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Review

Remote reporting in the COVID-19 era: from pilot study to practice

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AIM: To assess the benefits and challenges of remote reporting using an intra-departmental teleradiology system.

MATERIALS AND METHODS: A pilot of an in-hospital Trust radiologist reporting on in-hospital Trust patients via a remote login was undertaken. Reporting output, training impact, and quality improvement were measured.

RESULTS: Reporting output increased by 140%. Trainee satisfaction was high in a qualitative survey, particularly for out-of-hours support and teaching. Clinicians found the service to be similar to the same service provided by a locally based radiologist.

CONCLUSION: In the COVID-19 era, remote working has developed rapidly. This study shows that radiology departments can provide remote reporting that is equal in standard to reporting from within the hospital, and in addition, that there are advantages to output and training.

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Introduction

Since March 2020, the COVID-19 pandemic has accelerated a revolution in healthcare.¹ Clinical staff in both hospital and community settings have moved rapidly to remote working using a variety of platforms. Radiology may seem ideally suited to remote working, but similar to other branches of healthcare, needs to recognise and address the challenges.²

Teleradiology has been widely available for the last 15 years, used for in-house image distribution, on-call, and outsourcing,³ delivering better distribution of work and enabling collaboration between radiologists. Teleradiology

is used worldwide with most radiologists considering that quality and safety-assurance measures need to be built into standards of practice.^{3,4} In the UK, multiple teleradiology companies have delivered predominantly outsourced radiology reporting for NHS Trusts using FRCR or equivalent radiologists who are employed by the teleradiology company rather than the hospital or institution at which the patient is scanned and seen. In the majority of cases, the radiologist and referring clinician will not work at the same hospital and mitigating strategies are employed to overcome the barriers of insufficient integration of patient history and prior examinations as well as limited communication with clinicians.³ In parallel, regional in-

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sourcing of radiology reporting has also been developed. In this model, both radiologists and referring clinicians are from the same region, and therefore, more likely to know each other and have worked together or worked together at intra-regional multidisciplinary meetings.³

At Imperial College NHS Trust, a variant of remote desktop access was set up to provide a teleradiology solution. The solution was provisioned using VMware's VDI (Virtual Desktop Infrastructure) and either a link to the solution via an app on the user's home personal computer (PC) or a dedicated Wyse thin or zero client connected to the user's network. This system was piloted 2016–2020.

Materials and methods

As this was a quality-improvement project, ethical approval was not sought according to NHS Health Research Authority criteria.⁵

In June 2019, a 3-month pilot study of distant time-shifted in-hospital Trust remote reporting was carried out by a single consultant radiologist (17 years in post), operating remotely from Sydney, Australia. The radiologist logged onto the virtual desktop system during local daytime hours (Sydney = GMT +9 to +11) thereby logging on overnight UK time. The radiologist used ultra-high-definition monitors (Dell UP2716D monitors, screen resolution 2,560×1,440, screen size 27") supplied by Everlight Radiology Ltd. Quality assurance with AAPM (American Association of Physicists in Medicine) test images was performed in accordance with local Trust policy and compliance with digital imaging and communications in medicine (DICOM). Greyscale standard display function (GSDF) was performed locally.⁶ Once logged onto the virtual desktop, the radiology information system (RIS; Soliton Radiology 2.2.2.1808) and picture archiving and communication system (PACS; Carestream 12.1.6.1005) functioned as normal. The radiologist had access to almost exactly the same systems as they would in the hospital: nhs.net email, the RIS (Soliton) messaging system, as well as unlimited telephone calls to all UK telephone numbers. A speech mike was not used and the radiologist did not directly access patient electronic notes for technical reasons. Only Imperial College NHS Trust work was carried out during the pilot, which was indemnified by both NHS indemnity and the radiologist's personal medical indemnity on condition that the work consisted of "scans undertaken in the UK". The remote reporting radiologist was able to report routine computed tomography (CT) and magnetic resonance imaging (MRI) as well as to check/authorise out-of-hours on-call reports from radiology registrars.

Outcome measures collected included: (1) reporting productivity over 4 weeks pre-pilot versus during the pilot; (2) time taken to consultant authorisation for out-of-hours on-call reports initially provisionally reported by registrars, comparing two 3-week periods filtered by authorisation of out-of-hours report. The average time in the baseline period was compared with the average time in the remote working period; (3) qualitative gain in out-of-hours and in-hours

support for registrars on-call; and (4) clinician feedback via a retrospective survey sent to 75 members of the trauma and emergency team, in May 2020, selected via email, asking for clinician experience of radiology remote reporting with the opportunity for personal email feedback as well.

Results

Reporting productivity for the same number of direct clinical care (DCC) sessions was 140% greater comparing all studies reported in a 4-week period prior to the pilot (at the base hospital) with all studies reported in a 4-week period during the pilot (remote reporting via a virtual desktop). The case mix included out-of-hours work and routine musculoskeletal and general CT and MRI studies. Although some increase in productivity could be expected due to lack of multidisciplinary team (MDT) time during the pilot, this was counterbalanced by expected decreased productivity due to lack of voice recognition.

Time taken to consultant authorisation for out-of-hours on-call reports initially provisionally reported by registrars decreased from an average of 13.52 h (17 cases) in a 3-week baseline period to 8 h 18 min (42 scans authorised) during the pilot (see [Table 1](#)). This represented a 40% reduction in time for consultant authorisation of the registrar provisional report.

Qualitative feedback from radiology registrars was overwhelmingly positive ([Fig 1](#), sample quotes). Registrars commented that they liked the chance to review cases via the telephone, creating new out-of-hours learning opportunities.

A retrospective survey sent to 75 multidisciplinary acute and trauma team members (10 responses) asked those who had interacted with the remote radiologist to reflect on their experience of the pilot. It revealed that 70% were aware that the reporting service was being provided remotely. Overall, the service was rated as slightly better than usual. Individual qualitative responses are included below ([Fig 2](#); [Table 2](#)).

Discussion

This remote reporting in-Hospital was different to other UK teleradiology solutions in several respects. The reporting

Table 1

Efficiency gains: evaluation of two 3-week periods filtered by authorisation of out-of-hours reports by a remote radiologist.

	Period 1 (baseline)	Period 2 (remote working)
No. scans authorised following issue of provisional out-of-hours report	17	42
Average time from provisional reporting to authorisation	13 h 52 min	8 h 18 min ^a

^a Forty percent reduction in time taken for provision of consultant-authorised final report.



Figure 1 Qualitative feedback from trainees: sample quotes.

radiologist was an in-hospital Trust radiologist reporting only hospital Trust patients and communicating with in-hospital Trust clinical colleagues with whom the reporting radiologist had an established longstanding clinical and collegiate relationship. This represents the most integrated form of a patient care pathway.

The system encrypted the image data end to end and, as the data did not have to be migrated to a different radiology system with servers outside of the EU, was secure and compliant with GDPR (General Data Protection Regulations).

The remote reporting explicitly incorporated clinical training of radiology registrars both in and out-of-hours. To the authors' knowledge, no previous study has examined this aspect, although feasibility, quality, health outcomes, and cost effectiveness have all been studied.⁴

The pilot incorporated the use of the RIS messaging service for the remote reporter to communicate directly with both trainees and other Consultants. To the authors' knowledge this has not been previously commented on in a remote reporting pilot.⁷

The pilot enabled the Trust to roll out widespread remote reporting at the beginning of the COVID-19 pandemic with almost all radiology consultants set up to report remotely by the beginning of lockdown. The remote reporting pilot has even greater relevance as multiple Trusts have turned to remote working in the era of the COVID-19 pandemic. There has been a national realisation across healthcare, as for other workplaces, that remote working is desirable for the duration of the pandemic and that remote working should be optimised to provide a service as good as that seen in traditional in-hospital Trust settings. Additionally, there is a growing realisation that working patterns will likely be permanently changed.¹

This pilot shows the benefits of remote reporting: greater productivity, faster senior authorisation of out-of-

hours work, and potential better outcomes for patients, the ability to teach out-of-hours, as well as to provide greater support to trainees on-call. In this pilot, as the consultant authorising and reviewing out-of-hours studies was working in daytime hours, the effects of sleep disruption should have been mitigated.⁸ Importantly, although clinicians felt the service that they received was near-equivalent (whether delivered from the hospital or remotely), the qualitative feedback flagged up key negatives, e.g., "I couldn't call to discuss", "losing Dr X as a regular point of contact was felt by our team". A remote reporting service has to not only deliver a technologically seamless service, but also to deliver communication with the clinical teams at least as good as that given in person; be that an MDT, ward round, or in an "in-corridor" interaction.^{3,9,10} The remote reporter has to work harder to maintain good communication — provide easy to access telephone, email, and message services — and most of all, reach out to Clinicians. In-hospital remote reporting should not be an excuse for a radiologist to disappear into their reporting room forever; this will diminish any further interaction with clinicians.

This study had some limitations. The increased productivity of 140% may, in part, have been due to no MDT commitment during the remote reporting period; however, this was likely balanced, or possibly even outweighed, by the lack of voice recognition dictation in the pilot set-up, which required the reports to be typed by the radiologist. Therefore, the authors believe this was a real increase. Secondly, the comments from clinicians such as "I couldn't call to discuss", "losing Dr X as a regular point of contact was felt by our team" may already be out-of-date, as staff across the NHS adjust to remote working, realising the benefits of seeing each other at digital MDTs, and communicating via digital messaging systems in the 2020 pandemic and beyond.

2. How would you rate the service provided?



Figure 2 Average rating of service provided by clinicians (n=10), compared to normal reporting service (average 60%).

Table 2

Individual responses and comments from clinicians regarding remote-reporting in-house radiology reporting service.

- Reports up to usual excellent standard, I think they were turned around even faster
- The reporting was not affected at all but losing Dr X as a regular point of contact for radiology issues was felt by our team
- I thought it was excellent to have the support of you/consultant radiologist overnight to expedite care in the most time sensitive patients. It has been shown in many specialties that shorter time to definitive diagnosis saves lives and money
- I didn't know about this but I know some hospitals use services from Australia for out-of-hours reporting and they can also be called to discuss. Much better to keep in-house
- I didn't know you had done this but sounds like a great idea! Don't some hospitals get their OOH CTs reported in Australia anyway because of the time difference?
- Seemed seamless, no problems, only problem was I couldn't call to discuss
- Very reassuring as trauma team leader to have support of consultant radiologist overnight. This expedited management of care in many cases
- Great service delivery and much appreciated
- Really useful

OOH, out of hours.

In conclusion, this pilot study has relevance for all radiologists and radiology service providers in the COVID-19 and post-COVID-19 era, not only because it showed better productivity and shorter time to consultant authorisation. The positive feedback from clinicians and opportunities for increased support of registrars suggest potential benefits to training, and therefore, patient care. Radiologists need to provide the best clinical service possible and also continue to train and learn from colleagues: remote reporting can enable this.

Conflict of interest statement

E.A.D. was hosted by Everlight Radiology Ltd in Sydney June to Sept 2019, and in return delivered two webinars for Everlight. No other conflict of interest for the authors.

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