Evaluation of Current and Projected Nuclear Medicine Technology Curriculum

Mary Anne Owen, MHE, RT(N)[1]; Anthony W. Knight, MBA, CNMT, RT(N), NCT[2]; Gregory Passmore, PhD, CNMT[1]; LeRoy H.Stecker, III, MBA, CNMT, RT(N)[3]

[1]*Medical College of Georgia, Augusta, Georgia;* [2]*The University of Iowa Hospitals Nuclear Medicine Technology Program, Iowa City, Iowa;* [3]*Nuclear Medicine Technology Program, St. Vincent's Medical Center, Jacksonville, Florida*

New advancements in multimodal imaging and therapy, and increasing demands for accountability and outcomes documentation require increasing levels of knowledge and skill not easily delivered within the current structure for entry-level educational programs in nuclear medicine technology (NMT). The "needs assessment" process provides a systematic method for determining how best to fulfill emerging and projected practice requirements. The certification opportunities offered through the Nuclear Medicine Technology Certification Board and the American Registry of Radiologic Technologists in CT, PET, MRI, and emerging fusion technologies are just the first in a series of documented assessments of continuing education attempting to meet quickly evolving technology environments. This article provides an analysis of 2 recent surveys of existing nuclear medicine technology education programs to assess existing entry-level curricula and curriculum enhancements that address traditional and emergent practice knowledge and skills.

The formal academic nuclear medicine technology education system is accredited through the Joint Review Committee on Educational Programs in Nuclear Medicine Technology (JRCNMT). Education is overseen and delivered through divergent entry-level educational programs offered through hospitals, community colleges, universities, and academic medical centers. Data yielded from surveys of NMT program directors and a review of NMT program prerequisites will provide guidance in designing programs for NMT education of the future.

2005 Review of Course Prerequisites for Nuclear Medicine Technology Programs Published on Institutional Websites

MATERIALS AND METHODS

Thirty-two Web sites for nuclear medicine technology programs accredited by the JRCNMT were reviewed for published prerequisite courses required before applicant acceptance. This data is reported as percentage values and compared with mandatory requirements for prerequisites as outlined in the *Essentials and Guidelines for an Accredited Educational Program for the Nuclear Medicine Technologist* (last revised in 2003) published by the JRCNMT (www.jrcnmt.org.)

RESULTS

Program Offering by Terminal Degree

Nuclear medicine technology programs offer varying levels of terminal degree including certificate, associate, and baccalaureate. Programs reviewed were similarly matched in numbers to those offered nationally. The greatest number of programs, 47%, are offered at the certificate level, with a slightly fewer programs terminating in a baccalaureate degree, 44% (Table 1).

Evaluation of Prerequisite Courses

The minimum courses suggested by the JRCNMT before professional program admission are physics or physical science, chemistry, English I and II, oral communication, statistics, and computer skills. If not acquired as part of preprofessional education, these courses may be delivered concurrently with the professional NMT curriculum. Additional courses listed below are required as part of the NMT curriculum. When these courses are acquired before the professional program, additional time is available in the NMT curriculum for depth of instruction in professional content areas. Baccalaureate programs generally require additional math, science, and liberal arts as part of the preprofessional core curriculum that is acquired in the freshman, sophomore, and junior division courses before admission to the 12- to 20-month professional program that completes the baccalaureate degree (Table 2).

TABLE 1
Program Offering by Terminal Degree

Terminal degree	Number of programs (n = 32)
Certificate	15 (47%)
Associate	3 (9%)
Baccalaureate	14 (44%)

TABLE 2
Percentage of Programs Requiring Various Prerequisite Courses

Prerequisite courses	
Physics	62%
Biology	29%
Anatomy and physiology	22%
Anatomy and physiology II	38%
Pre-calculus/trigonometry	9%
College algebra	49%
Intermediate algebra	4%
Statistics	20%
Medical terminology	20%
English	31%
Introduction to computers	22%
Speech and communications	20%

2005 Survey of Nuclear Medicine Technologist Program Directors

MATERIALS AND METHODS

Surveys were electronically distributed to 117 directors of nuclear medicine technology programs accredited by the JRCNMT. Fifty-four surveys were returned for a 46% response rate, although not every respondent answered every item. Number of respondents is given for each item in the tables below. The survey sampled responses for a broad range of program information including student demographics, graduate demographics, program director demographics, and entry-level curriculum enhancement. This article presents information related to program director responses for enhancements currently offered for CT, PET, PET/CT, and MRI in existing programs.

RESULTS

Length of Professional Program

The length of the clinical and didactic phases of the professional NMT programs included in this survey ranged from 12 to 48 mo (Table 3). The greatest number of professional programs, 32, or 59%, fell in the 12–15 mo range. Of the remaining programs, 9 deliver the professional education sequence in 18 to 22 mo, and only 13 programs enroll students in clinical and didactic phases for 24 mo or longer.

TABLE 3
Professional Programs Vary in Length

Length of professional program (in months)	Number of programs (n = 54)
48	5 (10%)
33	1 (2%)
24	7 (13%)
22	5 (10%)
21	1 (2%)
20	1 (2%)
18	2 (4%)
15	5 (10%)
13	1 (2%)
12	26 (47%)

TABLE 4
Didactic Effort Expended on PET Education

Classroom hours spent on PET education	Number of programs (n = 54)
0	0
1–3	2 (4%)
3–5	8 (15%)
6–10	16 (29%)
11–15	6 (11%)
>15	22 (41%)

PET Didactic and Clinical Education

When asked how many classroom contact hours entry-level NMT programs provided in PET education, all programs reported PET as part of their curriculum (Table 4). Twenty-eight programs, or 52%, reported 11 or more hours of classroom PET education. Twenty-six, or 48%, of programs indicated that students receive 10 or fewer hours of didactic PET instruction.

When asked how many clinical contact hours entry-level NMT programs provided in PET or PET/CT, only one program reported that students received no clinical PET experience (Table 5). Thirty-four respondents, or 64%, reported that students spend at least 41 h (>five days) in clinical PET rotations. Only 13, or 25%, of the programs reporting indicated clinical experiences of greater than 120 h (15 d) in PET. Approximately 36% of programs reported that students spent 40 h or less in a clinical PET rotation with 17% of these students spending 16 h or less of their total clinical program time in PET.

CT Didactic and Clinical Education

When asked how many classroom contact hours entry-level NMT programs provided in CT education, 32 programs, or approximately 64% reported CT as part of the NMT professional didactic curriculum (Table 6). However, of these, only 5 reported greater than 10 classroom hours of instruction in CT.

TABLE 5
Clinical Effort Expended on PET Education

Hours spent by students in clinical PET or PET/CT practicum	Number of programs (n = 53)
0	1 (2%)
1–8	2 (4%)
8–16	6 (11%)
17–32	4 (8%)
33–40	6 (11%)
41–80	15 (28%)
81–120	6 (11%)
>120	13 (25%)

TABLE 6
Didactic Effort Expended on CT Education

Classroom hours spent on CT education	Number of programs (n = 52)
0	20 (38%)
1–3	15 (29%)
3–5	7 (13%)
6–10	5 (10%)
11–15	2 (4%)
>15	3 (6%)

When asked how many clinical contact hours entry-level NMT programs provided in CT or PET/CT, only 23 respondents, or 42%, reported that students receive more than 8 h of clinical CT experience (Table 7). Of these, only 8 programs reported greater than 80 h (10 d) at clinical CT or PET/CT rotations. Twenty-two programs, or 41% of those reporting, provide no clinical CT experience for students.

MRI Clinical and Didactic Education

When asked how many classroom contact hours entry-level NMT programs provided in MRI education, only 10 programs reported that MRI was included as part of professional didactic phase, and only one program reported that students receive more than 3 h (Table 8). No program provided greater than 5 h of MRI education. Forty-one respondents (80%) reported no MRI in the didactic curriculum.

When asked how many clinical contact hours entry-level NMT programs provided in MRI, only 12 respondents, or 23%, reported that students receive clinical experience (Table 9). Of these, only one program reported 33 h (4 d) or more in clinical MRI rotations.

DISCUSSION

An evaluation of entry-level NMT programs suggests that didactic and clinical education is disparate and varied across the nation. The instructional curriculum directed by the JRCNMT continues to grow with the addition of PET to the didactic curriculum in the last 2 years and needs, in consideration of CT and MRI, to prepare the technologist workforce for fusion technologies. JRCNMT requires documentation of student knowledge and skill competency in the wide range of tasks necessary for practice performance. Guidelines for NMT didactic and clinical instruction in the JRCNMT *Essentials and Guidelines for an Accredited Educational Program for the Nuclear Medicine Technologist* include:

1. Methods of patient care;
2. Statistics;
3. Nuclear medicine physics and radiation physics;
4. Radiation biology;
5. Radiation safety and protection;
6. Radionuclide chemistry and radiopharmacy;
7. Nuclear instrumentation;
8. PET;
9. Computer applications for nuclear medicine;
10. Diagnostic nuclear medicine imaging and nonimaging in vivo and in vitro procedures;
11. Radionuclide therapy; and
12. Quality control and quality assurance.

Instructional guidelines for professional development in the *Essentials and Guidelines* include:

1. The development of problem-solving, critical-thinking, and decision-making skills in oral and written communication, human relations, and patient services;
2. Familiarity with applicable medical law and ethics;
3. A commitment to make a significant contribution to the healthcare team;
4. An appreciation and respect for cultural diversity;
5. A holistic caregiver's perspective;
6. An understanding of departmental organization and function in relation to the healthcare delivery system as a whole; and

TABLE 7
Clinical Effort Expended on CT Education

Hours spent by students in clinical CT practicum	Number of programs (n = 54)
0	22 (41%)
1–8	9 (17%)
8–16	3 (5%)
17–32	4 (7%)
33–40	2 (4%)
41–80	6 (11%)
81–120	1 (2%)
>120	7 (13%)

TABLE 8
Didactic Effort Expended on MRI Education

Classroom hours spent on MRI education	Number of programs (n = 51)
0	41 (80%)
1–3	9 (18%)
3–5	1 (2%)
>5	0

TABLE 9
Clinical Effort Expended on MRI Education

Hours spent by students in clinical MRI practicum	Number of programs (n = 52)
0	40 (77%)
1–8	9 (18%)
8–16	2 (4%)
17–32	0
33–40	1 (2%)
>40	0

7. An understanding of the value and responsibilities entailed in being a professional.

The majority of programs deliver this education within a 12- to 15-month time frame. A limited number of programs provide didactic and clinical education in PET and PET/CT. Only a handful of NMT programs offer didactic and clinical education in MRI.

CONCLUSION

Based on the volume of competency performance required in accredited NMT programs, this study suggests that there are many challenges to presenting the breadth and depth of knowledge and skills needed for the near and projected future. Nuclear medicine technology programs are currently offered in a wide variety of nonstandard formats. Didactic and clinical education that responds to changing trends in routine and advanced technology practice may need careful review by the professional bodies that guide and oversee NMT training. Quickly evolving practice needs necessitate creative strategies to optimize academic and continuing education opportunities and to assure meaningful learning of NMT knowledge and skills.