

Home Working for Radiologists

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Executive Summary

The massive expansion of home reporting for radiologists proposed by 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. Whilst 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 provide 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 RIS, 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 down-time 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 trusts as well as promoting 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 radiologists role extends far beyond issuing reports for radiology investigations - any department implementing home working must ensure that

46 these other roles remain fulfilled. This requires high quality teleconferencing and good
47 quality IT support backed up by the ability to come on-site if the service demands this.
48

49 There is a longstanding shortage of radiologists in the UK^[ref 1] and burn-out is high in our
50 specialty, so facilitating increased input from staff is a win for all concerned. That said home
51 working cannot replace the physical presence in the radiology department required to fulfil
52 the multifaceted leadership roles of a radiologist.
53

54 **2. Background**

56 Home reporting has been technically possible for many years, initially using desktop sharing
57 solutions with lossy compression resulting in degraded image quality (VNC, Remote
58 Desktop etc.). This was predominantly used for on-call image review with formal secondary-
59 reporting the next day.
60

61 Subsequently, private reporting companies invested in the necessary technology to allow a
62 radiologist to view from home full fidelity, diagnostic quality images sent via relay servers
63 from a number of trusts, and to write reports which would be delivered back to the originating
64 site RIS.
65

66 The 2022 RCR document “Radiology reporting networks”^[ref 2] recommended investment by
67 NHS trusts in network radiology platforms (NRPs). This could facilitate both development of
68 more efficient reporting of night time radiology and sharing of expertise across hospitals to
69 provide sub-specialty reporting in smaller hospitals.
70

71 The outsourcing companies extended the service to include backlog reporting – with images
72 still being sent across a network with some relevant priors. However, early on imaging
73 reported in this way was commonly being re-reviewed by a local radiologist with the benefit
74 of access to the complete patient history and all prior imaging. Ongoing work between the
75 RCR and teleradiology companies has substantially reduced the need for local re-review, in
76 particular most teleradiology companies now offer immediate access to all relevant priors.
77

78 Development of quality home reporting solutions that complied with the RCR guidance on
79 diagnostic reporting stations^[ref 3] remained slow. There are however some excellent
80 examples e.g., the East Midlands Radiology (EMRAD) Consortium^[ref 4], the Scottish
81 National Radiology Reporting Service (SNRSS)^[ref 5] and Yorkshire Imaging Collaborative
82 (YIC)^[ref 6].
83

84 Even before the COVID pandemic the GIRFT radiology review identified great variation
85 across the UK in access to home reporting for radiologists. At the start of the COVID
86 pandemic in spring 2020 the RCR supported immediate home working for radiologists by
87 issuing a temporary relaxation of display guidance^[ref 7] applicable between March and
88 September 2020. This described how to report axial imaging accepting lossy compression,
89 allowing trusts to understand the limitations of their local home review systems and use
90 these effectively to develop safe off-site reporting services during the pandemic. Many trusts
91 accessed central capital funding to increase trust broadband speeds and purchase home
92 reporting stations. For example, the Yorkshire Imaging Collaborative distributed >220 home
93 workstations to consultants and reporting radiographers enabling remote reporting across a
94 network of 32 hospitals.
95

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

3. The case for home working for 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. Development of a multi-site imaging network can facilitate a reduction in the impact of out-of-hours work on daytime provision and sharing of the reporting backlog.

However, these changes must be approached with caution. 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. Queries need to be shared by the off-site team, to avoid those on-site becoming swamped, so home reporters must be easily contactable. One radiologist described the COVID home working arrangements as having “ripped the soul out of their department” – this outcome must be avoided at all costs. The incidental interactions with colleagues that occur on-site are crucial, it can be coffee room conversations that result in positive departmental change. Radiologists need these so as to fulfil their vital clinical leadership roles as well as 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.

Each unit needs to consider home reporting in the light of their local and regional needs – the introduction of home reporting can facilitate integration within networks and may be appropriate in only a very limited way.

3.1 Home work options:

A radiologist working remotely can fulfil all of the following functions. Vetting, SPA, preparation of MDTs, taking calls from clinicians, teaching, and provision of much of the on-call workload. MDTs deserve a special mention. It is feasible to run MDTs remotely, but experience suggests that these may be more efficient when run face to face. Split remote/face to face meetings need careful management. Any MDT with remote access requires each participant to have the facility to dial in from a single computer which can simultaneously allow access to MDT documentation usually reviewed by that participant on a second screen.

3.2 Job planning options:

Job planning needs to ensure that access to home working is fair and equitable across the team, and that home working sessions are evenly distributed across mornings / afternoons and the days of the week to facilitate an adequate in-person presence on site at all times to cover procedures and teaching. There should be clear guidance around what triggers a return to site e.g., annual leave / sick leave. Home working can also be used to address specific time limited needs e.g., a radiologist needing to self-isolate or somebody needing to be at home but able to work.

Managers must be encouraged to think laterally about the whole service when designing home working systems. A simple method of ensuring that work output is in line with the contracted home working time is helpful. Some possible systems follow:

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

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

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 156
 157

4. Training

158 While home working offers well documented benefits to employees who live in a cohesive
 159 family unit, junior employees more commonly report loneliness, social and professional
 160 isolation and perceived threats in professional advancement ^[ref 8]. It is important to ensure
 161 that home working provides benefits to all trainees. The document Radiology Training –
 162 What good looks like now and in the future ^[ref 9] outlines many demonstrated and potential
 163 benefits to training from home working.

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Training involves checking imaging, one to one meetings, supervision or procedures and
 accidental interactions. Enough time needs to be spent face to face to develop a good
 relationship and enable the trainee to feel supported, but many meetings can occur
 remotely. Supervision of procedures needs to be face-to-face.

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

174

Task	Entails	How to do remotely	Comments
Reporting	Need timely good quality feedback Checking SpR reports	2 way control – remote desktop	Trainees report face to face as best, followed by telecon followed by “chat box” Ability to pass control of cursor between trainer and trainee over video call so that each can highlight findings on images. Ability to show trainees the edits that are made to reports
Vetting	Vet jointly – SpR and consultant	Video call and screen sharing	Ability for trainee to share screen with consultant to ensure appropriate protocol is chosen.
Viva practice	Jointly reviewing images	2 way control remote desktop	Ability for trainer to demonstrate imaging to trainee and for cross-sectional imaging ability for both to scroll through images. For group teaching, ability for all to scroll through.

Consultant calls trainee to see “interesting scan”	Home reporter contacts trainee on 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 “status” of reporters.
Trainee on-site needs prompt consultant input	Trainee feels welcome to and being able to contact supervising consultant	Video conferencing 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 e.g., fluoroscopy or ultrasound	Supervising consultant needs to be on-site	n/a	n/a

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. Just as consultants, 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. This will require access to RIS, PACS, medical records and additional specialist software in use such as specialist cardiac imaging or AI systems [ref 10]. Videoconferencing is 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 IT support.

5.1 Limitations of “lossy” compression:

DICOM images are transferred between the PACS server and the workstation as a string of binary data consisting of the grey scale level for each pixel. Ideally the complete “lossless” image data is 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.

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 it 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) [ref 3, 7].

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

210
211 **Lossy compression in all forms is most risk prone when software fails to clearly**
212 **indicate in the user interface that images are being shown in lossy form.**

213 214 **5.2 Remote Reporting Systems**

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

- 216 • A **VPN (virtual private Network)** connects a home workstation provided and
217 maintained by the trust to the hospital network. This allows the user to log in and
218 work on RIS and PACS as if in the hospital. The use of client-side installed radiology
219 software with the transmission of HL7 and DICOM data over the VPN allows for full
220 fidelity reporting.
- 221 • A **Virtual Desktop** allows remote access to the trust network from the user’s own
222 computer. These however often use lossy compression but can be implemented with
223 lossless compression if there is adequate bandwidth.
- 224 • **Web based reporting** requires infrastructure to be provided by the RIS and PACS
225 suppliers with significant integration work required for organisation using the system.
226 The resultant software is very scalable and versatile, often less dependent on client-
227 side software installation and maintenance.

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

234 235 **5.3 RCR Recommendations for display standards in primary diagnostic work**

236

Feature	Plain film	CT/MRI US / NM	Breast Screening
Minimum Resolution	2048x1536	1600x1200	2560x2048
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

237
238 A further document with useful advice on designing and sourcing a home reporting system is
239 in the NHSE/I document by Robin Breslin “Radiology Home reporting Advisory Notice” ^[ref 11].

240

241

242 **6. Equipment and Maintenance**

243 A system for procurement of hardware, installation of software, maintenance, distribution
244 and collection of equipment, calibration of monitors and IT support will be needed.

245 Furthermore ongoing funding is required for maintenance and timely replacement of home
246 workstations to avoid a gradual slowdown or difficulty replacing broken machines.

247

248 Measures of temporal resolution such as frame rate / quality of streaming have an impact on
249 the reporting experience. Any home reporting solution must recognise that these dynamic
250 parameters are as important for safe and efficient reporting as the static parameters
251 recommended in the RCR document ^[ref 3]. As a good baseline the motion picture industry
252 standard of 24 fps should be adhered to as a minimum to avoid seeing motion “stutter”.

253

254 It seems appropriate for the RCR to recommend minimum standards for a home working
255 station in terms of loading and scrolling speeds, VR accuracy and IT support and to express
256 an expectation that these be met – even when it is difficult to pinpoint the cause. Nationally,
257 engagement with suppliers is needed to define standards and Key Performance Indicators
258 for home reporting. When the system is slow there are many possible causes: The home
259 internet connection, VPN connection, trust network bandwidth, specification of the home
260 reporting machine.

261

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

266

267 Unfortunately, there are many examples of suboptimal home working configurations, which
268 do not have adequate IT support and the “back-up” is to revert to on-site working. This can
269 be counterproductive resulting in radiologists taking on an additional workload and finding
270 themselves having to deal with poor equipment at home or come on-site to a newly reduced
271 workspace and queue for access to a workstation.

272

273 Ultimately home reporting equipment should be of the same standard as on-site equipment.
274 As such, second-hand hospital equipment repurposed for home reporting may not be
275 appropriate.

276

277

278 **7. Management / Medical Staffing**

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

284

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

288

289

290 **8. Governance and Peer Review**

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

295

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

298 **9. Equipment**

299 Internet speeds are crucial for home working – both the home connection and the trust VPN
300 bandwidth. The specification of the workstation is also crucial as is configuration of the
301 PACS system.

302

303 Engagement with suppliers and development of industry standards overall – perhaps KPIs
304 for loading times and VR accuracy would be of particular benefit when defining the safety, a
305 home reporting environment. Where the system is “skip-scrolling” through images for
306 example lung nodules can be missed by the reporter, so the practice of loading the full
307 image set into MPR may be appropriate.

308

309 Furthermore, consideration should be given to re-using equipment where possible for home
310 reporting.

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312

313 **10. Conclusion**

314 Home reporting is a fantastic tool that needs to be considered from both a service ^[ref 14] and
315 an individual perspective. Inappropriately implemented, it can produce a burden on staff who
316 remain on-site. The distribution of home reporting sessions can produce political difficulties
317 within a department and clear transparent boundaries are mandatory.

318

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

324

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