

**PROFESSIONAL STANDARDS FOR THE EDUCATION  
OF  
RADIOLOGIC TECHNOLOGISTS / RADIOGRAPHERS/  
X-RAY TECHNOLOGISTS**

**Submitted by**

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## 1. INTRODUCTION

### 1.1 Purpose

It is intended that this document will reflect the evolutionary developments relative to advances in the imaging field of medical radiation technology and the changes in educational philosophy.

This document aims to promote the free exchange of ideas and to allow the further development of educational programmes for medical radiation technologists (MRTs) in diagnostic radiography throughout the world. It has grown out of the response to requests for assistance and is intended to serve as a guide for an international standard in diagnostic radiography.

This document is intended to identify the roles, fields of knowledge and attributes that underlie competent professional performance, hence providing a framework for the development of professional standards of diagnostic radiography.

### 1.2 Philosophy

The profession is concerned with service to people and to their individual needs. In order to serve people effectively, the individual cannot be separated from the culture, customs and social patterns from which he is a product. It is equally important for MRTs to understand their role as members of the health care team as well as the role of the other health care professionals. The guiding principle in the development of a programme should be quality of education for the students and quality of care for patients.

Professional education is concerned with the development of a unique body of knowledge and skills which is translated into an educational programme. Inherent in this is the need to develop attitudes appropriate for the effective performance of the professional role. Programme design should be broad based and student-centred. This should, in turn, open avenues of inquiry and research leading to the future development of the student and the profession. Emphasis should be placed on self - motivation, development of critical and evaluative skills and the encouragement of originality of thought.

### 1.3 Application

This document is offered as a **recommended set of guidelines for national organizations**. It is not intended to list the specifics but it is intended to meet the needs of different educational systems, health care structures and socio-economic patterns.

This document recognizes that academic and clinical requirements of MRTs will vary both within and between countries. This is commensurate with existing educational programmes, the present and future needs of the medical community and existing policies.

This document does not indicate the type of qualification/ certification to be awarded.

#### **1.4 Interpretation**

In this document, all references in the masculine gender include the feminine. Unless the context requires otherwise, the following terminology is implied:

**APPROVING AUTHORITY:** the government body, professional organization or other persons who may have the responsibility of organizing, funding, monitoring or certifying the MRT programme

**ADVISORY COMMITTEE:** the committee appointed by the institution to provide advice in the organization of the education programme

**CERTIFICATION:** a qualification, award, diploma, degree, or any other documentation that indicates successful completion of the education programme and is used as recognition for employment

**COURSE MONITORING:** a series of activities to ensure the maintenance of the quality of education for the programme and sometimes referred to as Quality Assurance of the Programme

**CLINICAL SETTING:** the area/situation in which the practitioner performs his role

**CLINICAL EDUCATION:** a programme of clinical experience for the student in the clinical setting and would also involve working with patients

**COMPETENCY LEVEL:** the level of performance required for a particular professional skill in the clinical setting

**DIAGNOSTIC IMAGING:** diagnostic procedures using ionizing and non-ionizing radiation

**DIAGNOSTIC RADIOGRAPHY:** radiography for diagnostic purposes

**EDUCATIONAL INSTITUTION:** the institution which organizes the education programme for MRTs

**GENERAL RADIOGRAPHY:** conventional radiographic procedures

**MRTs:** Medical Radiation Technologists, Radiographers, Radiological Technologists, Radiation Technologists, Imaging Technologists and others who have successfully completed a nationally recognized educational programme in the profession. It is recognized that different countries use different terminology, however, the level of performance and responsibility is the same

**RADIATION RISK/BENEFIT STATUS:** that prior to any radiographic examination, the use of the ALARA principle (As Low As Reasonably Achievable) should be considered relative to the condition of the patient;

**STUDENT-CENTRED:** students are provided with opportunities to be actively involved in, and given responsibility for, their own learning.

## **2.0 ROLE OF THE TECHNOLOGIST in Diagnostic Radiography (Ref: APPENDIX 7.1)**

The MRT plays a central role in linking seven key areas of importance in the diagnostic imaging departments. The seven areas are:

- Patient care,
- Use of imaging technology,
- Optimization of dose,
- Clinical responsibility,
- Organization,
- Quality assurance,
- Education and training.

The role of the Technologist in each of these areas is as follows:

### **2.1 Patient Care**

The MRT has both a direct and a supervisory role with regard to the welfare of the patient in his care ensuring the patient's safety, dignity, and the quality of patient care.

### **2.2 Use of Imaging Technology**

The MRT is the only recognized expert in the broad range of the production of diagnostic images utilizing ionizing radiation.

### **2.3 Optimization of Dose**

The International Commission of Radiological Protection in its Publication ICRP 36<sup>1</sup> states that the MRT is in a key position regarding radiation protection of the patient. By his expertise, skill and care, he will determine within wide limits, the amount of radiation administered to patients.

1. Annals of the ICRP Vol. 10 No 1 1983, Pergamon Press

### **2.4 Clinical Responsibility**

The Imaging MRT's prime expertise and responsibility is to undertake the whole range of techniques in diagnostic imaging and to subsequently assess the quality of the work.

### **2.5 Organization/management**

Dependent upon the level in the organization to which an MRT is appointed, the technologist has responsibility for the proper and efficient organization of work, use of resources and the application of departmental policies and protocols in the area for which he is responsible.

### **2.6 Quality Assurance**

All areas of the MRT's responsibility require quality assurance procedures, therefore, the MRT must be a full member of the team which develops, maintains and monitors the quality standards of the department. If no quality assurance programme is in place, the MRT has the responsibility to initiate one and to ensure its implementation.

Quality assurance is to be carried out in an efficient, caring and cost-effective manner to achieve consistently optimum image quality with minimum radiation to the patient .

### **2.7 Education and Training**

As a professional, an MRT has the duty to:

- i) update and maintain his practice
- ii) to apply proven research results which will benefit patients.
- iii) be involved with the clinical education and the development of the MRT student. The MRT's qualifications, abilities and role enable him to advise, instruct and supervise other staff in appropriate circumstances.

In addition he may be required to participate in the theoretical education of students, other professionals and/or the general public. It is not expected, however, that the newly qualified MRT will be a competent educationalist but with time, experience, and further studies, he should be able to educate and guide the students and junior members of the profession.

- iv) be involved with any health promotion initiatives

### **3.0 EDUCATIONAL AIMS AND COMPETENCIES**

#### **3.1 AIMS**

The aims of an educational programme for radiography students will include:

- a) The provision of a sound foundation in the broad aspects of radiography integrating clinical experience with academic content.
- b) The encouragement of the progressive assumption of responsibility by the student for the needs of the patient to ensure a caring, patient-centred approach.
- c) The development of the ability of the student to transfer his knowledge and understanding to new situations.
- d) The development of the student to be self-reliant, resourceful, discrete and to act in a responsible mature fashion.
- e) The provision of a course which enables practitioners to proceed to advanced study thus providing for the future development of teachers, clinical supervisors, research workers and managers, with a progressive career structure.

#### **3.2 Competencies**

##### **3.2.1 Introduction**

The aim of this section is to illustrate integration of the major skills, fields of knowledge and capabilities inherent in competent, professional performance.

The qualified MRT in diagnostic radiography will be expected to be competent to examine/assess patients of all ages and conditions, from those who are ambulant and cooperative to those who are non ambulant, uncooperative, unable to understand and/or are suffering from major trauma or debilitating

disease. Particular attention should be paid to the exposure of pediatric patients to ionizing radiation.

The range of examinations undertaken must include general radiography (trauma and non-trauma), contrast media examinations, mobile and operating theatre radiography. All MRTs should show competence (as defined by the course team) under the headings patient care, use of imaging technology, optimization of dose, clinical responsibility, organization of the examination and quality assurance.

**There are other procedures/modalities which, dependent on local or national trends, could be considered as routine or specialized. These include computerized tomography, digital radiography, medical ultrasound and magnetic resonance imaging. Where these are included within the curriculum, specified competencies should be defined by the programme using similar and appropriate headings.**

**3.2.2 Competency statements** (the list is not prioritized nor necessarily complete).

#### **3.2.2.1 Patient Care**

The MRT must be competent to:

- a) perform proper identification of the patient
- b) ensure that the patient gives or has given informed consent having first given the patient a clear explanation of the procedure to ensure his cooperation
- c) meet ethical/moral considerations
- d) ensure that no previously performed imaging procedure has already provided the information requested
- e) ensure that a relevant clinical history has been obtained
- f) ensure that no concurrent treatment or investigation will prevent a good result
- g) ensure that any preparatory instructions, pre medications or contrast media have been administered correctly
- h) ensure that an appropriate check regarding pregnancy has been performed and that appropriate action has been taken

- i) consider the radiation protection status of the patient
- j) perform appropriate after-care
- k) use appropriate facilities and methods to prevent cross-infection with particular emphasis on precaution standards for blood born pathogens, specifically HIV and hepatitis
- l) evaluate the patient's condition prior to the examination in order to make judgment as to the best method to use
- m) initiate basic life-support methods if necessary
- n) react appropriately to other emergency situations
- o) give intravenous injections for the purpose of imaging **provided** that the appropriate training and authorization has been given

#### **3.2.2.2 Use of Imaging Technology**

The MRT must be competent at and able to:

- a) make a judgment as to the purpose of the request and take the correct action
- b) position the patient, source of radiation, image recording device and any ancillary equipment such that the final image is optimum
- c) make a judgment as to necessary adaptations to departmental protocols and take appropriate action
- d) use the equipment safely and correctly
- e) ensure that any error in the final image is not due to incorrect usage of equipment
- f) select suitable combinations of exposure factors and image recording materials to produce optimum images allowing for the patient's condition
- g) maintain and control all the steps involved in the production and storage of a permanent or visible image

- h) assess the resultant image for suitability for its purpose

*Where digital imaging is involved, in addition to the above elements the MRT must be competent to:*

- i) apply a detailed knowledge of anatomy in different sectional planes in order to be able to correlate the position of the patient with the required three-dimensional information
- j) select programmes
- k) give advice as to the likely quality of the image using the parameters selected e.g. use of compensating filters, timing of injection, selection of exposure factors etc.
- l) record, adapt and re-construct data to obtain optimum image quality
- m) store and retrieve information
- n) assess the resultant images for suitability for interpretation and diagnosis.

### **3.2.2.3 Optimization of dose**

The MRT must be competent to:

- a) select and manipulate the exposure factors and image recording materials such that the dose to the patient is minimized whilst giving the optimum image
- b) ensure that all equipment to be used is fully fit for its purpose
- c) use all equipment and methods in order to ensure optimization of dose to patient, staff and public and to ensure that no person receives unnecessary irradiation
- d) ensure that any protocols relating to the imaging of patients of child-bearing capability are applied
- e) fulfill any requirements for the recording of dose
- f) take appropriate action in radiological emergency situations

### **3.2.2.4 Clinical Responsibility**

The MRT must be competent to:

- a) be professionally accountable for his actions
- b) make judgments as to his professional limitations and take appropriate action
- c) maintain confidentiality of information.

**3.2.2.5 Organization** (the following competencies apply to the newly qualified MRT)

The MRT must be competent to:

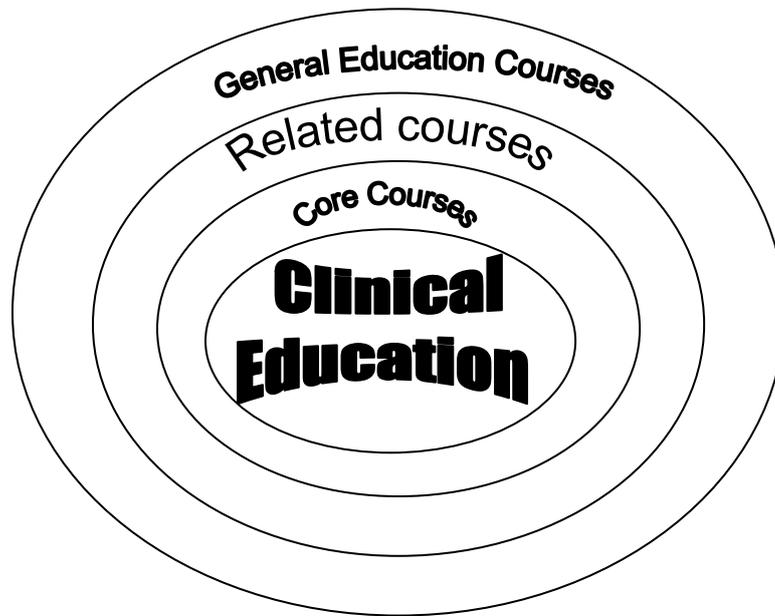
- a) efficiently organize the performance of an individual examination
- b) efficiently organize work within the area for which he is responsible
- c) ensure compliance with all applicable legislation relating to his work.

**3.2.2.6 Quality Assurance**

The MRT must be competent in assessing the quality of his own work. Each of the above competencies should be considered for inclusion in any Quality Assurance Program.

**4.0 GUIDELINES FOR CURRICULUM DEVELOPMENT**

A formal curriculum is required to enable the MRT to develop a level of understanding and skill required for the technology and its application. The formal curriculum can be divided into a number of integrated categories, each of which incorporate a number of courses. The following model is a conceptual framework of the curriculum.



This model enables the curriculum development group to see the thematic relationship of the various courses. It takes into account the educational aims and competencies outlined in the previous section.

## **4.1 The model**

The following is a more detailed description of the model:

### **4.1.1 Clinical Education**

This element is the framework around which the above courses are centred. It enables students to develop the full range of competencies as outlined in Section 3 of this document

Clinical Education must be patient-centred and take place in a clinical setting, that is, in the professional work-place.

### **4.1.2 Core Elements**

The following list constitutes the core elements which the student must undertake in order to satisfy the educational aims and competencies. A brief description of these courses follows.

#### **4.1.2.1 Radiation Safety/Protection**

This course provides the student with an understanding of radiation hazards and radiation protection requirements for the staff, patient and the general public, thus enabling effective application.

#### **4.1.2.2 Quality Assurance**

This course provides the student with the understanding and skills necessary to evaluate imaging procedures and imaging systems thus ensuring the provision of efficient service to the patient, clinician and employer.

#### **4.1.2.3 Imaging Technique/Procedures**

This course provides the student with the concepts and skills required to perform imaging procedures under a variety of conditions. Attention must be paid to the integration of the theoretical concepts and laboratory techniques with clinical applications.

#### **4.1.2.4 Instrumentation**

This course provides an understanding of all equipment used in imaging to enable the student to use the equipment competently.

#### **4.1.3 Related Courses**

The main justification for these courses is to provide the student with the level of understanding and skills required to undertake the core courses. The following is a brief description of recommended courses:

##### **4.1.3.1 Medical Sciences**

These courses give students an understanding of the structure, function and disease patterns of the human body. The courses should include anatomy, physiology, pathology and biochemistry.

##### **4.1.3.2 Physical Sciences**

These courses provide students with the understanding of general and radiation physics necessary for application to the various forms of the imaging technology,

##### **4.1.3.3 Radiobiology**

This course gives students an understanding of the effects of ionizing radiation on the human body.

##### **4.1.3.4 Mathematics/Statistics**

Mathematics forms the basis for an appreciation of scientific principles. Statistics enables the student to analyze data produced in various imaging modalities.

##### **4.1.3.5 Electronics**

This course enables the student to develop an understanding of the principles and operation of electronic devices.

##### **4.1.3.6 Management**

This course provides the student with an opportunity to develop his knowledge and skills in the management process.

#### **4.1.3.7 Research Methodology**

This course gives the student an opportunity to understand and use the elements involved in the research process.

#### **4.1.3.8 Nursing/Patient Management**

This course provides the student with an understanding of the concepts of patient care including the patient's physical and psychological needs. The student will be able to undertake a number of routine and emergency procedures in a variety of circumstances.

### **4.1.4 General Education Courses**

These courses are included with the aim of achieving the following objectives:

- a) To make the student an effective communicator
- b) To enable the student to develop outside interests
- c) To enable the student to reflect on and to take his place in society

A list of courses may include:

#### **4.1.4.1 Behavioral Sciences** (e.g. Psychology, Sociology)

These courses will provide an understanding of human development and behaviour.

#### **4.1.4.2 Communication skills**

These skills will enable the student to interact/function effectively in various situations.

#### **4.1.4.3 Computer Science**

This course will provide the student with an understanding of the principles in the operation of the computer and its associated technology. The course will also provide him with the necessary skills to apply the technology effectively.

#### **4.1.4.4 Elective Courses**

These courses/activities will provide the student with an opportunity to pursue a particular interest at the institution. These courses may not necessarily be related to radiographic technology, e.g. computer languages, economics, philosophy, health and fitness courses, activities in the national society/students' union. (This list is by no means exhaustive and can be modified to suit the local conditions).

### **4.2 Teaching and Learning Strategies**

Courses should be student-centred.

There should be a planned development of course themes integrating theory and practice with consideration given to course sequencing.

Clinical education must be organized in such a way that students' time in the clinical setting is optimized.

Ongoing evaluation of students' performance followed by constructive feedback should be a major consideration in the total programme.

### **4.3 Assessment**

A system for both formative (on-going) and summative (end of course) assessment should be practiced. Objective methods of assessment are recommended for clinical performance.

Assessment methods must be designed to meet/satisfy the educational aims of the course.

All assessment procedures must be subjected to internal and/or external quality control.

### **4.4 Application**

It is recognized that different types of educational settings and the entry level of students will influence the structure and content of each programme. It is further recognized that there is a trend in many countries towards increasing the length of programmes. This is particularly so in countries with long established programmes and is considered as part of the evolutionary process which encourages research and professional development.

The length of the programme should not be less than 3 years in order that the necessary competencies can be achieved and safety of the patient assured.

## **5.0 ORGANIZATION AND RESOURCES**

### **5.1 Organization**

#### **5.1.1 Advisory Committee**

It is recommended that there should be an Advisory Committee. This committee can be of great assistance in the planning, implementation, and on-going development of an educational programme.

The nature, structure and composition of this committee would depend on the local situation. The members of this committee should be selected on the basis of their involvement with the profession either through their expertise and interest or their influence as representatives of affiliated professions. It must include practicing members of the radiographic profession.

#### **5.1.2 Educational Institution**

The programme for MRTs may be offered by universities or institutions of higher education in cooperation with medical imaging departments. Successful candidates are awarded degrees or diplomas. Courses may also be offered by separate educational units affiliated with several hospitals or integral units of a hospital which offer their own certification.

Whichever model is followed, the standards of radiographic education in each country should be protected by the Approving Authority which should appoint a committee consisting of members especially qualified and selected to execute this task. It is this committee which should be responsible for the periodic review of the Programme to adapt new developments in radiation technology into the professional practice.

#### **5.1.3 Affiliation with clinical settings**

Guided and supervised clinical experience is an essential part of the preparation of MRTs. In the clinical setting, a student must, at all times, be working under the supervision of MRTs. Clinical sites should be selected on the basis of specific criteria. There must be provision for achievement of the required competencies in these clinical settings.

#### **5.1.4 Director/head of education programme**

The MRT who heads the programme should be sufficiently well prepared to assume the duties inherent in the position. The director of

the MRT programme is the person directly responsible for coordinating the planning and administration of the programme and the supervising and assessing of staff performance including clinical staff in relation to student experience.

### **5.1.5 General Criteria for Student Selection**

It is recommended that the student should have completed the recognized secondary school studies which would prepare him for higher education. The selection should not be based on academic qualifications alone. The selection should not disqualify the mature student lacking the formal academic qualification. Maturity and emotional stability, satisfactory attitudes towards social responsibilities and the ability to communicate are equally important.

The health of the prospective student, both physical and mental, should be considered.

### **5.1.6 Certification**

It is essential that on completion of the programme students receive some form of certification which will ensure professional recognition not only from their own profession but also from allied professions. The programme therefore should be established under the auspices of an institution which may grant such an award or, if established separately, care must be taken to ensure the graduates have recognized professional standing.

### **5.1.7 Continuing Education**

The education programme which has been described gives a sound foundation in the broad aspects of medical radiation technology. This must be viewed as a starting point from which depth of knowledge in specified areas must be acquired. The need for specialist education has become more urgent with the proliferation of information in radiation medicine and post qualification courses should be established.

Serious consideration should be given to promoting higher education for teaching personnel.

A continuing education programme should provide for better avenues for an appropriate career structure in the profession.

### **5.1.8 Research**

MRTs and teaching personnel should receive the necessary education, support and encouragement to initiate and participate in research projects. These may be educational or clinical in nature and may be directed towards higher qualifications.

## **5.2 Resources**

### **5.2.1 Physical Resources**

There are certain requirements which need to be established in accordance with the number of students to be taught at any one time. If the programme is set up in conjunction with a teaching hospital, it is frequently possible to share facilities. As well as providing space for formal lectures, there should be provision for seminars, small group discussion, demonstrations and experiments and student counseling.

### **5.2.2 Financial Resources**

There should be adequate financial support to provide staff , salaries and funds for equipment, books and teaching aids.

### **5.2.3 Human Resources**

MRTs teaching in the clinical and academic setting must be appropriately qualified. Adequate supporting staff should be provided .

## **6. COURSE MONITORING**

### **6.1 External**

It is expected that countries will have their own systems of periodic review in which the national association and any accrediting body will be involved.

### **6.2 Internal**

The education institute must have its own on-going defined programme of evaluation of the educational process and a mechanism for the correction/adaptation where this proves necessary. This should include a review on at least an annual basis of examination/assessment results, examiners' comments (internal and external where appropriate), and reports from clinical placements and other interested parties.

The person/team responsible for the programme must propose a course of corrective action if required and subsequently report on its effectiveness at an interval to be defined.

## **7. APPENDIX**

7.1 ISRRT ROLE OF THE MEDICAL RADIATION  
TECHNOLOGIST(Radiographer), September 1993.