Clinical
Radiology

The Royal College of Radiologists

Homeworking
for radiologists

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Contents

Executive summary

The massive expansion of home reporting by radiologists proposed by Getting It Right First Time (GIRFT) and accelerated by COVID has brought many changes to the specialty. This document is intended to enable departments to harness such changes for better patient outcomes. While home reporting offers flexibility and reduced commuting as well as uninterrupted reporting time, an adequate on-site presence remains important to provide leadership for teams and appropriate input for clinical colleagues and trainees.

A radiologist reporting from home needs to be enabled to work in the same way as if on-site, with an adequately specified radiology workstation, calibrated diagnostic displays, access to radiology information systems (RIS), picture archiving and communication systems (PACS), medical records and additional specialist software. Adequate connection bandwidth to allow image review, reporting and videoconferencing will be needed. Bidirectional communication should be supported by telephone call re-routing and seamless access to hospital lines, bypassing the switchboard. Timely access to IT support prevents downtime and the need to return to the physical workspace unexpectedly.

The whole endeavour needs to be supported by careful job planning to identify and accurately ring-fence contractual and non-contractual (additional) working periods.

1
Introduction

Allowing radiologists to work from home increases reporting capacity and flexibility for hospitals and promotes better work–life balance for overstretched radiologists. Examples include increased flexibility for those with caring responsibilities and reduced fatigue for those close to retirement. During the pandemic, home reporting was crucial, allowing shielding and self-isolating colleagues to contribute to the workload and facilitating social distancing on-site.

It is important to bear in mind that a radiologist's role extends far beyond issuing reports for radiology investigations – any department implementing homeworking must ensure that these other roles remain fulfilled. This requires high-quality videoconferencing and good-quality IT support backed up by the ability to come on-site if the service demands this.

There is a long-standing shortage of radiologists in the UK[1] and burnout is high in our specialty, so facilitating flexibility in working practice is a win for all concerned. That said, homeworking cannot replace the physical presence in the radiology department required to fulfil the multifaceted leadership and training roles of a radiologist.

2
Background

Home reporting has been technically possible for many years, initially using desktop-sharing solutions with suboptimal image quality, predominantly used for on-call image review with formal secondary reporting the next day.

Subsequently, private reporting companies invested in the necessary technology to allow a radiologist to view from home full-fidelity, diagnostic-quality images sent via relay servers from a number of hospitals and to write reports that are delivered back to the originating site RIS.

The Royal College of Radiologists (RCR) 2022 document *Radiology reporting networks*[2] recommended investment by NHS trusts in network radiology platforms (NRPs). This could facilitate both development of more efficient reporting of night-time radiology and sharing of expertise across hospitals to provide subspecialty reporting for smaller hospitals. The outsourcing companies have extended the service to include backlog reporting, but development of quality home reporting solutions that complies with the RCR guidance on diagnostic reporting stations[3] has remained slow within the NHS, with some exceptions such as the East Midlands Radiology (EMRAD) Consortium,[4] the Scottish National Radiology Reporting Service (SNRSS)[5] and Yorkshire Imaging Collaborative (YIC).[6]

Even before the COVID pandemic the GIRFT radiology review identified great variation across the UK in access to home reporting for radiologists. In spring 2020 the RCR supported immediate homeworking for radiologists by issuing a temporary relaxation of display guidance[7] applicable between March and September 2020. In the wake of the pandemic many NHS trusts and health boards accessed central capital funding to increase broadband speeds and purchase home reporting stations.

Recently more hospitals have utilised insourcing, allowing their own radiologists to take on additional reporting for their primary NHS employer flexibly. Systems of work and remuneration are negotiated locally. Some regional systems have developed, allowing groups of trusts and health boards to pool resources and standardise reporting tariffs.[3,4]

3
The case for homeworking by radiologists

Home reporting allows for better work–life balance and can provide interruption-free reporting time. Reduced travel time, reduced stress and flexibility increase reporting capacity and provide easier access to specialist opinions.[8] Development of a multi-site imaging network can facilitate a reduction in the impact of out-of-hours work on daytime provision and allow sharing of the reporting backlog.

However, the role of a radiologist extends far beyond that of producing imaging reports. Radiologists are needed on-site for planned and 'off the cuff' hands-on procedures, input into decision-making for complex patients, to fulfil their vital clinical leadership roles and for the positive mental health consequences of working together as a cohesive in-person team. It would be a mistake to underestimate the benefits of face-to-face interaction. That said, when easily contactable and engaged, home reporters can share queries to avoid colleagues on-site becoming swamped and can spend quality, uninterrupted time on reducing the reporting backlog.

3.1   Homeworking options

A radiologist working remotely can fulfil all of the following functions: vetting, supporting professional activities (SPA), preparation for multidisciplinary team meetings (MDTMs), taking calls from clinicians, teaching, research activity and provision of much of the on-call workload.

MDTMs deserve a special mention. It is feasible to run MDTMs remotely, but appropriate technology is mandatory to make hybrid remote/face-to-face meetings effective. Any MDTM with remote access requires each participant to have the facility to join from a single computer that can simultaneously allow access to MDTM documentation, usually reviewed by that participant on a second screen.

3.2   Job planning options

Job planning needs to ensure that access to homeworking is fair and equitable across the team. Homeworking sessions need to be evenly distributed across mornings, afternoons and the days of the week to facilitate an adequate in-person presence of diagnostic radiologists on-site at all times to cover procedures and teaching. Creating an on-site hot reporting service to deal with queries may be helpful. There should be clear guidance as part of a business continuity plan on what triggers a return to site, such as annual leave or sick leave. Homeworking can also be used to address specific time-limited needs, such as a radiologist needing to self-isolate or needing to be at home but able to work.

Clinical leads and clinical directors must be encouraged to think laterally about the whole service when designing homeworking systems. A simple method of ensuring that work output is in line with the contracted homeworking time is helpful. Some possible systems follow.

- Design homeworking to reduce the number of journeys made per week.
- Consider not allowing homeworking during known short-staffed or busy sessions.
- Agree a session to be worked flexibly through the week delivering, for example, MDTM preparation and reporting.
- Allow a session to be worked from home at a specific pre-agreed time with the understanding that this reverts to on-site working at short notice if required.

- Allow a session of homeworking that never reverts to on-site, such as enabling a part-time consultant to offer an additional session that fits with other commitments.
- Facilitate insourced reporting outside of the contracted job plan, with fee per item reimbursement, as a way of dynamically managing reporting backlogs.

4
Training

While homeworking offers well-documented benefits to employees who live in a cohesive family unit, some employees report loneliness, social and professional isolation and perceived threats to professional advancement.[9] It is important to ensure that homeworking provides benefits to all trainees. The document *Radiology training: what good looks like now and in the future*[10] outlines many demonstrated and potential benefits for training resulting from homeworking.

Training involves checking imaging and imaging reports, one-to-one meetings, supervision or procedures and incidental interactions. Most teaching time needs to be spent face to face to develop a good relationship and enable the trainee to feel supported, but occasional meetings can occur remotely. Supervision of procedures needs to be face to face. Participation in remote and hybrid multidisciplinary teams (MDTs) can present challenges for trainees.

Careful thought is needed in designing systems that allow access to a senior opinion with trainee involvement when a consultant is supervising remotely. The following table presents some ideas about how to manage remote supervision with the best outcomes for trainers and trainees.

Task	Entails	How to do remotely	Comments
Reporting	Need timely good quality feedback Checking trainee reports	Two-way control of remote desktop	Trainees report face to face as best option, followed by videoconference and then chat messaging. Ideally have the ability to pass control of the cursor between trainer and trainee over a video call so that each can highlight findings on images. Ability to show trainees the edits that are made to reports.
Vetting	Vetting jointly – trainee and consultant	Video call and screen sharing	Ability for trainee to share screen with consultant to ensure appropriate protocol is chosen.

Task	Entails	How to do remotely	Comments
Viva practice	Jointly reviewing images	Two-way control of remote desktop	Ability for trainer to demonstrate imaging to trainee and for cross-sectional imaging so both can scroll through images. For group teaching, ability for all to scroll through.
Consultant calls trainee to see interesting scan	Home reporter contacts trainee using videoconferencing		Consultants working from home can make contact with trainees over Teams, and departments can ensure adequate presence of on-site reporters. Need easy access to locations and online status of reporters.
Trainee or reporting radiographer on-site needs prompt consultant input	Trainee feels welcome to and is able to contact supervising consultant	Videoconferencing with ability to view images	Easy access to home reporters when there is nobody available on-site (this should be exceptional during daytime hours). Inclusion of trainees in these important decision-making discussions.
Dynamic studies such as fluoroscopy or ultrasound	Supervising consultant needs to be on-site	n/a	n/a
Informal interaction	Informal conversations for staff wellbeing	Videoconferencing	These relieve the sense of isolation, promoting team cohesion and providing some replacement for the unscheduled conversations that can result in helpful service improvements.

The virtual connectivity needs to be dependable with easy access to workstations, headphones and video-cameras as well as adjustable chairs. The messaging system needs to be bidirectional, allowing each user to control the PACS viewing cursor. Both consultants and trainees need access to home reporting.

5
Technological requirements for a home reporting system

A radiologist reporting from home will need to be able to work in the same way as if they were on-site. RIS, voice recognition, PACS, email, medical records and any additional specialist third-party manipulation software that is available on-site[11] must be available at home. The download speeds of the system need to be sufficient to allow reporting at the same speed as on-site. Videoconferencing software and associated peripheral devices are mandatory, as is some form of telephone redirection and a seamless ability to call into the hospital bypassing the switchboard. There needs to be easily available specialist IT support with knowledge of the teleradiology working environment. A system for monitoring the download speeds is recommended. Robust quality assurance of the reporting monitors in line with national guidance is mandatory, ideally using a remote calibration system.

5.1 Limitations of 'lossy' compression

Digital imaging and communications in medicine (DICOM) images are transferred between the PACS server and the workstation as a string of binary data consisting of the grayscale or colour level for each pixel. Ideally the complete 'lossless' image data will be available at all sites to offer full-fidelity viewing. However, limited network bandwidth and computer processing power often necessitate some form of data compression to maintain acceptable data transfer speeds.

Slightly simplified, **lossless compression algorithms** restore the transmitted image back to full fidelity on the receiving client workstation and are associated with longer transmission times. **Lossy compression algorithms** remove some data before transfer, replacing this by intelligent guesswork on the receiving workstation. This works well for known patterns such as text but can render radiology images non-diagnostic and so a reporting radiologist may inadvertently fail to observe a clinically important finding. The RCR advises against the use of lossy compression, but if it must be used then steps should be taken to assure diagnostic accuracy (both initially and routinely throughout its use).[3,7]

The '**build to lossless' variant of real-time temporal image compression** is particularly high risk for teleradiology because the image quality visually changes depending on factors such as bandwidth and graphical processing power.

Lossy compression in all forms is most risk prone when software fails to clearly indicate in the user interface that images are being shown in lossy form.

5.2 Remote reporting systems

Three main technologies are used for remote access for home reporting.

- A **VPN (virtual private network)** connects a home workstation to the hospital network and is provided and maintained by the hospital. This allows the user to log in and work on RIS and PACS as if in the hospital. The use of client-side installed radiology software with the transmission of HL7 and DICOM data over the VPN allows for full-fidelity reporting.

- A **virtual desktop** allows remote access to the hospital network from the user's own computer. These often use lossy compression but can be implemented with lossless compression if there is adequate bandwidth. However, the compression level is usually controlled by the hospital IT department staff, who can be unaware of the implications of changing this without reference to radiology.

- **Web-based reporting** or **VDI (virtual desktop integration)** requires a significant infrastructure investment and integration work by the organisation intending to use this method of reporting. The resultant software is very scalable and versatile and often less dependent on client-side software installation and maintenance.

A home reporting station must typically have access to an internet connection of over 50 Mbps, but lower home broadband speeds (e.g. 20 Mbps) can be used with systems that offer pre-caching. An adequately powered computer (desktops tend to offer more power at lower cost) and calibrated display monitors are also needed. RCR guidance is provided in the document *Picture archiving and communication systems (PACS) and guidelines on diagnostic display devices*, third edition.[3]

5.3 RCR recommendations for display standards in primary diagnostic work

Feature	Plain film	CT/MRI US/NM	Breast screening
Minimum resolution	2048 × 1536	1600 × 1200	2560 × 2048
MP resolution (MP)	3	2	5
Maximum pixel pitch	0.21	0.21	0.17
Colour/monochrome	Mono	Colour	Mono
Calibration DICOM GSDF	≤10%	≤10%	≤10%
Luminance (min/max) cd/m²	1/350	1/350	1/400

Note: MP = megapixel; GSDF = grayscale standard display function

5.4 Quality assurance

Regular quality assurance (QA) tests for reporting monitors are subject to current national recommended standards and requirements.[15,16] QA is particularly exacting for mammography reporting. An initial inspection by medical physics staff and ongoing monitoring should be undertaken on a similar basis to that provided for on-site workstations. Conducting site visits to perform QA for homeworking would be costly and time-consuming

and periodic return of monitors to the hospital may be required. Available systems for remote QA should be utilised where possible, and remote login by IT and medical physics staff could support this.

Staff using home reporting stations should be appraised of the risks associated with automatic software updates that can change screen settings, resulting in non-diagnostic image display.

6 Equipment and maintenance

Suboptimal homeworking configurations, using decommissioned workstations without adequate IT support and the back-up to revert to on-site working, can be counterproductive. Radiologists may take on an additional workload and find themselves having to deal with poor equipment at home or come on-site to a newly reduced workspace and queue for access to a workstation.

Home reporting equipment should be of the same standard as on-site equipment. Consideration should be given to reusing equipment where possible for home reporting, but only where it is fit for purpose, is approved by medical physics and resource has been made available for appropriate QA, maintenance and replacement.

Appropriate download speeds will be required to facilitate home reporting at the same speed as on-site. There is no current accepted standard for this, but a 50 Mbps connection once logged into the VPN seems to be acceptable for most systems. Measures of temporal resolution such as frame rate and quality of streaming have an impact on the reporting experience. These dynamic parameters are as important for safe and efficient reporting as the static parameters recommended in the RCR guidelines.[3] Ideally the motion picture industry standard of 24 fps minimum should be used to avoid seeing motion 'stutter'.

To make the most of homeworking a **system for procurement** of hardware, installation of software, maintenance, distribution and collection of equipment and calibration of monitors is needed. An equipment inventory needs to be kept and updated for all on-site and off-site PACS workstations and display monitors. Ongoing funding is required for maintenance and replacement of home workstations matching provision for on-site workstations.

IT support needs to be available in a timely and accessible manner to reduce reporting downtime. This should be delivered remotely by IT staff with the specialist knowledge to support all of the installed applications. There also needs to be a clear business continuity plan for what happens when home reporting is not working in the short or medium term.

Engagement with suppliers and development of industry standards for loading times, scrolling speeds, voice recognition (VR) accuracy and IT support would be of particular benefit when defining the appropriateness of a home reporting environment. When the system is slow there are many possible causes, such as the home internet connection, VPN connection, hospital network bandwidth and specification of the home reporting machine. Co-operation between providers is required to resolve speed issues. These should be met for home reporting systems even when it is difficult to pinpoint the cause.

7
Management and medical staffing

The management of a home-based workforce has been much written about over the past two years. Managers need to be assured that radiologists are delivering a good service when working from home, and measuring the performance of a radiologist is a challenging task. Equitable access to home reporting sessions and agreeing clear and realistic outcomes for these as part of job planning is crucial for radiologists and managers.

Ensuring that the homeworking environment is safe, with appropriate seating, lighting and data security, is important. A local system of work is recommended, supported by an appropriate agreement signed by the employer and employee.

The attitude of the in-house team, including radiographers and administrative staff, to the homeworker is crucial for success. The homeworker should be viewed as present and included in the daily conversation. Staff need to be comfortable with contacting a radiologist working from home for advice and to put through calls. If the attitude of both parties is right, it feels like the homeworker and in-house team are working side by side.

8
Governance and peer review

Homeworking needs to be undertaken in line with the usual data protection guidance. Additional issues such as working in a private space and ensuring that family members and visitors do not have access to patient data must be considered. Broadly the same principles apply as in the workplace.[12]

Facilities for any peer review activity and attendance and learning meetings should be available from home.[13]

9
Conclusion

Home reporting is a valuable tool that needs to be considered from both a service[14] and an individual perspective. At best the hospital can gain access to engaged homeworking radiologists immediately available via phone, PACS chat and email. That said, care must be taken to avoid an inappropriate burden on staff who remain on-site. Clear and transparent boundaries are mandatory to navigate potential difficulties around the distribution of home reporting sessions.

High-quality technology deals with many issues, but on-site radiologists remain essential for hands-on procedures. A core of staff must remain in the department to facilitate prompt access to radiology services and advice for clinicians. Finally, sufficient on-site presence to maintain training and trainee supervision as well as a cohesive departmental culture for all staff members must be maintained.

Acknowledgements

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