow Maintenance: prevent, identify, and solve structural issues Billing office: manage, receive, and pay invoices Operations: improve patient workflow and throughput Scheduling: accomplish and coordinate scheduling HR selection of suitable personal, maintaining an optimal workforce
Advantages	Remote access to radiological department resources Centralized management Cost saving Risk reductions Productivity increases Externalization of specific services (maintenance)
Disadvantages	No physical or geographical barriers Minimized patient contact Difficult to deal with personal problems Diminished interpersonal communication Dependence on IT and telecommunications

IT information technology, *BME* biomedical engineer, *HR* human resources, *VPN* Virtual Private Network, *RIS* radiology information system, *HIS* hospital information system, *EHR* electronic health record, *PC* personal computer

develop and move projects forward [13]. Improvement and updating protocols, performing internal audits, online continuous training of fellows or residents, completing unfinished scientific manuscripts, and development of artificial intelligence (AI) algorithms for COVID-19 and for other clinical-radiological purposes are among the wide range of opportunities this unexpected situation is providing us. The use of teleconference platforms, shared calendars, and worksheets reflecting project status including deadlines will help organize the team, and everyone will know their commitments at each point in time.

In our opinion, teleworking is allowing reduction of the impact of COVID-19 outbreak and preserve healthcare-related activities in RDs including workload. Telework goes beyond conventional teleradiology and may be applied to other RD areas, maintaining activity and even increasing productivity in other areas such as administrative, operations, education, and research units or updating strategies for optimizing workflow and safety policies. All these efforts in stabilizing and adapting resources for teleworking during COVID-19 crisis are expected to be positive for RDs and its workforce in the short term.

Funding The authors state that this work has not received any funding.

Compliance with ethical standards

Guarantor The scientific guarantor of this publication is Antonio Luna, MD, PhD.

Conflict of interest Antonio Luna, MD, PhD, declares relationships as occasional lecturer with the following companies: Canon, Siemens Healthiners and Philips. The rest of the authors of this manuscript declare no relationships with any companies, whose products or services may be related to the subject matter of the article.

Statistics and biometry No complex statistical methods were necessary for this paper.

Informed consent Written informed consent was not necessary for this study.

Ethical approval Institutional Review Board approval was not required because this article is an opinion editorial.

Methodology

- Opinion article, no research has been conducted.

References

- Cheng LT-E, Chan LP, Tan BH et al (2020) Déjà vu or jamais vu? How the severe acute respiratory syndrome experience influenced a Singapore radiology department's response to the coronavirus disease (COVID-19) epidemic. *AJR Am J Roentgenol* 214:1206–1210
- Ohannessian R (2015) Telemedicine: potential applications in epidemic situations. *Eur Res Telemed* 4:95–98
- Ohannessian R, Duong TA, Odone A (2020) Global telemedicine implementation and integration within health systems to fight the COVID-19 pandemic: a call to action. *JMIR Public Health Surveill* 6:e18810
- Revel MP, Parkar AP, Prosch H et al (2020) COVID-19 patients and the radiology department – advice from the European Society of Radiology (ESR) and the European Society of Thoracic Imaging (ESTI). *Eur Radiol* 20:1–7. <https://doi.org/10.1007/s00330-020-06865-y>
- Ai T, Yang Z, Hou H, Zhan C et al (2020) Correlation of chest CT and RT-PCR testing in coronavirus disease 2019 (COVID-19) in China: a report of 1014 cases. *Radiology*. 2020. <https://doi.org/10.1148/radiol.2020200642>
- Politi LS, Balzarini L (2020) The radiology department during the COVID-19 pandemic: a challenging, radical change. *Eur Radiol Springer* 3600–3602. <https://doi.org/10.1007/s00330-020-06871-0>
- Ding J, Fu H, Liu Y et al (2020) Prevention and control measures in radiology department for COVID-19. *Eur Radiol* 30:3603–3608
- Caramella D, Lencioni R, Mazzeo S, Bartolozzi C (1994) Transmission of radiological images using broadband communications. *Eur Radiol* 4:377–381
- Benjamin M, Aradi Y, Shreiber R (2010) From shared data to sharing workflow: merging PACS and teleradiology. *Eur J Radiol* 73:3–9
- Silva E, Breslau J, Barr RM et al (2013) ACR white paper on teleradiology practice: a report from the task force on teleradiology practice. *J Am Coll Radiol* 10:575–585
- Tridandapani S, Holl G, Canon CL (2020) Rapid deployment of home PACS workstations to enable social distancing in the coronavirus disease (COVID-19) era. *AJR Am J Roentgenol* 215:1–3
- European Society of Radiology (ESR) (2014) ESR white paper on teleradiology: an update from the teleradiology subgroup. *Insights Imaging* 5:1–8
- Boeken T, Le Berre A, Mebazaa A, Boulay-Coletta I, Hodel J, Zins M (2020) Non-COVID-19 emergencies: where have all the patients gone? *Eur Radiol*. <https://doi.org/10.1007/s00330-020-06961-z>

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.