Education

Continued Competency of Nuclear Medicine Technologists

The Task Force on Continued Competency, Technologist Section, Society of Nuclear Medicine

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The continued competency of nuclear medicine technologists was investigated by retesting previously successful NMTCB candidates and those who gained NMTCB certification by recognition of previous certification (by passing other exams). Volunteers from this random sample of CNMTs took the September 1982 NMTCB exam. The results were tabulated and analyzed against previously acquired sample demographic data. In this pilot study we found 87% of the sample maintained their competency. Further, a trend of higher test scores corresponded with increased amounts of continuing education.

Once a health practitioner enters a chosen field after initial training, it is assumed that he or she is prepared to practice in that field at a minimally acceptable level. This minimal competency is usually demonstrated by written or oral examinations, or both. In many allied-health professions, these "certification" examinations are voluntary, meaning that a person who has not demonstrated minimal competency may still be hired to work in the profession. This has led to continuing concern about the competency of allied-health professionals at all levels of practice. Indeed, many states and the Federal government have adopted various laws that are intended to protect the public and the patient by assuring competency.

Many methods, such as "continuing education, readministration of the entry-level examination, development of a mid-career examination, proficiency testing, practice audit or peer review, and self-assessment" (*1*), imply continued competency. Continuing education is used solely by a few professions in some states for license renewal (*2*); in others, it is combined with an entry-level examination for recertification (*3*).

One of the areas of concern in the nuclear medicine community is whether nuclear medicine technologists (NMTs) maintain their competency after initial entry into the field and whether there are any factors that might contribute to maintenance, or lack, of competence. Individual NMTs, the Technologist Section of the Society of Nuclear Medicine, and the Nuclear Medicine Technology Certification Board (NMTCB) have a mutual interest in this matter.

If a mechanism for assuring the continued competency of NMTs were developed, the Section and the NMTCB could work in consort for its implementation. With this understanding the Task Force on Continued Competency, composed of representatives of the Section and NMTCB, was formed in 1980 to investigate the continued competency of NMTs.

The Task Force defined continued competency as "an ongoing demonstration of an individual's ability to perform effectively at a defined level of expertise" (*4*). While discussing various pathways of demonstrating continued competency, it became apparent that no research had been published on continued competency in the health professions and, in particular, nuclear medicine technology. Thus, a study was approved in 1982 to investigate the maintenance of competency.

Four assumptions underlie our continued competency study:

1. All NMTs who participated in the study had equivalent initial nuclear medicine technology education.
2. All NMTs who participated in the study had equal opportunity to obtain continuing education (CE).
3. Continuing education was defined as reading journals, participating in in-service or outside workshops or lectures, and viewing audiovisuals pertaining to nuclear medicine.
4. If 90% (a value arbitrarily set by the Task Force) of the sample passed the NMTCB exam, the sample maintained competency.

Five limitations are noted about the study:

1. The sample size was small when compared with the entire NMT population.
2. The sample was not necessarily representative of the entire NMT population.
3. The observations were true only for the sample.
4. The study relied on self-reported demographic data.
5. The sample was composed of volunteers.

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Methods

The population consisted of 5,800 certified nuclear medicine technologists (CNMTs). They belonged to two groups: CNMTs who had gained recognition of prior certification (RPC) from the NMTCB by previously passing certification exams given by the American Registry of Radiologic Technologists (ARRT) or American Society of Clinical Pathologists (ASCP) before Jan. 1, 1979, and CNMTs who passed the NMTCB exam in 1978 or 1979 (1978–79 examinees). Originally only those examinees who passed the NMTCB exam in 1978 were to be contacted, but problems arose with soliciting a sufficient number of volunteers, and the population was expanded to include those examinees who passed the NMTCB exam in 1979. These 1978–79 examinees served as a control group.

Every 25th name was randomly selected from the two groups, RPCs and 1978–79 examinees, for a telephone survey. Each participant heard a statement describing the project and answered questions based on our appraisal of factors contributing to continued competency, which included training, certification, work area (imaging, nonimaging, education/administration, or other such as radiopharmacy and commercial), and number of years experience in nuclear medicine, and amount of continuing education. The sample who voluntarily took the Sept. 18, 1982 NMTCB exam consisted of 109 CNMTs (52 RPCs and 57 1978–79 examinees). It should be noted that a total of 286 CNMTs (147 RPCs and 139 1978–79 examinees) originally agreed to take the exam with the following stipulations: (1) participation was entirely voluntary, (2) the exam would be given at no charge to the participant, (3) individual results would be held strictly confidential; only the participant and the American College Testing Service (ACT) could associate test scores with names, and (4) the score received on the exam would have no bearing on certification status.

The NMTCB exam was chosen since it assesses entry-level knowledge of nuclear medicine technology, is competency-based, and is the certification exam supported by the Society and Section. Exam internal reliability coefficients, using the Kuder Richardson 20 formula, are approximately 0.93–0.94 (*5*). The NMTCB validated the exam by assessing whether the task analysis, upon which the exam was based, was a true reflection of NMT job performance. The NMTCB used the Nedelsky method to determine the pass/fail score. The exam consisted of 200 scorable items counting toward each examinee's score. Examinees had four hours to complete the exam under the same conditions as regular NMTCB examinees.

The ACT performed the testing and scored the answer sheets, and the NMTCB sent results to each examinee. The ACT ran 66 comparisons based on the initial questionnaire. The data were statistically analyzed by Student t-tests and chi-square tests for significance.

Results

Chi-square tests on the number of participants in each demographic category revealed no statistical difference ($p < .01$) in demographic distribution between examinee and nonexaminee (we define the latter as technologists who originally agreed to participate but later declined). A summary of the demographic characteristics of the 109 participants (Table 1) eliminates the area of certification because some categories included CNMTs who passed one certification exam and CNMTs who passed more than one. For instance those people who were identified as having ASCP certification included RPCs who had passed only the ASCP certification exam and 1978–79 examinees who had passed both the ASCP and NMTCB certification exams.

Student t-test statistics gave no significant differences ($p < .01$) in mean scores for the following analysis: (1) RPC ($n = 52$; $\bar{x} = 151.596 \pm 23.01$) vs. 1978–79 examinees ($n = 57$; $\bar{x} = 150.439 \pm 19.15$); (2) RPC-on-the-job training (OJT) ($n = 17$; $\bar{x} = 150.235 \pm 17.573$) vs. RPC—Committee on Allied Health Education and Accreditation (CAHEA) ($n = 35$; $\bar{x} = 152.257 \pm 25.445$); and (3) 1978–79 examinees-OJT ($n = 6$; $\bar{x} = 153.333 \pm 10.893$) vs. 1978–79 examinees-CAHEA ($n = 51$; $\bar{x} = 150.098 \pm 19.947$).

The total group was used because there was no significant difference between the mean scores of the RPCs and the 1978–79 examinees. In addition the comparisons within the

TABLE 1. Demographic Distribution of the Sample

Area	Number (% of 109)*
RPC	52 (48)
1978–79 examinees	57 (52)
Training	
OJT total	23 (21)
AS/BS	8 (7)
RT/MT/RN/CLS	14 (13)
Certificate	1 (1)
CAHEA total	86 (79)
AS	20 (18)
BA/BS	15 (14)
Certificate	51 (47)
Experience	
3–4 years	21 (20)
5–6 years	31 (28)
≥ 7 years	56 (51)
Work area	
Imaging	60 (55)
Nonimaging	5 (5)
Education/administration	32 (29)
Other (radiopharmacy, commercial, etc.)	6 (6)
Imaging and nonimaging	6 (6)
Continuing education activities	
Number of *times* in last five years	
1–10	5 (5)
11–50	47 (43)
> 50	57 (52)
Number of *hours* in last five years	
1–25	3 (3)
26–50	17 (16)
51–75	22 (20)
76–100	18 (16)
> 100	49 (45)

*These are rounded and may not total 100%.

RPC and 1978–79 examinee groups did not yield usable data because of the small number of candidates within each comparison. Total group comparisons for the roles of experience and work area indicated no observable trend in the sample (Tables 2 and 3). However, an observable trend was noted in total group comparisons for continuing education where the mean scores tended to increase as continuing education increased (Table 4). The sample mean of 150.991 was significantly higher than the mean score of 129.364 for 1982 regular NMTCB examinees. Number and percent passing and failing for the sample and 1982 regular NMTCB examinees indicated significantly fewer sample examinees failed than 1982 regular NMTCB examinees who included new graduates of Committee on Allied Health Education and Accreditation (CAHEA) accredited schools (Table 5).

The mean, range, and standard deviation for the sample appeared less variable than for the 1982 regular NMTCB examinees (Table 6).

For the fourteen volunteer CNMTs who failed the exam by NMTCB standards, a demographic analysis revealed no one subtest area of the exam contributed to failure. In addition the examinees in the sample completed the exam to the same extent as the 1982 regular NMTCB examinees.

Discussion

A study was performed during 1982 to determine if NMTs maintained their competency after initial entry into the field. Fifty-two RPCs and 57 1978–79 examinees took the Sept. 18, 1982, NMTCB exam.

Student t-test results showed no statistical difference in mean scores of RPC and 1978–79 examinees. Thus, the two groups appeared to score equally well on the NMTCB exam.

Chi-square tests showed the number of candidates in the sample in each demographic category was the result of chance. Therefore, the sample of 109 used in the study was thought to be reasonably similar, demographically, to the 177 who originally volunteered, but did not take the exam.

Because there were no statistical differences in mean scores of RPC-OJT and RPC-CAHEA candidates or 1978–79-OJT and 1978–79-CAHEA candidates, the role of training did not appear to contribute to differences in sample scores. Likewise, there did not appear to be an observable trend for the roles of experience or work area. A trend in increasing mean scores with increasing CE (Table 4) suggested the possibility of an effect of continuing education on examinee scores.

The sample mean (Table 6) was statistically higher than 1982 regular NMTCB examinees; statistically fewer of the sample failed than 1982 regular NMTCB examinees (Table 5). In addition, the score distribution of the sample was less variable than 1982 regular NMTCB examinees.

The original assumption of this study was that if 90% of the sample passed the NMTCB exam, the sample maintained competency. Eighty-seven percent of the sample passed the exam. The difference between 87% and 90% of the sample

TABLE 2. Role of Experience in Performance of Total Sample (RPC and 1978–79 Examinees)

Group	Number	Mean	Standard deviation
Total group: 3–4 years	21	150.238	17.804
Total group: 5–6 years	31	148.226	19.485
Total group: ≥ 7 years	56	152.250	22.785
	108*		

*One person was eliminated from this category because of inadequate information.

TABLE 3. Role of Work Area in Performance of Total Group (RPC and 1978–79 Examinees)

Group	Number	Mean	Standard deviation
Imaging	60	148.717	18.917
Nonimaging	5	152.000	13.379
Education/administration	32	155.969	22.682
Other (radiopharmacy, commercial, etc.)	6	152.500	16.802
Imaging and nonimaging	6	144.833	37.531
	109		

TABLE 4. Relationship of Continuing Education Activities and Performance of Total Group (RPCs and 1978–79 Examinees)

Group	Number	Mean	Standard deviation
Number of *times* CE:			
1–10	5	143.200	24.874
11–50	47	148.894	23.399
> 50	57	153.404	18.457
	109		
Number of *hours* CE:			
1–25	3	136.333	15.535
26–50	17	143.647	24.927
51–75	22	144.500	22.656
76–100	18	149.278	20.326
> 100	49	157.980	17.332
	109		

TABLE 5. Numbers and Percent Pass/Fail for Study Sample and Regular 1982 Examinees

Group	Numbers (%) Pass	Fail
Total study sample	95 (87)	14 (13)
RPC	44 (85)	8 (15)
78–79 examinees	51 (89)	6 (11)
1982 NMTCB	546 (57)	405 (43)
OJT	60 (24)	186 (76)
CAHEA	486 (69)	219 (31)

TABLE 6. Exam Performance of Study Sample and Regular 1982 NMTCB Examinees

	Number of items	Study sample	1982 NMTCB
Overall exam	200		
Minimum score		78	48
Maximum score		190	187
Mean		150.991	129.346
Standard deviation		20.990	26.161

passing was three people. Thus, for this sample, 87% maintained their competency by NMTCB standards.

Recommendations

Because this is probably the first pilot study in the area of continued competency of nuclear medicine technologists, it is important to consider these data. Athough the results of this study must be tempered by the aforementioned limitations, there does appear to be a relationship between continuing education and continued competency. Thus, the Task Force recommends continued support and expansion of continuing education activities in nuclear medicine technology by the Technologist Section of the Society of Nuclear Medicine. The Technologist Section's National Council has requested the NMTCB to consider providing their exam, at a reduced fee, to CNMTs for self-assessment as a continuing education activity without affecting current certification status. Thus, CNMTs may be able to use the NMTCB exam to ascertain individual strengths and weaknesses in nuclear medicine technology.

The Section has undertaken a manpower survey that will determine the number of practicing NMTs and collect certain demographic data about these NMTs. Demographic data available from the manpower study and the data in the present study might be re-evaluated for possible generalization to a broader NMT population. If the manpower study demographics do not substantiate the Task Force results, investigation of an in-depth study, representative of the NMT population, may include examining more fully the role of continuing education in continued competency.

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