

## A Distance Assisted Training Programme for Nuclear Medicine Technologists

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### Introduction

**M**any countries have made significant investments in nuclear medicine technology with the acquisition of modern equipment such as gamma cameras. However, the lack of appropriate training for medical technologists is a major constraint to the effective use of the technology. Examination of the training syllabi for medical technologists in some countries shows a lack of sufficient instruction in nuclear medicine and a variation in syllabus content from country to country. A survey was conducted in the Asian region showing there are few formal training courses for nuclear medicine technologists, although many people working in the field have training in related specialities such as radiography or medical technology.

In 1992 the Australian Government (through its AusAID program) agreed to fund a project, entitled 'Strengthening of Nuclear Medicine in RCA Countries', which included a sub-project on the development of a scheme for the education of Nuclear Medicine Technologists. This project was approved as a Regional Co-operative Agreement (RCA) project which has been administered by the International Atomic Energy Agency (IAEA) and the Australian Nuclear Science and Technology Organisation (ANSTO). The project has been coordinated at Westmead Hospital, Sydney, Australia and commenced in early 1994 with Brian Hutton as Project Manager and Heather Patterson as Course Coordinator. During the project a set of materials was developed, intended

for use by either individual students or departments, to provide a basic practical understanding of Nuclear Medicine. The materials are also suitable for use in formal courses in Nuclear Medicine, providing a program for in-service training that can complement face-to-face teaching, as well as a valuable resource for teachers. The material has been written by practising technologists and scientists in Nuclear Medicine with editing for publication largely undertaken by Heather Patterson. The course was tested with an initial set of students in Malaysia, Indonesia, Sri Lanka and India in 1995-96 and the materials were subsequently refined and improved for final use, based on this initial experience.

The aims of this versatile program include:

- to provide training in countries where none exists
- to provide assistance to present training courses
- to encourage the further development of training courses
- to encourage in-country distance training
- to establish a regional standard for basic training
- to promote quality improvement

### **Project planning and materials development**

#### ***Participating countries***

An Advisory Board, representing the Asian countries that are RCA Members, was formed to provide ongoing advice on the project. At the initial meeting of the Advisory Board implementation plans, course syllabus and country involvement was agreed upon. For the purpose of the pilot program it was agreed that Malaysia, Sri Lanka and Indonesia test the material as no formal courses existed and translation of materials was considered unnecessary in these countries. India also agreed to test the material, with a view to possible development of in-country distance education for the benefit of students who are unable to undertake the formal training courses available. A total of 19 students commenced study in May 1995. In addition, Bangladesh, Pakistan and the Philippines agreed to assess the material and advise on its suitability for inclusion in courses that were under development in those countries.

#### ***Course design***

As most students work full time, the course of study was initially designed to occupy 224 hours, conducted over a period of 16 months, which is about 4 - 5 hours study per week. Seven learning modules were developed with material written in a progressive learning sequence. Each module contained about 32 hours of study and included a variety of subjects, both in basic science and clinical application. An outline of the syllabus is given in Table 1. The developed materials focus on practical details whose relevance can be easily identified. These have been shown to have a high motivational value. The materials appear well suited to complement formal coursework and it is the course developers' intention to further update the materials and explore suitable complementary aids such as audiovisual and interactive media.

The goal has been not only to produce the training materials but also to assist in the implementation of training programs based on the materials. The material has been specifically designed to assist individuals to develop basic practical skills that enable them to perform good quality Nuclear Medicine studies. The course attempts to provide a focus on factors that are important rather than, as in many courses, offering a very broad coverage. It is hoped that this focus highlights the relevance of underlying theory so that students can understand the importance of what is presented and can better identify problems that may occur in their daily work. The material is valuable as a manual for practising Nuclear Medicine Technologists and contains practical detail that can be useful to both scientists and physicians.

**Table 1** Progressive learning sequence of subjects and modules

Module	Basic Science	Clinical
1	Basic Physics Radiation Safety 1 Radiopharmacy 1	
2	Radiation Safety 2 Radiopharmacy 2 Quality control Instrumentation 1 Dose calibrator Scintillation counter	Endocrinology 1 Thyroid Uptake
3	Instrumentation 2 Rectilinear scanner Gamma Camera Imaging Techniques  Computers 1	Endocrinology 2 Thyroid Uptake  Gastrointestinal Liver/Spleen Imaging
4	Instrumentation 3 Gamma Camera QC Film processing	Endocrinology 3 <sup>131</sup> I Therapy for hyperthyroidism Pulmonary Ventilation and perfusion
5	Computer 2	Skeletal Radionuclide Brain Imaging (planar)
6		Renal differential Gastrointestinal dynamic flows
7		Cardiovascular Gated blood pool First pass Hot spot

### Implementation of the pilot program

#### *Student selection*

In each country a number of students were selected who already worked in Nuclear Medicine but who had no previous formal training in Nuclear Medicine. A key factor in selecting students was that

they each have a supervisor available to provide ongoing support in the workplace. A basic level of instrumentation was assumed: a gamma camera interfaced to a computer was considered essential. Where a department lacked facilities, the local coordinator was encouraged to arrange for students to have access to equipment in



*Midcourse Workshop held in India with students and supervisors from Bombay, New Delhi, Lucknow and Bangalore. Also Australian assessors Richard Smart and Scott Evans*

other hospitals or institutions. Tutorials involving staff from other Institutions (universities or atomic energy authorities) were also encouraged.

#### ***Mid-course workshops***

To help assess progress a mid-course workshop was held in each country when a physicist and a senior technologist visited the students and their supervisors. They discussed problems and conducted impromptu tutorials, where necessary, to help explain some difficult concepts. In addition they assessed students' understanding, practical capabilities and general progress.

Feedback from the workshops indicated that students were responding well to the training program. In particular students showed a questioning attitude in their daily work and were much more attentive to radiation safety and quality control. There was also evidence that department protocols had been changed in view of the course content. The face to face interaction with assessors and the other students helped students achieve a sense of teamwork, temporarily removed them from their isolation and helped motivate them to continue and progress.



*Brian Hutton in discussion with students in Indonesia*

However, the workshops also highlighted certain limitations where some students had a poor understanding of English or received poor support that limited their motivation. Others experienced adverse local conditions such as interruption of isotope supply, import duties delaying delivery of learning material, equipment down-time and interruptions to power supply. Lack of study time was a general concern, particularly for those students who had a second job.

### ***Student assessment***

Successful completion was measured, based on marks from regular assignments, successful completion of a Workbook in which the student recorded ongoing practical work and a final assessment in the workplace, in which both practical capabilities and general understanding were examined. This assessment was carried out in November 1996 by two senior Australian technologists who visited each student in their own department. The assessors spent two days observing hot-lab practice, safety precautions, patient positioning and imaging procedures. Questions were asked to assess understanding, followed by explanations and discussions to



*Students at Universiti Sains Malaysia, Kota Bahru*

help clarify any points. A written assignment, including multiple choice questions and calculations, was completed by each student.

An important aspect of the project has been the development of appropriate assessment methods, which demands not only completion, but level of understanding and demonstration of practical competency. These essential components are included in the final IAEA “Certificate of Achievement”.

### ***Course completion***

Due to the difficulties experienced in understanding English by Indonesian students, it has been recommended that translation should be performed before these students progress further. All other students participating in the pilot project progressed to completion and were awarded the IAEA certificates that reflected their level of understanding and the practical skills attained. Student supervisors have commented that successful students demonstrate an improved attitude to their work and enhanced quality of work. The course has had further benefits as it encouraged department involvement and raised confidence in local ability to provide technologist training.

### ***Preliminary Cost Analysis***

An analysis of the implementation costs for this pilot project indicates that the cost per student for 20 students is similar to the present cost for a student to train overseas for 6 months. However, having developed the course of study, there are only minimal ongoing refinement costs and reduced implementation costs. For further 20 students the estimated cost per student is about 25% of the pilot project cost and

there is an exponential fall in cost per student as the program reaches more students in more countries.

### Further developments

#### *Continuation of the project*

The Australian government has agreed to fund the continuation of the project for a further three years, during which time additional materials including SPECT, infection / tumour imaging and behavioural science will be developed and trialed with the same students. The final syllabus for the course was determined at a second Advisory Board Meeting held in July 1999 (see Table 2 \*\*\*HEP). It is estimated that the

complete course will occupy 450-500 hours of study time. Criteria for student participation and more detailed guidelines for student supervision and assessment were discussed at this meeting. The importance of student support, both within the department and at a national level, was emphasized. During this second stage of the project around 100 students from seven countries (Bangladesh, India, Malaysia, Pakistan, Philippines, Sri Lanka and Thailand) will undertake the complete English version of the course. In some cases the materials may be used to complement existing courses and direct comparison of student performance will be of interest. In addi-

**Table 2** *Progressive learning sequence of subjects and modules  
 Phase 2 To commence late 1999*

Module	Unit no.	Basic Science	Unit no.	Clinical
8	12a	Understanding SPECT (1) SPECT Theory Quality Assurance Image reconstruction	13	Brain SPECT General SPECT
9	12b	Understanding SPECT (2) Advanced SPECT topics  Introduction to PET	14	Myocardial Perfusion SPECT
10	15	Radiopharmaceuticals for infection & tumours	16	Infection & Tumour imaging General Anatomy & Physiology (including cross sectional anatomy) Special paediatric studies
11	17	Behavioural Science	18	In-vivo non imaging blood volume & urea breath test CSF - Cerebral Spinal Fluid Shunt patency
12	19	Introduction to Literature Review with assigned topics		

tion, the materials will be translated for use with approximately 200 students in China and 50 students in Korea. The complete set of materials and teaching guides will be available on CD. As the project develops, additional audiovisual aids will be included.

### ***Recognition of the course***

The training material has been designed specifically to address the basic concepts underlying Nuclear Medicine, building on essential knowledge and practical skills required by a practising Nuclear Medicine Technologist. In essence the course provides a formal training as opposed to a broad education, as would be achieved through a University-based course. Formal recognition of the course is the responsibility of each country. However, an important precedent has been set in Australia where one of the major Universities has assessed the complete course and has indicated that they are prepared to independently assess students who complete the IAEA course, with a view to awarding an intermediate qualification. This would provide students with credit towards a more advanced academic course, with the possibility of students gaining an internationally recognised qualification. It is hoped that this may encourage national authorities in participating countries to recognise the value of the course.

### ***Use in other countries and regions***

It has been recognised that several countries will require the materials to be translated in order to meet the needs of the technologist. During the pilot study China took the initiative to commence translation to Chinese under the auspices of the Chinese Society of Nuclear Medicine. Sections of the material were distributed around sev-

eral nuclear medicine centres in different provinces and the workload shared. This not only resulted in reducing the individual effort involved, but also made many people over a wide area aware of the program and its content. Materials already have been used as a reference manual for short courses conducted in different regions of China. Approximately 200 students in 6 regions of China will commence the full course in early 2000. The Korean Nuclear Medicine Technologists Society will be mainly responsible for the translation of the materials for use in Korea and the first course there will also commence in early 2000. Vietnam has also indicated an interest in translating the materials.

There was particular interest in the Distance Assisted Training program at the IAEA Regional Training Course held in Capetown, South Africa in October/November 1996. It was considered that the training materials and method of delivery was relevant for most African countries where there is little or no structured training. Since then a similar pilot study has been approved through the IAEA AFRA section, which is being coordinated by Ms Geraldine Philotheou from Capetown, South Africa. This will commence in 1999 for a number of English-speaking countries in central Africa. As several North African countries require translation to French and Arabic, it is foreseen that translation may also be a possibility.

In addition, a further project has been established in the Latin American region, coordinated through the ARCAL section of the IAEA. In this case the materials will be translated to Spanish and Portuguese for use throughout the region. The project will be managed by Dr Eduardo

Touya, in Uruguay and the main country responsible for translation to Spanish is Argentina. A similar structure is being established to that used in the RCA region. The RCA project has been selected as one of the first to be transferred for use in other regions. Regular contact is being maintained between the RCA, AFRA and ARCAL projects and all three regions will be involved in developing the final assessment guidelines. The adoption of similar criteria in the three regions will encourage a standard level of training across the three regions.

### **Summary**

The project has had a very positive effect in accelerating the development of technologist training courses throughout the region with the material already being used to complement formal courses in several countries. To establish common standards of training and competency it would be appropriate to assess course development and student assessment methods throughout the region. Several countries should be

encouraged to adopt in-country Distance Assisted Training in order to reach more technologists in remote regions, with continuing advice and support from Australia at this stage. The project has stimulated the development of similar projects in other regions.

In the long term there are significant cost savings compared to the fellowships and short courses currently offered. In addition, the course material provides a practical understanding of basic concepts which should form a useful background for persons who may be offered further training through fellowships or courses, with potential for this supplementary training to be more effective. The project has demonstrated that the Distance Assisted Training Program for Nuclear Medicine Technologists is both achievable and effective. The material is directed at an appropriate level with a mechanism of delivery that is flexible and well suited to local needs. The project continues to attract wide international interest.