Certification

NMTCB Task Analysis Validation Update

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The Nuclear Medicine Technology Certification Board (NMTCB) examination is currently based upon a Task Analysis validation survey completed in 1983 (*1*) and a reexamination of the 1983 data in 1986 (*2*). The NMTCB examination is a criterion-referenced examination that tests job-related knowledge and skills deemed necessary to practice nuclear medicine technology at entry level. In criterion-referenced examinations, an examinee's performance is judged against a job-related base of knowledge and not against the performance of other examinees.

To ensure that an examination is testing job-related tasks, a task validation study must be performed periodically. The NMTCB has conducted several such Task Analysis surveys (*1–3*). Since the last NMTCB survey four years ago, the practice of nuclear medicine technology has changed significantly. For instance, with the emergence of new techniques that do not utilize radioactive tracers, many nuclear medicine departments no longer perform radioimmunoassay tests. Tomography and dual-photon bone absorptiometry are gaining widespread use. A variety of new radiopharmaceuticals (e.g., ^{111}In-labeled white cells, ^{123}I iodoamphetamines) have been approved for routine clinical use. In addition, commercial radiopharmacies are becoming the major suppliers of the radiopharmaceuticals used in nuclear medicine departments. To keep pace with the changing technology practice, a task validation study was conducted again by the NMTCB in 1988.

A total of 172 completed task analysis surveys were used in the analysis. Review of the demographic data indicates that the respondents were from 41 states. Years of practice and percentages of present positions of the respondents, for example, have not changed substantially since the 1983 validation study (*1*).

A total of 182 tasks were included in this latest validation study. Five characteristics were evaluated for each of the 182 tasks:

1. Performance—Is the task performed in the nuclear medicine department?
2. Level of task—Is the task performed by entry-level technologists?
3. Frequency—How often is this task performed?
4. Importance—Is performance of the task important to technologist job success or is it unrelated?
5. Consequences—What is the most likely outcome if this task is not performed competently?

The respondents rated each characteristic using a numbered scale, except performance which was a yes/no answer. In addition to evaluating the tasks, the respondents identified procedures performed and the equipment utilized at each institution.

In this task survey, data analysis indicated that all 182 tasks were performed by technologists at the entry- to six-month experience level. Therefore, no tasks were eliminated from the task list because of being beyond entry-level performance. One task was eliminated because it is no longer required to be performed, performance is by recommendation only. After analysis of the equipment and procedure lists was completed, however, 12 tasks were eliminated because they involved equipment or procedures used by only a few institutions.

At the same time that this validation survey was being conducted, the NMTCB made the decision to make editorial changes to 61 items on the task list to add clarity and accuracy to the task list after the content had been validated (e.g., various tasks related to NRC record keeping were combined as one item). The validated task list which follows contains 108 tasks, and is the result of those editorial changes.

The NMTCB previously had established the practice of dividing the task list into two major categories referred to as domains (*1*). Each task appears either in the critical domain (CD) or the associated domain (AD). Assignment is based upon the composite score derived for each task using the five characteristics previously described. Core tasks (CD) were judged to be important, performed frequently, or with the greatest amount of medical consequence attached if performed poorly. Noncore or associated tasks had lower composite scores but were still considered important to entry-level practice. All core tasks appear at least once on every examination while noncore tasks are randomly sampled for each examination.

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The revised Task Analysis and NMTCB examination matrix which follows are based upon this 1987–1988 validation procedure. The task analysis continues to be divided into four major groups: Radiation Protection and Radiopharmacy, Instrumentation, Imaging, and Nonimaging. The notable changes in this matrix when compared to previous ones are as follows:

1. There are fewer number of tasks, therefore the number of questions appearing on the examination for certain tasks will increase.
2. All RIA related tasks are now part of the associated domain.
3. The percentage of core questions will increase on future examinations from 67% to 76.5% of the total number of scored items.

The revised matrix and validated task list will be implemented on the September 1989 examination. As in the past, the NMTCB examination will consist of 225 multiple-choice questions, 200 scorable items, and 25 nonscorable pretest items.

As the practice of nuclear medicine technology changes, the NMTCB is committed to ongoing validation of the task analysis with revisions as needed to its examination matrix. However, this validation would not be possible without the cooperation and help of many practitioners working in nuclear medicine. The authors and the entire NMTCB wish to thank sincerely all of those who participated in this validation study. The NMTCB is indeed fortunate to enjoy the long-standing support of the nuclear medicine community.

Note: The revised equipment and procedures lists can be obtained by contacting the NMTCB office.

REFERENCES

1. Nuclear Medicine Technology Certification Board. NMTCB critical task validation study: Identification of entry level domain. *J Nucl Med Technol* 1984;12:192–200.
2. Nuclear Medicine Technology Certification Board. Reexamination of NMTCB critical task survey: A response to changing entry-level practice. *J Nucl Med Technol* 1986;14:228–234.
3. Nuclear Medicine Technology Certification Board. NMTCB certification examination validation report. *J Nucl Med Technol* 1982;10:210–222.

NMTCB EXAMINATION MATRIX

		Total Task Items	Selected Exam Questions
Group I	Radiation Protection and Radiopharmacy		
	Core Tasks (weight = 3)	5	15
	Core Tasks (weight = 2)	18	36
	AD Tasks	16	18*
	Subtotal		69 (34.5% of exam)
Group II	Instrumentation		
	Core Tasks (weight = 3)	3	9
	Core Tasks (weight = 2)	8	16
	AD Tasks	5	5*
	Subtotal		30 (15% of exam)
Group III	Imaging		
	Core Tasks (weight = 4)	4	16
	Core Tasks (weight = 3)	10	30
	Core Tasks (weight = 2)	7	14
	AD Tasks	7	7*
	Subtotal		67 (33.5% of exam)
Group IV	Nonimaging		
	Core Tasks (weight = 3)	1	3
	Core Tasks (weight = 2)	7	14
	AD Tasks	17	17*
	Subtotal		34 (17% of exam)
	TOTAL	108	200

* These tasks will be randomly chosen for testing from the total number of AD tasks within each group.

SUMMARY OF ENTRY-LEVEL DOMAIN ON THE EXAM

		Core Tasks	Associated Tasks
Group I	Radiation Protection and Radiopharmacy	51	18
Group II	Instrumentation	25	5
Group III	Imaging	60	7
Group IV	Nonimaging	17	17
	TOTAL	153 (76.5% of exam)	47 (23.5% of exam)

NMTCB Task Analysis of Nuclear Medicine Technology (Entry-Level Practice)

Group I
RADIATION PROTECTION AND RADIOPHARMACY

Task	Domain	Weight
Post appropriate signs in designated areas to comply with NRC regulations.	AD	0–1
Package radioactive materials according to regulations.	AD	0–1
Maintain appropriate radiation safety/protection records to comply with regulatory requirements.	AD	0–2
Use personnel monitoring devices.	AD	0–1
Use patient monitoring devices.	CD	2
Review monthly personnel exposure records in regard to maximum permissible radiation dose limits.	AD	0–1
Continuously use appropriate measures for reducing radiation exposure to keep radiation exposure as low as reasonably achievable.	CD	3
Notify the appropriate authority of excessive radiation exposure.	AD	0–1
Notify the appropriate authority of misadministration when applicable.	CD	2
Use proper methods for the storage of radiopharmaceuticals.	CD	3
Identify and use proper procedures for radiopharmaceuticals that pose special hazards.	CD	2
Instruct the patient, family, and hospital staff in radiation safety precautions after the administration of diagnostic and therapeutic radiopharmaceuticals.	CD	2
Provide instruction on proper radiation emergency procedures to be followed until radiation personnel arrive.	AD	0–1
Perform wipe tests and area radiation surveys following a standardized schedule and format.	AD	0–2
Follow required procedures for receipt of radioactive materials in the radiopharmaceutical laboratory.	AD	0–1
Appropriately store nonradioactive supplies, including kits.	AD	0–1
Assemble a radionuclide generator and position it behind lead barrier.	AD	0–1
Elute a radionuclide generator using aseptic technique.	CD	2
Assay the activity of the generator eluate using a dose calibrator or whole vial assay.	CD	2
Check the generator eluate for radionuclide and chemical contamination.	CD	2
Review the daily work schedule to plan radiopharmaceutical needs.	AD	0–2
Prepare radiopharmaceutical compounds.	CD	3
Determine the total volume and radioactivity to be added to a radiopharmaceutical kit within activity limits.	CD	2
Check total activity in radiopharmaceutical reaction vials with a dose calibrator.	CD	2
Calculate the concentration of radioactivity of a radioactive compound and label vial as to date, time of preparation, lot number, concentration and volume.	CD	2
Check all radiopharmaceutical preparations for proper pH, color, clarity, and particle size, if appropriate.	CD	2
Determine the radiochemical purity of radiopharmaceutical preparations by chromatography.	CD	2
Verify label on radiopharmaceutical vial, including concentration, specific activity, total activity, lot number, assay time, and date.	CD	2

Calculate activity to be administered for diagnostic or therapeutic procedures.	CD	3
Determine the volume or number of capsules of the radiopharmaceutical required for diagnostic and therapeutic procedures.	CD	2
Withdraw correct volume of the radiopharmaceutical into a syringe using aseptic technique and proper radiation safety precautions.	CD	2
Using a dose calibrator, verify the activity to be administered in the dispensed preparation.	CD	3
Verify that radionuclide impurity limits are not exceeded in the dispensed preparation.	CD	2
Maintain appropriate radiopharmaceutical preparation and administration records to comply with regulatory requirements.	AD	0–2
Load radioactive gas into administration equipment if appropriate.	AD	0–1
Appropriately dispose of radioactive material.	CD	2
Maintain a long-term storage area to allow for decay of radioactivity.	AD	0–1
Use proper procedures for managing a radioactive spill.	CD	2
Maintain appropriate instrumentation quality control records to comply with regulatory requirements.	AD	0–2

Group II
INSTRUMENTATION

Task	Domain	Weight
Calibrate a scintillation spectrometer.	CD	2
Determine the percent-energy resolution of a scintillation spectrometer.	AD	0–2
Conduct sensitivity checks on the scintillation spectrometer or scintillation camera.	AD	0–1
Obtain background on a scintillation spectrometer.	AD	0–1
Perform a chi-square on the scintillation camera or spectrometer.	AD	0–1
Adjust pulse height analyzer (PHA) on the scintillation spectrometer or camera for the appropriate photopeak.	CD	2
Perform field uniformity check on the scintillation camera on a routine basis.	CD	3
Perform detector linearity check on a scintillation camera on a routine basis.	CD	3
Perform spatial resolution check on the scintillation camera on a routine basis.	CD	3
Assess performance of image recording equipment.	CD	2
Perform reference check on survey meters.	CD	2
Ascertain the activity linearity of the dose calibrator over the entire range of radionuclide activity to be measured.	CD	2
Test accuracy of dose calibrator for commonly used radionuclides.	CD	2
Check for constancy of dose calibrator using a long-lived radionuclide standard.	CD	2
Perform basic computer operations.	CD	2
Maintain proper environmental conditions for computer and associated equipment and supplies.	AD	0–1

Group III
IMAGING

Task	Domain	Weight
Maintain adequate supplies to assure timely completion of patient studies.	AD	0–1
Maintain auxillary equipment, such as ECG monitor, multiformatter, aerosol and xenon gas delivery and trapping equipment, etc., used in imaging procedures.	AD	0–2
Schedule patient studies, ensuring appropriate sequence for multiple procedures, and interact with hospital staff regarding special orders.	CD	3
Maintain appropriate patient procedure records.	AD	0–1
Receive patient and provide proper nursing care during nuclear medicine procedure.	CD	3
Maintain good communication with patients by explaining procedure, answering questions, and listening to patient's comments.	CD	3
Provide functionally safe and sanitary conditions for patient.	CD	2

Recognize emergency conditions and determine patient's vital signs when necessary.	CD	4
Administer cardiopulmonary resuscitation when necessary.	CD	4
Administer first aid.	CD	2
Receive patient and verify patient identification and written orders for study.	CD	3
Check procedural contraindications for study and obtain pertinent patient history.	CD	3
Obtain informed consent to perform study, when necessary.	AD	0–1
Prepare patient for procedure as required, i.e., instruct patient to void, attach ECG leads, wrap legs with elastic bandages, remove objects which may attenuate radiation, etc.	CD	3
Transfer patient from wheelchair/stretcher to the imaging table.	CD	2
Administer the appropriate radiopharmaceutical by the proper route.	CD	4
Discard contaminated materials in appropriate waste container.	CD	2
Wait an appropriate length of time after administration of the radiopharmaceutical to begin imaging.	CD	3
Select and prepare proper instrument, computer, and auxiliary equipment necessary to perform imaging procedure as indicated by protocol.	CD	2
Place the patient in correct position using supportive materials and immobilizers, and at appropriate distance from detector, to obtain scintigrams for each view.	CD	3
Indicate appropriate anatomical landmarks for each view of a procedure.	CD	3
Collect specimens according to imaging protocol if applicable.	AD	0–1
Analyze image appearance or computer information for artifacts making adjustments, if necessary, and assuring that correct information is supplied.	CD	4
Perform any special views as required.	CD	2
Retrieve and process patient data acquired on a computer.	CD	3
Process film according to manufacturer's specifications and film processor optimum operation.	AD	0–1
Record information relative to any special circumstances affecting the procedure as needed.	CD	2
Perform film processor quality control.	AD	0–2

Group IV
Nonimaging

Task	Domain	Weight
Conduct accuracy and precision check on pipetting devices.	CD	2
Conduct temperature checks on water baths and refrigerators.	AD	0–1
Operate centrifuge and conduct routine tachometer checks.	AD	0–1
Calibrate and use laboratory scales and balances.	AD	0–1
Perform venipuncture for blood collection at appropriate time intervals.	CD	2
Determine hematocrit.	AD	0–2
Process blood sample following collection and store appropriately.	AD	0–2
Collect and process urine samples appropriately.	AD	0–1
Label cells with a radiopharmaceutical according to protocol for procedure.	CD	3
Prepare a standard dilution.	CD	2
Prepare assay reagents and patient specimens.	AD	0–1
Combine radioassay components and incubate according to protocol.	AD	0–1
Separate the bound from the free radioactivity using the necessary laboratory equipment, and prepare sample for counting.	AD	0–1
Count samples, standards, and room background for a statistically significant number of counts.	CD	2
Outline organs to be counted externally, if applicable.	AD	0–1
Choose correct detector—patient distance for external counting, and count for a statistically significant number of counts.	CD	2
Calculate the desired radioassay fraction and plot results to generate a standard curve.	AD	0–1
Determine final results for all patients and controls from the derived standard curve.	AD	0–1

Review procedure for possible technical errors that may alter results.	CD	2
Perform calculations, as required, to determine final results for in vivo non-imaging procedures.	CD	2
Report both patient calculated values and the reference range of a radioassay for in vivo nonimaging procedures.	AD	0–2
Maintain appropriate radioassay quality control records.	AD	0–1
Perform the appropriate control sera checks.	AD	0–1
Recognize a significant shift in assay control and take appropriate action.	AD	0–1
Perform tasks necessary to assess the precision of all assays.	AD	0–1