TSR Guidelines for the Practice of Teleradiology: 2021 Update

Introduction

Guidelines in the form of standards for the practice of teleradiology in Turkey were first published in 2010. This decennial update was prepared in consideration of the evolving nature of imaging technologies and medical informatics as well as the changing character of the patients' and public's demands (1).

Theseguidelines have been prepared with the aim of providing guidance on the appropriate use of teleradiology applications, thereby increasing the impact of theircontribution to public health. They comprise recommendations and are not intended to fill legal gaps. They are prepared—and expected to be implemented—with a view to highlighting a patient-oriented and good clinical practice approach.The application of other requirements and prerogatives not defined in theseguidelines, specific to any clinical situation, is at the discretion of the responsible physician who performs or oversees the radiological service or renders its interpretation.

Provided that they are carried out in accordance with the guidelines, teleradiology allows the reporting of radiological examinations in a shorter time, renders this process possible independent of time and place, facilitates easy consultation when necessary, and makes possible continuous training and assessment/appraisal processes. Thanks to teleradiology, users in different locations can view radiological images simultaneously. Teleradiology is a means of maintaining health service without interruption during disasters and other extraordinary circumstances (2–6).

The use of teleradiology should not diminish the radiologist's responsibilities for the supervision and management of the entire process of radiology service, which comprises steps to select the most appropriate examination for the patient, to make the examination at the most appropriate time and with the pertinent protocol, to prepare the patient for the examination, to select and prescribe the appropriate contrast material when its use is beneficial, to perform the examination in a way that minimizes the harm, especially radiation, to the patient and staff, to provide on-site supervision and quality control of the examination, to evaluate the images from the examination in the light of clinical and laboratory information and previous examinations, to communicate the imaging findings by preparing a report that includes differential diagnosis and recommendations, and to archive the patient's radiological images and reportwith appropriate methods. The radiology report is an intermediate yet integral product of this service. Teleradiology applications should be carried out in a way that ensures the integrity of these steps at the highest possible degree.

Definitions

Telehealth: All services and information exchanges that can take place, regardless of location, throughout the life of a targeted individual relevant to their health protection, disease treatment and disability managementby the use of information and communication technologies.

Telemedicine: A subfield of telehealth encompassingall applications whereby health services are carried out remotely through information technologies, regardless of location.

Teleradiology: A subfield of telemedicine comprising applications that allow the digital transfer, storage, processing, evaluation, and reporting of radiological images and related information to a different place from where they were obtained.

Sender party: The party that performs radiological examinations and sends images to another party along with related information for the purpose of reporting, consultation or obtaining secondary opinion.

Receiving party: The party that writes reports for or consulted on medical images.

In-house teleradiology service model: Teleradiology applications performed simultaneously or at different times by the employees of the institution using the institutional picture archiving and communication system (PACS) onsite or offsite.

Outsourced teleradiology service model: Teleradiology applications in which the radiological examinations obtained in an institution are evaluated byway of aconcurrent or nonsimultaneous service to be received from outside the institution.

Source radiologist: Onsite radiologist who is required to be present at the sender party and is responsible for patient communication and supervision of the radiological examination including the latter's appropriateness, vetting, and planning.

Teleradiology performed with diagnostic equipment: Teleradiology applications performed onsite or offsite in personal office/home spaces via workstations with diagnostic monitors.

Teleradiology performed with non-diagnostic equipment: Teleradiology applications that technically provide image and other data sharing onsite or offsite in personal office/home spaces, via equipment with non-diagnostic monitors such as personal computer and mobile phone.

Radiology service: The entire process that starts with the requisition of a radiological examination for the patient, including scheduling, admission, patient preparation, vetting, examination, quality control, reporting, timely transmission of all relevant output (including report and images) to the referring clinicans and archiving.

Radiological examination: The section of the radiology service starting with the patient's entrance into the radiology examination room and progressing until the images obtained are sent to the PACS. This also includes quality check.

Reporting: Part of the radiology service whereby medical images are interpreted in the light of clinical and laboratory information and put into an actionable text.

Primary reporting: The process of reporting the radiological examination by an authorized radiologist who is responsible for the entire radiology service.

Expert opinion: Opinion given by a radiologist (with specific expertise on a subject), different from the primary reporting radiologist, upon the requisition of the latter. The opinion and the identity of the expert should be explicitly mentioned in the report of the radiological examination in question.

Radiological consultation: The billable service of rendering professional opinion by a radiologist, different from the one who performed the primary reporting, performed upon the request by a clinician responsible for the patient and submitted as a written report. This service is not necessarily limited to a single episode of imaging; it can be in the form of comparatively evaluating the examinations performed on the patient at different times.

Alternatively, consultation may entail a phase or aspect of the radiology service earlier than the image acquisition.

Secondary opinion: The billable service of rendering professional opinion by a radiologist, different from the one thatmade the primary reporting, performed upon the request of a patient, their legal guardian/relative or any other legitimate entity such as an insurance company, sports club, or legal firm. This is not a health service and should be considered as an independent professional opinion on a specific subject and not a radiology report *per se*. Social security institutions are not expected to pay for this service in patient-related payments. The price is borne by the party requesting the opinion.

Expert opinion for a legal prosecution or administrative investigation: The billable service of rendering professional opinion by a radiologist, different from the one that made the primary reporting, performed upon the request of a legal or administrative body. This is not a health service and should be considered as an independentprofessional opinion on a specific subject and not a radiology report *per se*. The price, when applicable, is borne by the party requesting the opinion.

Preliminary (provisional) report: A fast, concise and goal-oriented reporting that is mostly used in emergency departments and situations. After the provisional report, primary reporting is made by the same or (an) other radiologist(s).

Addendum: Additional report created after approval of the primary report, when a change, clarification or correction becomes necessary for any reason. Once the primary report is approved, it should be stored in such a manner that it cannot be altered. An addendumstands distinctly apart from, but also visibly along with, the primary report in electronic patient records. Identity of the approving radiologist and time (date, hour:minute) of the approval should be explicitly mentioned in the addendum.

Electronic signature (e-signature): A legal identity verification system in the form of electronic data, used for authentication purposes in lieu of a wet signature in electronic/digital environment.

General principles

a. The main purpose of teleradiology is to provide the dissemination of qualified radiological services for the benefit of patients and society by using the opportunities provided by information technologies and informatics.

b. The primary goal of teleradiology service provision is to make radiology processes meaningful as a whole and to design them in a way that ensures this integrity.

c. Teleradiology should not be used to compensate for scarcity or absence of radiologists.

d. A source radiologist should be present at the sender party who, in addition to their aforementioned roles, is responsible forthe timely communication of urgent or unexpected findings. Under such circumstances as disaster, extraordinary conditions and specific screening programs (e.g., screening mammography), source radiologist may not be present.

e. In-house teleradiology use should be focused on patient benefit and quality of service.

f. Patients and their legal guardians are entitled to have information about the outsourced teleradiology service provided.

g. Teleradiology service should be carried out in a manner that protects patients' personal and health information within legal and ethical frameworks.

h. Reports and other relevant outputs produced by the teleradiology service should be stored without loss and in an easily accessible/retrievable way.

i. Elements that play a role in providing teleradiology service (e.g., service provider company, network environment used, certification, radiologist information) should be included in the patient's examination report.

j. Teleradiology service should be designed by the relevant institutions and parties in a way to at least maintain and preferentially raise the health service standards and be priced in a fair way that confers the labor therein its due value.

k. Teleradiology service should be carried out under the supervision and control of the relevant public and/or private authorities.

l. In education and research institutions, the in-house or outsourced teleradiology services should not be allowed to interfere with education and research activities; precautions and/or regulations should be established to ensure the obviation of such interference.

m. Continuous quality improvement should be an integral part of teleradiology services.

Modes of teleradiology applications

With the developing technology and business models, the methods of teleradiology diversified over time. Today, it is possible to classify the modes of various teleradiology applications under three categories, namely the business model, the hardware infrastructure or the purpose of service.

With regard to their **business model**, teleradiology applications can be divided into twoas internal or external. Teleradiology applications in which the service is carried out in-house as a business model are carried out in the form of the evaluation of the images obtained from single or multiple institutional unit(s) by the use of the infrastructure and radiologists of the institution, usually through a single PACS, inside or outside the institution (at their office or other personal living spaces such as home). Teleradiology applications can also be carried out by the same radiologist at another personal living space such as home by continuing an imaging assessment that the radiologist initiated within physical confines of the institution. In such applications, access to patient clinical data is relatively easy and straightforward. On the other hand, teleradiology applications where teleradiology service is outsourced are also quite common. Here, the producedradiological images along with clinical data are shared with an external service provider, who ensures the review and reporting of the radiological examination. Although this method generally increases the speed of radiology reporting, it can cause various problems as it significantly disrupts the integrity of the radiological service.

In terms of their **hardware infrastructure**, teleradiology applications can be performed with a diverse set of components. The main hardware components of teleradiology are the sending web server, institutional firewall, transmitter network, and reporting radiologist's computer and monitor. Dictation and report output tools are among thesubcomponents of this infrastructure. Each of these components has application-specific requirements for image quality and patient data security. There may be diagnostic and medical standards for each component;an array of equipment that,although not intended for this specific purpose,

can nevertheless do the job and is suitable for such non-standard use may be employed as well. Teleradiology applications can be divided, according to the properties of their components, into three groups as those using diagnostic or non-diagnostic equipment or a hybrid of these two.

A third classification of teleradiology applications is according to the **purpose** of service. The point of discrimination here is whether the service is used for primary reporting, expert opinion or radiological consultation. In addition, as stated in the definitions section above, teleradiology can also be used for generating preliminary (provisional) reports or addenda. Other uses of teleradiology, which are not considered healthcare services, include reporting in the form of secondary opinion or expert opinion for a legal prosecution or administrative investigation, and meeting educational demands.

Qualifications of the practicing parties

In order to ensure that both service providers and receivers can produce health care service meeting established standards, implementation of individual and institutional training, certification and accreditation procedures should be encouraged.

Radiologistsconstituting parts of teleradiology services should be trained in the field of teleradiology. The training for this purpose should entail the technical requirements of teleradiology, patients' rights, legal regulations governing the protection of personal data, ethical rules, and an awareness of the unintended consequences that might arise from wrong practices.

There should be a sufficient number of radiologists for the workload that the service is supposed to cover.

Technical issues

Once acquired, radiological images are stored in local or institutional archives (PACS). Cloud-based archiving systems are also being used with increasing frequency for this purpose. The conformity of data storage to the stipulations of the Turkish Law (No. 6698) on the Protection of Personal Datashould be assessed and ensured by the organization where the teleradiology service is utilized (7). Whenever there is outsourcing of this service, the teleradiology service provider is obliged to ensure such conformity.

Teleradiology operations require an appropriate network structure that provides rapid data transfer in the broadband range while ensuring the confidentiality of patient data. The basic information system used in teleradiology operations should be designed taking into account the issues of speed, back-up, security, reliability and confidentiality.

In order for the radiologist at the receiving party to access the images without loss, both data transfer and monitor characteristics need to comply with the recommended specifications. Requisition information, priordiagnostic images and all relevant information in the patient's electronic records have to be accessible.

Data transfer

Data transfer in teleradiology can be done in several different ways (3):

1. Virtual private network (VPN): This type of transmission is the most suitable method for remote access of the radiologists to the images obtained in their institutions, as it is

usually required for out-of-hours remote assessments or pandemic or other disaster situations. After establishing the VPN structure of the institution, the radiologist remotely connects to the PACS, Radiology Information System (RIS) and Hospital Information System (HIS) in the institution to which he is connected, and performs the works on the job list remotely as if in the institution. Its greatest advantage is that it does not require the image and other information to be copied and reproduced on another system. VPN also provides the necessary security measures in the cyber environment.

If such a network will be used to report radiological examinations through an external teleradiology institution such as in the outsourced teleradiology model, it is recommended to make necessary arrangements and take precautions to eliminate medicolegal problems that may arise due to the institution's access to all health data.

2. Data sending ("DICOM push") technique: The only data transferred are the medical images (along with relevant information of patients) that are needed to be reported. The institution's PACS-RIS-HIS system can send relevant data to the teleradiology system. This system is mostly used in situations where reporting is outsourced to an external organization. The transmission of images and data and reception of the issued report are carried out in accordance with HL7 standards. In such applications, the systems belonging to both parties should work in harmony and there should be no manual applications in the workflow. For example, when the patient reports are created and sent and the report–patient matching is done manually (in a setting whereby HL7 communication is not used), this carries the risk of misfiling the report to the electronic patient record that is not the intended patient's. DICOM e-mail system or secure web services can be used for this purpose.

3. IHE ("Integrating the Healthcare Enterprise") supported protocols: IHE is a non-profit organization established to provide interoperability in the health system. The IHE's XDS (Cross-Enterprise Document) and XDR (Cross-Enterprise Document Reliable Interchange) integration profiles define the safe performance of such data transfers. When the information systems of both parties support these protocols, data transfer occurs smoothly. Medical device manufacturers and health informatics producers produce their products to support many different IHE protocols with the main purpose of ensuring interoperability.

*4. Remote desktop access:*This is an application that provides remote access (as with VPN) to all health data of the institution through a desktop device within the institution. This can cause serious problems in institutional data management and security. Healthcare institutions should not allow such an approach by their employees and should design and install secure connection systems. It should be made clear that employees and managers will face medicolegal problems in cases where institutional secure data transfer is not provided. Turkish Law (No. 6698) on the Protection of Personal Datastates that such an application cannot be made without the approval of the institutional data controller (7).

Image compression

Image compression can be performed using lossless or lossy methods. As the name implies, there is no loss of image data in lossless compression. Data compression can be performed lossy to reduce image transfer speed and archive requirement. Under the supervision of a responsible radiologist, many lossy or lossless compression methods can be used that will not lead to degradation of clinical diagnostic image quality (8). Compression methods and ratios to be used for different imaging studies provided by the responsible

radiologist should be monitored and, when necessary, updated regularly to ensure appropriate image quality.

Reporting console

The screens on which the technologist who performs a radiological examination, the radiologist who makes the reporting in-house or by remote access, and the clinician who accesses the images are generally similar. However, the screen on which radiological evaluation and reporting is made is especially important in terms of spatial and contrast resolution. These features are determined by the software as well as the characteristics of the monitor and graphics cards (8–11). Workstation and screen features can be listed as follows:

Workstation

a. Graphics bit depth: The greater the bit depth that the card and display can support, the greater the depth of gray, red, green, and blue. For example, 16.4 million colors can be featured in an 8-bit system, whereas in a 10-bit system this exceeds 1 billion. However, in the studies conducted so far, from the diagnostic standpoint, no significant difference has been shown in systems over 8 bits.

b. Graphic card connection: LCD and OLED screens used in radiology practice today work with digital data. For this reason, digital transfer of data from the card, where digital data is produced, to the screen is the most suitable. For this purpose, HDMI, DVI-D or display port connection can be used. VGA or DVI-A connections are analog and inconvenient.

c. Image size: The number of rows and columns of the image acquired and the image displayed is usually not equal. When a 512x512 matrix image is displayed on a 3840x2160 pixel matrix screen, the need for interpolation naturally arises. A high quality interpolation ensures that the image is displayed without delay. The video card should be high-end in this regard.

*d. Imaging software:*For proper reporting of radiological examinations, the software should be compatible with the workflow steps of the radiologist, and should include many features that facilitate the radiologist's work. Some of these features are as follows:

i. Comparative (prior or otherwise) examinations and/or image series should be able to be opened at the same time.
ii. There should be a customizable work list. The users should be able to open the examination they want to access and even the series within the examination.
iii. There should be image hanging options (“hanging protocols”) that take into account many features such as the diagnostic method evaluated, personal preferences, and imaging sequences obtained, and optional changes should be easily made.
iv. Zooming, panning, windowing, triangulating, rotating, and creating a mirror image should be possible.
v. The desired information about the patient and the technique should be displayed on the image, and all image-related information and introduced markings (annotations) should be made invisible when necessary.
vi. The image should be able to be recorded in different formats including DICOM, and, if necessary, the recording should be stored by deidentification (i.e., anonymized).

vii. A calculation tab should facilitate relevant measurements.
viii. Other aspects of the user interface (such as mouse button function assignments) should also be customizable.

Screen

a. Display technology: Almost all displays today are produced with LCD ("liquid crystal display") or OLED ("organic light emitting diode") technology. There are different panel technologies in LCD screens and their "TN" feature is not suitable for radiological use. It can, however, be used as a third screen to access patient information. LCD screens with "IPS" and "VA" features are suitable for radiological evaluation and do not create a difference in brightness, contrast and color depending on the viewing angle.

The light source in LCD displays can be CCF (cold cathode fluorescent) or LED (light emitting diode). LCD screens with CCF sometimes have a warm-up time of 30 minutes, while LCD screens using LEDs do not have such a problem.

b. Luminescence: It is a combination of brightness and contrast and is important in selecting a screen for radiological imaging. Although brightness is only the level of photons emitted by the light emitting source, luminescence is related to the level of photons the receiver (eye or light meter) encounters.

Ambient luminescence is the level of light reflected off the device when it is turned off. Minimum luminescence is the lowest level of light that the device emits when it is turned on. The sum of these two values forms the "effective minimum luminescence". This value is expected to be at most 1 cd/m^2 on diagnostic screens (at most 1.2 cd/m^2 in mammography monitors). Maximum luminescence is the highest light level. This value, which was formerly defined as the "contrast ratio", is now defined as the "luminescence ratio" and is obtained by dividing the maximum luminescence value into the effective minimum luminescence. This value should be above 350:1 on diagnostic screens. For this reason, the brightness calibration values of medical screens are usually set to 350–400 cd/m^2 and automatic calibration is continuously run in the background to maintain this value for a very long time. Since such a calibration is not possible, non-medical monitors require manual measurementsat regular intervals.

Medical monitors usually have very high brightness values. In order to maintain constant brightness throughout the life of the device, the maximum brightness value can be reduced to the values given above, thereby achieving this level of efficiency for a long time.

It is desired that the gray scale level of the screen is parallel with the DICOM part 14 GSDF ("gray scale display function") level. A deviation of up to 10% in this value is acceptable. Medical displays can calibrate system responsiveness within this range. However, the response curve of most non-medical displays (LCD or OLED) produced today is very similar to the DICOM GSDF and does not significantly affect the diagnostic quality (12, 13). It is also known that some non-medical professional monitors have manual calibration software, although not like medical monitors, where this is done automatically.

c. Pixel and screen size: These are the factors that determine the spatial resolution. Often medical monitors are described as 2-, 3-, or 5-MP ("megapixel") by the number of pixels they contain. These values make sense, as these monitors are in a 4:3 aspect ratio and are usually 21–24 inches in size. However, non-medical monitors are nowadays often in 16:9

aspect ratio and come in a wide variety of sizes and resolutions. Therefore, pixel and screen size are meaningful in terms of image evaluation.

A pixel size is larger than 0.21 mm is not desirable in diagnostic monitors. In non-diagnostic monitors, this upper limit value is 0.3 mm.

The screen size has an upper limit, especially for the proper evaluation of its peripheral areas. Bigger screen is not necessarily better. The most appropriate diagnostic image evaluation should be made from a distance of approximately 60 cm. In order to avoid peripheral evaluation problems from this distance, a 4:3 aspect ratio screen with a diagonal length of 80% of this distance is required. Hence a 21-inch medical monitor. The pixel size of such a monitor with 3 MP (1500x2000) pixel count is around 0.21 mm.

Appropriate layout of the reporting console

1. Workstations used in radiology units should be planned with at least three monitors. Apart from one standard information screen, systems containing two 4:3 aspect ratio, 21–24-inch, pixel size of less than or around 0.21, preferably 3 MP medical screens that can operate on at least 8 bits should be designed. Medical monitors should have automatic calibration software and hardware. All workstations should be calibrated to the same level and different workstations should be able to display the same image with the same gray scale properties after calibration.

2. In remote use, 8-bit monitors, with a pixel size of less than or around 0.21 mm, minimum luminescence value below 1 cd/m^2, brightness over 350 cd/m^2, preferably less than 27 inches (recommendably with a diagonal diameter of 24 inches) should be used. It should be kept in mind that these screens cannot maintain their calibrations for a long time and that DICOM GSDF measurements or calibrations should be performed manually at least once a year.

3. For mammography reporting, equipment to be used either in the radiology unit or at the remote reporting point should be at least 5 MP medical monitors.

4. When designing the reporting console and environment, workplace ergonomics rules should be observed (14, 15). Optimum ergonomic conditions are mandatory for the most effective reporting by the radiologist. Therefore, appropriate ventilation, ambient lighting and sound levels, suitable table and chair, proper dictation and communication systems should be provided.

Archiving and documentation

Provided that other relevant requirements in theseguidelines are met, primary reporting teleradiology applications should meet the sender's archiving rules, as well as the rules on medical records of the institutional, national or other domains served, and all relevant legislation.

Images should be securely stored in one of the parties for the period stipulated by laws, regulations or bylaws and in a way to meet the legal responsibilities of the image sending party where the radiological service process has started. There should be a digital image storage policy and rules agreed by both parties and announced in writing that will meet legal requirements.

For each examination, database records containing patient information, examination information and other pertinent information, the times of the examination process and the identities of those responsible should be kept. These records should contain, as a minimum, the patient name, file number, name and type of the examination, the times of the examination steps, the examination performed and the identity information of the sender responsible. Similarly, on the receiving side, the time the image is received, the reporting approval time and the identity information of the responsible parties of the receiving party should be recorded. Transmitted clinical information, which is the basis for review and reporting, should be kept in an accessible form and preferably included in reports.

Previous examinations and related clinical information of the patient should be able to be called at a rate suitable for the needs of the sender and receiver staff during the teleradiology service.

In primary reporting with teleradiology, the radiology report writing standards of the Republic of Turkey's Ministry of Health and the Turkish Society of Radiology (TSR) should be followed. Documents given for primary reporting purposes made with the teleradiology service should include the names of the receiving and sending parties, the identity of the source radiologist and the reporting radiologist, the physicians making the request, clinical information, date and contact information. The identity of the source and reporting radiologists should be explicitly placed in the documents, and a secure method such as wet signature or electronic signature should be used.

"Ghost reporting", which does not include the true identity of the reporter,is a serious misconduct and should not be allowed under any circumstances.

An approved report document should not be changed in any way. If any change or amendment is needed, there should be a clear record these changes such as "addenda" or "erratum/correction/amendment". Additions or corrections that will change the report content should be kept as a separate record; however, they should be readily accessible through the original report.

For applications using teleradiology methods in capacities other than primary reporting (such as emergency provisional or preliminary report), mechanisms in which the teleradiology process is adequately documented should be established(1–3,5).

Security and privacy

In addition to honoring internationally accepted basic medical values, teleradiology systems should have network and software security protocols to ensure the privacy and confidentiality of patient data, observing relevant international health standards and national legal regulations.

It should be clear which patient data will be shared, under which conditions and with whom, and precautions should be taken in order to restrict access to such data, granting such access to only a select group of authorized persons.

Precautions should be taken to ensure data integrity against intentional or unintentional corruption of data. These security measures should also be met in all sorts of teleradiology applications such as remote primary reporting by in-house employees, remote primary

reporting by outsourcing, preliminary (provisional) report, radiological consultation, expert opinion or secondary opinion.

Reliability

National and institutional written policies and procedures should be in place to ensure the quality and continuity of the teleradiology service. These should include backup systems of patient data, telecommunication link failure contingency planning, faulttolerance leeways and disaster plans.

In primary teleradiology reporting applications, measures should be taken to prevent data loss in case the service provider or information systems change or discontinue the service for any reason (1–3, 5).

Responsibilities

All radiologists serving in teleradiology applications in Turkey should have a specialization diploma that enables them to work as a Radiology Specialist in the Republic of Turkey (1).

The radiologist serving via teleradiology should be authorized by the party they provide service for, should serve under contract and should have the necessary qualifications. These physicians should work in a manner proper for fulfilling their professional legal responsibilities.

The sender and receiving party employees and the radiologists on both sides are responsible for the quality and timeliness of the radiological examination. The functions performed by radiologists and other employees in teleradiology services in each procedural step should be clearly defined, announced by mutual agreement, and all responsibilities of the radiological service process should be completely met.

The names and contact details of the teleradiology staff of the sending and receiving parties should be accessible and verifiable by the stakeholders of the process. Images archived on either side should meet the legal requirements of the sending party. Where interpreted images are properly archived at the sender side, they do not have to be archived at the receiving end. However, if archiving is to be done at the receiving end, the archiving should meet the legal archiving requirements at the sending side. How the records are kept should be stated in writing in advance.

Radiologists performing teleradiology should work in accordance with the laws, rules and regulations on the sending side.

The work plan and responsibilities of the employees in the teleradiology service process should be arranged in a way that does not violate the working hours and personal rights determined by law.

In cases where primary reporting is made in the form of outsourcing, the organization requesting such service procurement is responsible for the design of the service in accordance with the laws of the Republic of Turkey, relevant ministry regulations, bylaws and communiqués, and the featuresspecified in this guide. The responsibility of complying

with the rules specified in the contract framework for the provision of this service lies with the contractor teleradiology company or organization.

Quality assurance and improvement

Teleradiology practice should be considered as part of the radiology service and the same quality criteria should be met as with onsite radiology services.

Teleradiology parties should have a written plan for quality control, improvement and patient safety. These plans should, as a minimum, comply with the institutional quality policies of the receiving and sending parties, the national regulations and the guidelines announced by TSR. Teleradiology service provided by either in-house employees or external service providers should meet all of these quality requirements.

Quality metrics should regularly monitor patient safety and best diagnostic and therapeutic practices. Teleradiology process should comply with evidence-based guidelines. As with all healthcare processes, teleradiology practice should be monitored in terms of efficiency, effectiveness, safety and cost effectiveness.

In cases where teleradiology is applied for the generation of a preliminary (provisional) report, the quality criteria required by emergency radiology applications should be met.

Certification procedures showing teleradiology accreditation, licensing and related training for teleradiology service providers or employees of teleradiology services should be prepared and implemented by the relevant institutions.

For teleradiology service providers, there should be an independent institution or entity that evaluates the quality of service in terms of radiological examination and reporting components, and audit reports should be submitted regularly (1–3, 6).

Reimbursement and accountability

A reimbursement system should be established to meet the services and efforts provided in teleradiology applications.

Medical or technical errors that may occur during teleradiology applications should be insurable.

Ethical issues

All established principles of medical ethics, including those governing medical research outlined in the World Medical Association Declaration of Helsinki, shouldapply to the conduct of teleradiology practice.

In the outsourced teleradiology service model, patients or their legal guardians should be explicitly advised on the nature of service they are provided and their informed consent to the outsourcing of their radiological procedural consultation or evaluation should be obtained and stored. Otherwise, all institutional procedures governing informed consent of the patient or their legal guardian shouldapply (16).

References

1. Turkish Society of Radiology Board of Qualification and Standards. TSR Standards fort he Practice of Teleradiology [Turkish]. 9 April 2010.
2. Ranschaert ER et al. Comparison of European (ESR) and American (ACR) white papers on teleradiology: Patient primacy is paramount. J Am Coll Radiol 2015; 12:174–182.
3. European Society of Radiology. ESR White Paper on Teleradiology: an update from the teleradiology subgroup. Insights Imaging 2014; 5:1–8.
4. European Society of Radiology. ESR teleradiology survey: results. Insights Imaging 2016; 7:463–479.
5. Silvia E III et al. ACR White Paper on Teleradiology Practice: a report from the task force on teleradiology practice. J Am Coll Radiol 2013; 10:575–585.
6. Royal College of Radiology. Standards for the Provision of Teleradiology within the United Kingdom, Second Edition. 23 June 2016.
7. Republic of Turkey Personal Data Protection Authority. Law (No. 6698) on the Protection of Personal Data. Ratified 24 March 2016. https://www.kvkk.gov.tr/Icerik/6649/Personal-Data-Protection-Law. Accessed 11 May 2021.
8. American College of Radiology. ACR–AAPM–SIIM Technical Standard for Electronic Practice of Medical Imaging. 2017.
9. Kagadis GC et al. Medical imaging displays and their use in image interpretation. RadioGraphics 2013; 33:275–290.
10. Compton K, Oosterwijk H. Requirements for medical imaging monitors (part I). https://otechimg.com/publications/pdf/wp_medical_image_monitors.pdf. Accessed 11 May 2021.
11. National Electrical Manufacturers Association. Digital Imaging and Communications in Medicine (DICOM). Part 14: Grayscale standard display function. 2011.
12. McIlgorm DJ, McNulty JP. DICOM. Part 14: GSDF-calibrated medical grade monitor vs a DICOM part 14: GSDF-calibrated "commercial off-the-shelf" (COTS) monitor for viewing 8-bit dental images. Dentomaxillofac Radiol 2015; 44:20140148.
13. Salazar AJ et al. DICOM gray-scale standard display function: clinical diagnostic accuracy of chest radiography in medical-grade gray-scale and consumer-grade color displays. AJR 2014; 202:1272–1280.
14. Harisinghani MG, Blake MA, Saksena M, Hahn PF, Gervais D, Zalis M, da Silva Dias Fernandes L, Mueller PR. Importance and effects of altered workplace ergonomics in modern radiology suites. Radiographics 2004; 24:615–627.
15. García-Lallana A, Viteri-Ramírez G, Saiz-Mendiguren R, Broncano J, Dámaso Aquerreta J. Ergonomía del puesto de trabajo en radiología [Ergonomics of the workplace in radiology]. Radiologia 2011; 53:507–515.
16. World Medical Association. WMA Statement on the Ethics of Telemedicine. 2017 (Amended 2018).https://www.wma.net/policies-post/wma-statement-on-the-ethics-of-telemedicine.Accessed 11 May 2021.