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# Measuring Competence of Radiology Education Programs and Residents: The Egyptian Experience

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## 11.1 Introduction

Ancient Egypt was one of the largest and most advanced elaborate medical education and practice in the ancient world. Medicine was not practiced by witch doctors, as in primitive tribes with magic, but was a highly organized profession being practiced and taught in institutions called Houses of Life (Peri-Ankh). The first medical school opened there in the first dynasty (4,000 BC), and many others followed. Teachers were carefully chosen from priests of good and honest characters with scientific background (El-Gammal 1993; Nunn 1966).

Medical information in ancient Egypt was documented in medical papyri according to specialization to be references for physicians. The most famous were Ebers Papyrus (3,000 BC), an internal medicine reference; Kahun Papyrus (1,825 BC), which dealt with gynaecology and paediatrics; and Edwin Smith Papyrus (1,600 BC), which was concerned with surgery. The medical information in these papyri discussed clinical cases in the same steps we follow in our modern medical education books. Interrogation of the patient as a first step was followed by inspection, palpation and the percussion of the body and diseased organs. This was followed by 'diagnosis' and—if considered treatable—the 'recommended treatment'. Most of the cases also include an additional subheading 'explanation' for the medical students in which unfamiliar terms used in the case description was clarified (Breasted 1930; Nunn 1966; Sanchez and Burridge 2007; Walker 1996).

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According to Herodotus, there was a high degree of specialization among physicians: *The practice of medicine is very specialized among them. The country is full of physicians. Each physician treats just one disease* (Herodotus et al. 2005).

Physicians in ancient Egypt were organized with ranks. The lay physician (named *swnw*) was overranked by overseer of physicians (*imy-r swnw*), a chief physician (*wr swnw*), eldest physician (*smsw swnw*), inspector of physicians (*shd swnw*) and finally overseer of physicians of Upper and Lower Egypt. The competent medical bureaucracy was responsible to apprentice physicians to practicing healers (El-Gammal 1993). In the prologue to the *Instruction of Ankhsheshonq*, the physician was called to the royal court and underwent some quizzing by the king himself and then became a member of the medical team looking after the pharaoh: *Pharaoh asked him many [things] and he answered them all* (Lichtheim 2006). In ancient Egypt, women succeeded not just in acquiring medical knowledge but also in climbing to the top of the scribal hierarchy. An Old Kingdom female physician named Peseshet had a title of ‘Lady Overseer of the Lady Physicians’. She supervised women who were qualified physicians, not midwives. She also taught and graduated midwives at the *peri-ankh* (medical school) of Sais (El-Gammal 1993; Nunn 1966).

In modern history, the Faculty of Medicine at Cairo University (Kasr Al-Ainy), established in 1827, continues the glory of Egypt in medical education as one of the biggest and oldest medical schools in Africa and the Middle East. A central Radiology Department is responsible not only for the clinical services in the hospital but also for providing multiple calibre radiology education programs for trainees from Egypt and neighbour countries.

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## **11.2 Facilities of Faculty of Medicine of Kasr Al-Ainy, Cairo University**

Kasr Al-Ainy Medical School is composed of 16 facilities (Table 11.1) with more than 5,000 beds and serves about one million patients annually.

A central Radiology Department with total 77 staff members (professors, assistant professors and lecturers) in 9 subspecialty units (Table 11.2) is responsible for the clinical services in these facilities as well as for educating about 100 radiologists annually. All education programs (under- and postgraduates), clinical reports (including radiology), patients clinical files and interdepartmental communications at Kasr Al-Ainy Hospital are in English.

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## **11.3 Objectives and Goals of Education Programs and Training in Radiology Department at Kasr Al-Ainy, Cairo University**

### **11.3.1 General Philosophy and Principles of Radiology Academic Programs**

The Radiology Department at Kasr Al-Ainy provides different training programs that enable candidates to specialize in the field of diagnostic radiology: junior radiology

**Table 11.1** Cairo University hospitals and health facilities

|                                                           |
|-----------------------------------------------------------|
| 1. Manial University Hospital                             |
| 2. Manial Specialized Hospital                            |
| 3. Obstetrics and Gynecology Hospital                     |
| 4. Emergency Hospital                                     |
| 5. Oncology and Nuclear Medicine Center                   |
| 6. King Fahd Renal Failure and Surgery Unit               |
| 7. Intensive Care Unit                                    |
| 8. Internal Medicine Hospital                             |
| 9. Abu El Reesh Children Hospital                         |
| 10. Mubarak Hospital                                      |
| 11. Social Preventive Medical Center                      |
| 12. National Clinical and Environmental Toxicology Center |
| 13. Outpatient Clinic                                     |
| 14. New Kasr Al Ainy Teaching Hospital                    |
| 15. Medical Treatment Unit                                |
| 16. Operative Unit                                        |

**Table 11.2** List of the subspecialty units in Radiology Department at Kasr Al-Ainy

| Subspecialty                         | Number of radiology staff |
|--------------------------------------|---------------------------|
| 1. Neuroimaging and head and neck    | 12                        |
| 2. Musculoskeletal imaging           | 12                        |
| 3. Vascular imaging and intervention | 9                         |
| 4. Ultrasound and Doppler            | 3                         |
| 5. Cardiothoracic imaging            | 8                         |
| 6. Urogenital imaging                | 4                         |
| 7. Women's imaging                   | 9                         |
| 8. Abdominal imaging                 | 11                        |
| 9. Paediatric imaging                | 9                         |

resident candidates for the first part of master of radiology (M.Sc.), senior radiology resident candidates for the second part of M.Sc. of radiology and assistant lecturer candidates for the medical doctorate (M.D.) in radiology, as well as visitor trainees from other Egyptian hospitals or foreign countries. In the academic year 2010–2011, there were 37 and 25 candidates for the first and second parts of M.Sc., respectively, and 21 candidates for medical doctorate (M.D.) in addition to 20 visitor trainees from foreign countries, with a total of 103 candidates.

The general training philosophy and principles of the training in our department is to establish a qualified specialized radiologist who will be able to transfer his/her experience to colleagues and fulfil the following at the end of the program:

- To run a radio-diagnostic unit that provides basic and common diagnostic procedures
- To write a comprehensive report on a radiological study with clinical radiological interpretation to deduce the correct diagnosis or the possible differential diagnosis

- To be aware of current and advanced diagnostic imaging modalities and their applications in medicine for the purpose of diagnosis and treatment
- To be aware of clinical problems of the community and interact efficiently
- To communicate and keep pace with radiology practice in other parts of the world
- To investigate published scientific research and to present a short talk on an assigned topic
- To conduct research
- To have sufficient preliminary knowledge about the use of computers and information technology in radiology practice and research

### **11.3.2 Intended Learning Outcomes (ILOs) for Training Programs**

The intended learning outcomes (ILOs) depend on the level of the training program. These include the development of both knowledge and practical skills and the enhancement of intellectual and communicating capabilities at different levels according to that of the training program (M.Sc. or M.D.).

1. Knowledge: recognition of scientific knowledge related to diagnostic radiology
  - (a) Basic: includes physics, radiobiology, radiological anatomy
  - (b) Clinical: medical, surgical and pathological.
  - (c) Concepts of diagnostic modalities and appearances of different pathologies in different imaging modalities
2. Practical skills: applying different diagnostic imaging procedures competently and independently
3. Intellectual skills: to be able to review and search literature and perform research with sound methodology
4. Communications: working with colleagues in teams, referral to senior colleagues, responding to staff guidance and remarks, treating patients with respect and being aware and effectively responding to community's clinical problems

More specific objectives are assigned for each group of trainees in our department: residents (candidates for first and second parts of M.Sc. in Radiology) and assistant lecturers (candidates for M.D. in Radiology) in addition to visitor trainees from foreign countries.

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## **11.4 Education and Training Programs for Radiologists in Radiology Department at Kasr Al-Ainy, Cairo University**

### **11.4.1 Education and Training Programs for Residents**

The Radiology Department offers 36 months of residency training in which both academic and practical training are given. Program admission requirements, according to the Faculty of Medicine, Cairo University Bylaws for Post Graduate Programs (2009), applicants should have a bachelor degree in medicine (MBBCh or equivalent).

**Table 11.3** List of different imaging techniques practiced by residents in Radiology Department in Kasr Al-Ainy

|                                            |
|--------------------------------------------|
| Gastrointestinal barium techniques         |
| Hysterosalpingography                      |
| Urology conventional techniques            |
| Special paediatrics techniques             |
| Ultrasound and Doppler examinations        |
| CT angiography                             |
| High-resolution computed tomography HRCT   |
| Magnetic resonance angiography             |
| Virtual endoscopic techniques              |
| Angiographic and interventional procedures |

Candidates should fulfil preliminary courses in English language (TOEFL), medical statistics and computer skills (ICDL or equivalent). Preliminary courses are given at the Medical Education Center (MEDC) at Kasr Al-Ainy Hospital. Different imaging modalities are discussed in early morning and late afternoon lectures on a daily basis for all residents (6 days a week). Each resident spends a period of 2 months in each subspecialty unit (Table 11.2) as well as in the Emergency Unit as a junior resident and then repeats the cycle again as a senior resident.

Under the supervision of an assistant lecturer and an attending staff member, each resident is trained to attain different skills (Table 11.3) in performing radiological techniques and ultrasound examinations, as well as different special CT and MRI techniques warranting reconstruction of images on a separate work station.

Training objectives for senior residents include training them how to approach an imaging study, analyze it in a systematic way, and write a comprehensive report deducing a diagnosis or possible differential diagnoses. Weekly conferences are thus held with the residents to discuss different clinical cases. The residents are requested to share in the preparation of these meetings by presenting the case, preparing a short review on its theoretical background and sharing in discussions of the findings and diagnosis. Residents are also encouraged to spend time in the department's imaging library to study archival films and make use of its digital facilities. According to the Faculty of Medicine, Cairo University Bylaws for Residency Training Programs, a logbook is required for each resident. The logbook contains participation of the candidate in the scientific activities in the department.

#### **11.4.2 Education and Training Programs for Assistant Lecturers in Radiology Department in Kasr Al-Ainy**

Assistant lecturers are junior practicing radiologists who have completed radiology residency, passed their master's exams (M.Sc.), and are preparing for an M.D. (medical doctorate) degree in Radiology. An assistant lecturer is trained for a minimum of 3 years under the supervision of staff members in the different subspecialty units.

Assistant lecturers in the Radiology Department practice radiology as well as carry out academic duties while they study for their degree in M.D. in Radiology. The education objective is to prepare candidates who are capable of applying the recent trends in radiology.

The requirements for M.D. degree are preliminary 6 months course in surgery, internal medicine and pathology, then a minimum of 2-year course in radiology practice and lectures, after which the candidate may apply for the M.D. exams, which are held twice a year.

During this period, the candidate is supposed to complete a research project under the supervision of two senior radiology staff members as well as a senior member in a clinical department.

### **11.4.3 Education and Training Programs for Visitor Trainees in Radiology Department in Kasr Al-Ainy**

Visitor trainees are medical doctors with bachelor degree in medicine (MBBCh) from faculties other than Cairo University who attend training program in radiology at Kasr Al-Ainy Hospital. The trainees are from Egypt as well as other countries such as Sudan, Libya, Yemen, Palestine, Syria and Iraq. The number of visitor trainees is usually 10–15 per academic year.

Candidates for M.Sc. degree have to attend a 2-year training course at Kasr Al-Ainy Hospital to achieve the required skills in performing and interpreting the different radiological examinations. Visitor trainees attend the same academic program for residents. Those trainees number vary from about 10–15 per academic year.

Junior radiologist trainees with a master's degree are also present, submitting for an M.D. degree exam. There are usually two training sessions annually that follow the same training procedure as for assistant lecturers.

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## **11.5 Assessment and Evaluation of Trainees in Radiology Department Kasr Al-Ainy**

### **11.5.1 General Evaluation**

The Radiology Department training program is planned to enable candidates to specialize in the area of diagnostic radiology. The program is designed to evaluate the trainees for their competency, knowledge and skills as a part of a general evaluation that is done every 2 months by the administration of the department. According to the program, candidates are expected to achieve satisfactory levels in knowledge in all subspecialties in radiology practice, to be able to interact with community problems, to respect ethical values of the community culture, to promote their medical standards through engaging in continuing medical education and to introduce them to scientific medical research. Assessment is fulfilled by the

head of each radiology subspecialty unit for all trainees in the unit (residents, assistant lecturers, visitor trainees). Assessment includes attendance, participating in the scientific and administrative activities, general performance, attitude with colleagues and patients, improvements in technical skills and capabilities of solving problems.

The progress of learning of each trainee is followed up by the staff members through the evaluation reports. We implemented logbooks to register the progress of the trainee based on research studies in the faculty about standards of postmedical education (Selim 2008). The logbook documents the skills and experience attained by using credit points. The candidate of the program should fulfil 152 credit points through completion of compulsory courses, residency training, different scientific activities and thesis defence. These assessments are considered when the candidate is considered for promotion from a resident to assistant lecturer or from assistant lecturer to lecturer upon obtaining M.Sc. or M.D. degrees, respectively.

## 11.5.2 Objective Evaluation

Trainees at Radiology Department are assessed objectively by daily, weekly and biannual evaluations as well as by a thesis defence to determine whether or not the goals of the education program have been achieved.

### 11.5.2.1 Daily Assessment

This is done during film reporting sessions where daily clinical cases are discussed between staff members and the trainees in each subspecialty unit. On these sessions, technical skills of trainees are assessed.

### 11.5.2.2 Weekly Assessment

Daily ongoing assessment is done during the weekly scientific conference of the department. On weekly basis, each subspecialty unit presents clinical cases with relevant educational merits. Residents and assistant lecturers participate in presenting the cases and discussing the imaging findings and diagnoses. Short reviews of literature are presented digitally by the trainees during the conference and are assessed by the attending staff members for the following:

- Fulfilment of the assigned goal of the lecture
- Methodology of the presentation
- Clarity of the images and slides

### 11.5.2.3 Biannual Assessment

Examinations for M.Sc. and M.D. are carried out in May and November every year. Certain credit hours should be fulfilled as a requirement to attend the exams. A mock exam is given for the trainees 1 month before the exam to evaluate their general standard before proposing for exams. The exams are comprised of written and oral, as well as spotting and reporting tests (Table 11.4).

**Table 11.4** Examinations schedule for M.Sc. (part II) and M.D. degrees in Radiology in Kasr Al-Ainy

|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Written exams (4 days)            | (a) Multiple choice radiology exam (3 h)<br>(b) Short questions radiology exam (3 h)<br>(c) Pathology (2 h)<br>(d) Internal medicine and surgery (1 h each)                                                                                                                                                                                                                                                                                                                                              |
| Oral and practical exams (6 days) | (a) Oral radiology exam (1 day):<br>(i) M.Sc. degree in radiology: examined by 4–5 examiners<br>(ii) M.D. degree in Radiology: examined by 7–10 examiners<br>(b) Practical radiology exam (2 days)<br>(i) Ten short cases spotting and three long cases reporting<br>(ii) Practical ultrasonography examination (for M.Sc. candidates)<br>(c) Surgery (oral and practical exams) (1 day)<br>(d) Internal medicine (oral and practical exams) (1 day)<br>(e) Pathology (oral and practical exams) (1 day) |

In the *spotting test*, cases from different radiological subspecialties are meticulously chosen to cover the different imaging modalities and techniques. Candidates for Part I M.Sc., are assessed for knowledge of performing the radiological techniques and radiological anatomy. Candidates for Part II M.Sc. and M.D. are assessed for knowledge of pathological basis of abnormalities detected in diagnostic imaging modalities.

In *oral exams*, candidates for M.Sc. or M.D. are examined by several examiners in different subspecialties; candidates spend about 15–20 min with each examiner (Fig. 11.1). During oral exams, the candidate's knowledge, way of thinking and approach to diagnose clinical cases are tested.

In *reporting exams*, candidates for M.Sc. or M.D. are tested on three imaging cases; they are given 20 min to report on each case. Candidates are assessed for how they approach the case, describe the findings, suggest differential diagnoses and conclude with a logical diagnosis.

In *written assessments*, candidates of M.Sc. and M.D. degrees in Radiology are assessed by written tests in the form of MCQ and short questions that are held on two consecutive days for 3 h each. The questions are selected to cover the different subspecialties in radiology. In short questions exams, a candidate is tested for his/her ability to solve a clinical case, to describe the imaging appearances of a certain pathological entity, to include the differential diagnosis of a certain pathological picture or clinical presentation and to mention a possible radiological algorithm when dealing with certain clinical situations.

#### 11.5.2.4 Thesis Defence

According to the Faculty of Medicine, Cairo University Bylaws for Post Graduate Programs (2009), candidates for M.Sc. and M.D. in Radiology have to fulfil assigned



**Fig. 11.1** Oral examination for M.D. degree in Radiology held in Cairo University. The candidate typically spends about 15 min with each of the *seven* examiners

research during her/his training period under the supervision of two or three senior staff members of Radiology Department as well as senior member of a clinical department in Faculty of Medicine at Cairo University.

The research project should be formulated in the form of a thesis. A candidate then has to defend the thesis in an open session in front of a committee of three examiners: an internal examiner (a senior member of Radiology Department at Cairo University) and the senior supervisor of the thesis, as well as an external examiner (a senior member of a university other than Cairo University) that meets the faculty standards. The candidate is asked to prepare a 20-min digital presentation to show his/her work (Fig. 11.2). The discussion assesses the candidate's knowledge of the research topic, methodology, results and conclusions of the work. A decision of acceptance or refusal of the thesis is based on the competence of the candidate in performing her/his research.

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## **11.6 Assessment and Evaluation of Education Programs in Radiology Department at Kasr Al-Ainy**

### **11.6.1 Radiology Academic Programs Design and Follow-Up**

Specifications for the academic programs for master's (M.Sc.) and doctorate (M.D.) degrees in radiology are designed, evaluated and followed up by directors from Faculty of Medicine according to Cairo University's perspectives. The training programs are designed with the aim that candidates achieve satisfactory levels in knowledge of radiology and its subspecialties, gain practical skills, engage in continuing medical education, and get introduced to the basics of scientific medical

**Fig. 11.2** Defence of Thesis for Master (M.Sc.) degree in Radiology in Radiology Department at Cairo University. **(a)** The candidate defends her thesis in front of three examiners (a supervisor of the thesis, an internal examiner from Cairo University, and an external examiner from another university). **(b)** A candidate typically uses digital presentations



research. Radiology training programs are also designed in respect to the ethical values of the community and culture and prepare trainees to interact positively with community's clinical problems.

### **11.6.2 Evaluation of Radiology Academic Programs by Accreditation Bodies**

Radiology academic programs in Kasr Al-Ainy are measured for professional performance by accreditation bodies of different levels: self-assessment by Cairo University, national and international bodies.

#### **11.6.2.1 Self-Assessment Through Medical Education Development Center (MEDC) at Cairo University**

As an initial step of accreditation, Cairo University assigned the Medical Education Development Center (MEDC) in the university in 2003 to prepare a self-study for

the Faculty of Medicine. The MEDC team is composed of staff members of the Faculty of Medicine who are assigned to collect information, analyze data and write reports to be used for the self-study of the faculty. MDEC prepared two self-studies for Faculty of Medicine, one in 2004 and another in 2009. Continuous measuring of professional performance of all hospital departments at Kasr Al Ainy Hospital, including the Radiology Department, has been carried out regularly by MEDC since 2004.

In each department of Kasr Al-Ainy Hospital, including the Radiology Department, an internal audit is assigned to observe, measure and follow-up the professional performance at the departments. Checklists are often used, and a feedback is presented regularly to MEDC. Since 2008, the system of academic mentor is applied in the Radiology Department as suggested by self-study of 2004 as well as by other academic researches that followed it concerning the medical education process in the Faculty (Seleem 2007; Selim 2008). Each senior staff member is assigned to mentor the academic progress of few (from 1 to 3) radiology trainees.

Continuous upgrading and renewal of teaching facilities in Radiology Department are pre-requisite for accreditation. Educational facilities include up-to-date data show machines, digital library facilities, computers and fast internet connections, as well as a supply of latest periodicals and textbooks of radiology.

#### **11.6.2.2 National Assessment Through National Authority for Quality Assurance and Accreditation in Education (NAQAAE), Egypt**

NAQAAE, established in 2007, is the accrediting body for all Egyptian educational institutions (about 55,000 institutions). The board is formed of a President, 3 vice-presidents and 11 board members selected mainly from educational experts. The main goal of NAQAAE is to support Egyptian educational institutes by fostering their quality assurance practices (NAQAAE 2011).

NAQAAE aims at raising awareness of educational quality assurance in the Faculty of Medicine of Cairo University through helping the faculty to establish an integrated system for accreditation, to set up educational standards and performance assessment indicators and to assert confidence and establish accountability in the educational outcome.

The intended learning outcomes (ILOs) of radiology education programs are developed according to the general guidelines of National Academic Reference Standards (NARS) for medical education by NAQAAE (Medicine Cairo University 2011).

Continuous measuring of professional performance of all hospital departments at Kasr Al-Ainy Hospital, including the Radiology Department, is carried out regularly by NAQAAE since 2007; the last inspection was in May 2011.

Evaluation of the radiology academic programs' ILOs are carried out during biannual meetings of the Radiology Department. However, more subjective evaluation of ILOs is currently under construction and includes the following:

1. Questionnaire to be answered by the candidate at the end of the program
2. Alumni office for postgraduates: to supervise the academic programs, to solve problems and to supply CME facilities

3. Stakeholders: representatives from different medical authorities in Egypt including army hospitals, National Medical Insurance, Medical Syndicate and Ministry of Health
4. External evaluators from national universities other than Cairo University to review the academic programs and participates in the biannual examinations to provide biannual reports
5. Quality assurance unit: a specialized unit to monitor the level of the education process and provide annual report

### **11.6.2.3 International Assessment Through the World Federation for Medical Education (WFME)**

WFME is a global organization concerned with medical education and training of medical doctors as well as undergraduate medical students. A central part of the WFME strategy is to give priority to specification of international standards and guidelines for medical education, comprising both institutions and their educational programs (WFME 2012). In December 2004, WFME visited and inspected the Faculty of Medicine of Kasr Al-Ainy. Evaluation of WFME is based on generally accepted standards.

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## **11.7 What Do We Know from Experience That We Can Learn From?**

The self-studies that were carried in 2004 and 2009 introduced the concepts of quality assurance and self-review as well as the global standards of medical education to the authorities, administration, faculty members and students. The studies followed the basic standards of medical education from the WFME global standards. These self-studies systematically evaluated the institution's objectives, development and implementation procedures to evaluate the extent to which it achieves its goals. Data collected through interviews, documents, questionnaires and focus group discussions helped to identify points of strength and weakness of the medical education programs. These studies also suggested corrective measures to each standard to comply for WFME accepted standards and measures. These researches and analyses helped medical programs improvement.

Learning, teaching and scholarship in radiology are dynamic progressive processes, with experience gained and shared in every step. Successful medical education programs lead to better tutors, education strategies, training programs and eventually better trainee outcomes (Saleem 2007; Selim 2008).

One of the most important recommendations in this accreditation is how staff members themselves are trained to teach the academic programs. For this purpose, the Faculty of Medicine has designed training programs and workshops for its staff members. Attendance of faculty members in skill workshops is an essential requirement for each promotion and every 5 years at maximum.

In the Radiology Department at Cairo University, we aim to prepare radiologists to master their skills and knowledge through continuous measurement, assessment

and evaluation of ourselves (as tutors), our academic programs, our facilities and our trainees.

Evaluation of the radiological educational programs based on accepted standards is an important incentive for improvement and for raising the quality of medical education. We believe that adoption of internationally accepted standards provides a basis for national evaluation of radiology education and facilitates mobility of trainees as well as ease acceptance of radiologists in countries other than those in which they are trained. Finally, improvement of evaluation and accreditation enhances the quality of health care both nationally and globally.

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