A training program in radiation protection and quality control for radiographers and radiological technologists from developing countries

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Abstract
A training program of two months duration is developed for radiographers and radiological technologists from developing countries as part of the international training program (ITP) of the Flemish Interuniversity Council (VLIR). The aim of the training is to provide theoretical and practical knowledge in radiation protection, optimisation of examinations and quality control to allow capacity-building in developing countries.
The program includes theoretical seminars in dosimetry and radiation protection, alternated with "hands-on" training in the skills-lab radiology at EHSAL. A theoretical and practical training in quality control of radiological equipment is also part of the training and some attention is given to ultrasound, CT and digital radiography as important developments in the world of medical imaging. The training includes an internship of two weeks at a department of radiology and visits to companies and institutes. Participants return to their home country with essential documentation and contacts with Belgian/ European colleagues to initiate local initiatives in the field of radiation protection and quality assurance.
The training was first organised in the autumn 2004 for 12 students and was evaluated positively by both the organisers and students. The students gained experience in the field of radiation protection. For the participating hospitals the visit of the ITP students was a good moment to evaluate their own radiation safety and quality control.

1. Introduction

The medical use of radiation is the largest and a growing man-made source of radiation exposure. From these activities, diagnostic radiology represents the largest part. The United Nations Scientific Committee on the Effects of Atomic Radiation states in her 2000 report that particular large numbers of people in developing countries can not yet take advantage of many of the available medical procedures using radiation. 'For the time being', the commission concludes, 'therefore, those people receive less radiation exposure from medical diagnosis and treatment then people living in countries benefiting from advanced medical procedures, a situation that is expected to change in the future and will need to be followed by the Commission' [1].
To improve the quality of diagnostic radiology, the diagnostic power as well as the radiation safety, the technologists and radiographers are an important link. This is even more important in developing countries, where the technologists are working often independently and with little technical support. A study on quality control in developing countries concluded, there is an urgent need for X-ray equipment, but even more for the basic knowledge of X-ray technology, quality control and machine maintenance [2].
The quality of available equipment can vary widely between countries and even within a country. MR scanners are introduced in central medical services and 20-year-old x-ray machines are available in rural diagnostic centres. A training program should focus on both the low- and the high-end reality.
There are initiatives of similar training courses in the South. However the authors think there is reason to organise the training in Belgium/Europe:
Specialists in different subjects can easily be asked to contribute to the training, even for a limited contribution.
Students can get to know equipment that is not yet available in their country (MRI, multi-slice CT, ...)
Practical sessions can be organised in the skills lab of EHSAL, where two well equipped X-ray rooms, dedicated for training purposes and quality control material are available.
During two weeks internships, students can get to know quality control programmes in practise, their advantages as well as their practical drawbacks.

The students get the opportunity to visit manufacturers of radiological equipment and to participate in workshops and congresses.
The internships, company visits and contact with Belgian and European lecturers enable the students to build networks with colleagues in the North.

2. Objectives and organisational framework

A training program of two months is organised for radiographers and technologists from developing countries by the department of medical imaging of EHSAL in collaboration with the VUB and KU Leuven. The Objectives of the program are to :

- give the students a training in the functioning of diagnostic radiological equipment;
- give the students a theoretical and practical training in radiation protection of patients and staff in diagnostic radiology;
- give the students a practical training in setting up and putting in practise a quality control programme at a department of medical imaging;
- give the students further training on new developments in medical imaging, specially in CR/DR, ultrasound, MRI and CT;
- train the students in methods to pass the knowledge to colleagues and other students;
- bring the students in contact with colleagues and specialists in Europe and other developing countries.

The candidates should have a preliminary training as radiographer, radiological technologist or equivalent of minimum three years. The candidates should have some years of practical experience at a department of diagnostic radiology. He/she should clearly prove (through letters of recommendation, intent or previous experience) that the training would lead to capacity building in the home country. Especially therefore priority was given to students younger than 35, with a link to a training centre in medical imaging.
The Training originates from another International Training Program: “Training in Medical Imaging, Radiation Therapy and Nuclear Medicine and Related Radiation Protection”. This program aimed at medical physicists working in the fields of diagnostic radiology, radiotherapy and nuclear medicine. In the four years this training was organised (2000 – 2003) several radiographers and technologists participated, although the training was not meant for them. The experiences with these students were very positive.
The Training in Radiation Protection is part of the International Training Programs of the Flemish Interuniversity Council (VLIR), an umbrella organisation representing all six Flemish universities [3] [4]. The field of action for VLIR has recently been extended to the Flemish hogescholen (non-university higher education institutions). One of the activities of the VLIR concerns the management of the funds made available by the Belgian government (Directorate-General for Development Cooperation) for university cooperation for development initiated by the Flemish universities. One of the VLIR activities is International Training Programmes (ITPs). ITPs are short-term training programmes whose main focus is transferring skills rather than knowledge. The International Training Programmes are designed for people from developing countries with a certain professional experience. Knowledge and skills are transferred through the ITPs, and the possibility for cooperation and networking is created. Participants of VLIR trainings receive a scholarship that includes:

- Weekly allowance
- Fee for educational materials
- Fee covering mailing costs of educational materials
- One economy class return airline ticket
- Insurance

3. Practical implementation

The program was organised in the period October-November in 2004 and 2005. The maximum number of participants is 12 due to the limited number of trainee posts. Table 1 shows the number and nationalities of the students in the program. In the second year more application forms were received, probably due to the fact that the training was better known by the target group. The organisers used the communication lines of the International Society of Radiographers and Radiological Technologists (ISRRT) to promote the training. This resulted not only in a raise of the

number of applications but also in a better fit of the candidates to the student profile. In 2004 seven medical physicists and three medical doctors applied for the training. In 2005 these figures were 1 and 3. The organisers try to include students from as much different countries as possible. In 2004 the students originated from 8 countries, in 2005 from 9.
Table 2 shows the different topics that are covered in the training. The bold printed parts are practical courses. These practical parts concern, dosimetry, quality control and practical radiology techniques. The practical dosimetry is trained in the skills lab of the department of medical imaging of EHSAL. This lab consists of two X-ray rooms dedicated for training. Training in modern quality control techniques is taught by the team of the Leuven University Centre of Medical Physics in Radiology (LUCMFR). On request of the students the topic 'low cost quality control was introduced, a training in techniques for basic image quality control in conventional film screen radiology with a minimum of test equipment.

	2004	**2005**
Number of applicants	35	47
Selected	12	11
Female	4	3
Zambia	1	
Ethiopia	3	1
Uganda	1	2
Nigeria	1	1
India	2	2
Cameroon	1	
Tanzania	2	1
Nepal	1	1
Ghana		1
Sudan		1
Malawi		1

Table 1: Number of students, their nationality and gender in the ITP program.

Within the two months program the contents shifts from a mainly theoretical approach at the start toward more practical work. The students spent two weeks of the training in a radiology department of a Belgian Hospital. The first week internship is an introduction to Belgian or European radiology. The objectives are:

- to give the students an idea of the work situation in a Belgian hospital.
- to give the students a general idea of the practical implementation of techniques that are not yet common in his or her country (MRI, multi-slice CT, DSA and CR/DR).
- to analyse the radiation protection situation at a department using the knowledge from the theoretical courses.

During the second week internship the student can focus on a subject that has his or her special interest. An important objective of both internships is the exchange of ideas between colleagues of North and South.

The students develop during the training a small project concerning quality control or radiation protection related to their personal work situation. The duration is project is one month. At the end of the training the student must present the project to a jury and fellow students. Once back at work he/she must start the project within one month must report the results to the course organisers. The aim of this project is twofold:

- The student can show the colleagues and superiors the outcome of the training.
- It forces the student to put the course contents into practice.

Examples of personal projects are:

- setting up a reject analysis
- developing criteria for in-bed radiography examinations
- a comparison between the image quality before and after introduction of the EC quality criteria
- developing a radiation protection course for radiographers in rural X-ray departments

- improving the quality control program for mammography screening equipment

4. Evaluation of first results

The students evaluate the training in general as very valuable. The mix of theoretical and practical work is highly appreciated.
All lecturers agree on the fact that the students are highly motivated. The topics of the training match to a high extend with the needs of the students.
The duration of the course (2 months) is a good compromise: some students have interest for a longer duration, others have to offer all their holidays to participate.
Several students stay in contact with the lecturers. The objective of networking is put into practise.
In some cases the analyses of the trainees is quite confronting for the participating departments of radiology. Especially the use of fluoroscopy is criticised as exaggerated.
Nevertheless the departments evaluate the participation in the program as very positive.
This year's students asked for more practical work, especially in CT quality control.

5. Future plans

The program is already scheduled for October-November 2006. The organisers adapt the contents of the course every year to the feedback of the students. They will analyse if the part of practical training can be increased.
Another possibility the organisers consider is to organise the program for technologists alternating with the training for medical physicists.

Introduction in X-ray technology
The X-ray tube
The generator
The X-ray table and bucky
Image detectors: film, image intensifiers, phosphor plates, DR
Imaging Systems: film development, PACS
New developments in technology: CT, MRI, angio-cardio, ultrasound
Dosimetry and Radiation Protection
Introduction in radiation physics
Biological risk of radiation
Dose units and quantities
Dosimetry methods
Basic principles of radiation protection
International guidelines and legislation
Staff Protection
Patient protection in:
Conventional radiology
CT
Interventional radiology
Pediatry
Optimisation of examination protocols
Influence of parameters
Relation dose and image quality
Practical dosimetry (skills lab EHSAL)
Quality Control
Basic principles
Starting a QC program
Using phantoms and test objects
Developing protocols
Low-End QC (skills lab EHSAL)
Practical QC (LUCMFR)
Visits and projects
Internship at radiology departments
Visits to manufacturers, research institutes workshops
Personal projects

Table 2: contents of the training.

References

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