
The 2011 Nuclear Medicine Technology Job Analysis Project of the American Registry of Radiologic Technologists

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The American Registry of Radiologic Technologists (ARRT) conducts periodic job analysis projects to update the content and eligibility requirements for all certification examinations. In 2009, the ARRT conducted a comprehensive job analysis project to update the content specifications and clinical competency requirements for the nuclear medicine technology examination. ARRT staff and a committee of volunteer nuclear medicine technologists designed a job analysis survey that was sent to a random sample of 1,000 entry-level staff nuclear medicine technologists. Through analysis of the survey data and judgments of the committee, the project resulted in changes to the nuclear medicine technology examination task list, content specifications, and clinical competency requirements. The primary changes inspired by the project were the introduction of CT content to the examination and the expansion of the content covering cardiac procedures.

Key Words: nuclear medicine technology job analysis; ARRT nuclear medicine technology exam; ARRT nuclear medicine technology clinical competency requirements

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The job responsibilities of the nuclear medicine technologist are constantly evolving. New technology emerges that makes established procedures obsolete, and improvements in existing technology encourage the incorporation of new equipment and software into the workplace. The American Registry of Radiologic Technologists (ARRT) tracks these trends in the workplace by conducting periodic job analysis projects for all examinations.

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In 1980, the ARRT conducted its first systematic, large-scale effort to document the job functions of entry-level technologists working in nuclear medicine technology (NMT) (1). Throughout the 1980s and 1990s, ARRT conducted a job analysis study every 5 y. More recently, the studies have been performed on a 6-y cycle, with an interim, smaller-scale job analysis update performed every 3 y. These updates are important for professions that are constantly evolving because of advances in equipment and technology, ensuring that the content specifications and clinical competency requirements keep up with current practice. The rationale for job analysis is outlined in the *Standards for Educational and Psychological Testing* (2) and in the standards adopted by the National Commission for Certifying Agencies (3). A job analysis project can be summarized as a thorough, systematic study of the activities performed in the work setting. Examination content is then designed to assess the knowledge and skills necessary for competent performance of the job duties identified by the study.

MATERIALS AND METHODS

A job analysis study for NMT was initiated in January 2009, with a goal of updating the content specifications and clinical competency requirements for the ARRT NMT examination in 2011. The central element of this study was a large-scale survey, conducted to determine what job functions were being performed by nuclear medicine technologists across the country. Responses to the survey were to be used to determine the list of tasks that defined the job functions of the nuclear medicine technologist. An advisory committee of experts in the field, representing a variety of work settings and job titles, was assembled to work on the project.

The first project for the advisory committee was to develop a comprehensive list of tasks performed by entry-

level nuclear medicine technologists. Information aiding the development of the list included job descriptions, curriculum guides, and, most important, the current task list—a result of the previous job analysis study completed in 2004. The committee also identified several emerging tasks (i.e., job functions that were not performed by a significant portion of nuclear medicine technologists in the past but were becoming more commonly performed). Some of the emerging tasks were the result of changes to practice brought on by new equipment or pharmaceuticals, and some were due to new protocols for previously existing procedures. The idea behind the development of this new list was to include a large number of tasks and then analyze the survey data to decide whether a significant percentage of entry-level nuclear medicine technologists was performing each task. Rather than allowing the committee to decide that tasks were not being performed by most nuclear medicine technologists, it was more definitive to have data to provide evidence for committee decisions. Thus, survey tasks could then be excluded from the final list when the data showed that they were not being performed by a significant portion of the workforce. Another reason for including emerging tasks on the survey was to acquire baseline data for these tasks so that future projects would be able to analyze the trend in performance of these tasks over time.

Once the list of tasks was completed, to make the survey shorter the committee eliminated those tasks that all committee members agreed were being performed frequently (almost daily) by virtually all nuclear medicine technologists (90% or higher). The omitted tasks (which included 45 items) were on the final task list but not on the survey. No diagnostic or therapeutic procedures were included on the omitted-task list, because more accurate tracking of the trends in the nuclear medicine workplace can be done when data for these types of procedures are acquired each time ARRT conducts a job analysis project. The following are examples of the tasks on the omitted-task list: verify the accuracy, appropriateness, and completeness of the patient requisition form; monitor equipment to detect malfunction; and, store and dispose of radioactive waste.

The list of the nonomitted tasks was formatted into a survey consisting of 31 general tasks and 64 diagnostic and therapeutic procedures. About the tasks and procedures, the survey asked how often the respondent personally performs each task, and answer options were “not responsible for performing,” “daily,” “weekly,” “monthly,” “quarterly,” and “yearly.” A second section of the survey listed 54 diagnostic radiopharmaceuticals, interventional pharmaceuticals, and therapeutic radiopharmaceuticals. The survey asked how often the department administers each of these, and the answer options were the same as those for the procedures section. The final section of the survey consisted of 9 questions about the experience and workplace of the survey respondent.

A survey sample of 1,000 ARRT-registered, entry-level, full-time staff technologists whose primary sphere of employ-

ment was nuclear medicine technology was selected from a population of approximately 13,000 radiologic technologists who were registered in NMT. The ARRT generally considers an entry-level technologist to be a staff technologist with 1–3 y of experience in an imaging modality. The survey sample focused on those fitting the entry-level criteria but also included some staff technologists with less than 1 y of experience and some with more than 3 y of experience. Information for selecting the sample, concerning job title, years of experience, primary sphere of employment, and work status, was collected from responses to questions on ARRT annual renewal forms. The survey was mailed in April 2009, and data collection was completed in May 2009.

RESULTS

There were 492 returned surveys (a response rate of 49.2%). The surveys were initially screened to ensure the data had been entered correctly and responses were valid. A few surveys were eliminated from the analysis because of excessive missing data; a few more were excluded because the data were not thoughtfully entered (e.g., it is not realistic for someone to respond that he or she is responsible for all tasks on a daily basis). Responses from part-time technologists (those working fewer than 30 h per week) and from those who were no longer working as staff technologists were also excluded from the analysis. After the screening steps were completed, the sample contained 430 surveys. Results were tabulated for this group, and then the sample was further filtered to select only the group of respondents with 1–3 y of experience; there were 256 in this group, the target group. Most of the decisions concerning inclusion of tasks on the final task list were based on the analysis of the target group responses.

DISCUSSION

The percentage of the respondents responsible for performing each task was reviewed, and the frequency with which each task was performed was summarized. When there was debate as to whether to include a task on the final list, data from previous job analysis studies were reviewed to determine whether a task was being performed more or less than it had been in the past. When decisions were difficult to make, the target group and entire survey population were compared. The normal criterion for a task to be included on the final task list was that at least 40% of the target group must perform it. However, exceptions were made when tasks fell below the 40% threshold but were deemed to be critical, were done with a high frequency, or were becoming more commonly enough performed in the NMT workplace that it was thought they would soon be performed by greater than 40% of staff technologists. Generally, decisions were easy to make—most tasks on the survey were performed by a large majority of the target group. After the committee reviewed the data and discussed all relevant criteria, the task list was finalized.

The following new tasks, with the percentage of the target group responsible for performing the task in parentheses, were added to the list for 2011:

- Electrocardiographic lead placement for stress imaging (65%)
- Tumor imaging with metaiodobenzylguanidine (MIBG) (46%)
- Tumor imaging with octreotide (67%)
- CT in association with SPECT or PET (32%)
- Sentinel node (69%) lymphoscintigraphy

The following tasks were on the task list from the previous job analysis project but were dropped for the 2011 list because they did not meet the minimum criteria:

- Cardiac first-pass imaging (31%)
- Cardiac gated blood pool with SPECT (36%)
- Cardiac myocardial perfusion SPECT (28%)
- Gastrointestinal esophageal transit/reflux imaging (34%)
- Genitourinary cystography (25%)
- Genitourinary testicular imaging (22%)
- Tumor antibody (33%) imaging
- Other tumor imaging (thallium, sestamibi) (35%)

Exceptions, however, were made to include the following tasks. Although these tasks also did not meet the normal minimum criteria (i.e., 40% or more of the target group was responsible for performing the task), they were deemed critical or were performed more frequently or were becoming more commonly performed:

- Brain PET or PET/CT
- Cardiac PET or PET/CT
- Genitourinary renal morphology imaging
- Tumor PET or PET/CT
- CT procedures: CT in association with SPECT or PET
- Therapeutic procedures: palliation of pain
- Therapeutic procedures: non-Hodgkin lymphoma

The CT in association with SPECT or PET entry was included, despite being performed by only 32% of the target group, because it was expected that the percentage of the target group performing it would continue to increase and would soon exceed 40%. This task was also included because those who were responsible for performing these CT procedures did so frequently.

The justification for including the therapeutic procedures was that these tasks involve a high level of criticality. Although fewer than 40% of the survey respondents were responsible for performing these tasks, the consequences for incorrect performance are severe; thus, the committee thought it was important to include these tasks on the list and incorporate into the examination the knowledge and skills required to perform them.

Developing a task list is a preliminary step to changing the examination content specifications and clinical competency requirements. The added task that most affected the new content specifications was CT in association with

SPECT or PET. This is the first time that CT examination content will appear on the ARRT NMT examination. Content assessing CT knowledge will appear in the “Instrumentation and Quality Control” and the “Diagnostic and Therapeutic Procedures” sections of the examination. The incorporation of CT into nuclear medicine, primarily in hybrid imaging equipment, is an important innovation that allows for anatomic localization and provides accurate information for attenuation correction (4). To take advantage of these advances in imaging, it is increasingly essential that the nuclear medicine technologist is familiar with the CT components of the equipment. The Society of Nuclear Medicine Technologist Section (SNMTS) added CT content to the SNMTS Scope of Practice for the nuclear medicine technologist in 2007 (5), emphasizing the importance of students having students prepare for using CT in the nuclear medicine workplace.

Other changes to the content specifications were made because new tasks were added to the task list or tasks that were previously on the task list were dropped. For example, cystography was dropped from the task list because only 25% of the target group indicated that they were responsible for performing it, down from 45% in 2003. Consequently, cystography was also then dropped from the “Diagnostic and Therapeutic Procedures” section of the content specifications.

The committee also reviewed and updated the number of questions assigned to each content area. Besides the addition of questions assessing CT procedures, another significant change was the expansion of the “Cardiac Procedures” section. Numerous sources have noted the increasing demand for and performance of nuclear cardiology procedures and the expectation that this trend will continue (6,7). Because the committee agreed that cardiac procedures now make up a larger percentage of total nuclear medicine examinations than in the past, the number of questions in the “Cardiac Procedures” section was increased from 18 to 24.

In August 2009, the draft content specifications and clinical competency requirements were sent to all NMT educational programs and posted on the ARRT Web site. Comments on both documents were encouraged.

In November 2009, the committee met to review comments, primarily from the educational community, on the content specifications and clinical competency requirements. Committee members were eager to get feedback from educators concerning the addition of CT content to the NMT examination, wondering whether any educational programs would have problems providing training in CT. However, there were no negative comments on the addition of CT content; in fact, several comments emphatically endorsed the addition of CT content. The topic that drew the most critical comments addressed the inclusion of therapeutic procedures on the clinical competency requirements. Some educators commented that their students were not allowed to participate in any therapeutic procedures,

and after a thoughtful discussion the committee agreed that this was a potential problem and responded by changing the clinical competency requirements to allow all therapy procedures to be simulated.

The ARRT Board of Trustees approved the content specifications and clinical competency requirements in January 2010, and they will go into effect for examinations beginning in January 2011.

CONCLUSION

At the start of this project, there were ideas of how the job responsibilities of the nuclear medicine technologist were evolving, but to modify the structure of the NMT examination the job analysis committee required evidence of those changes. By analyzing survey data from a large representative sample, the committee acquired empirical evidence of the tasks being performed by the entry-level nuclear medicine technologist. Decisions that were made and the accompanying changes to the content specifications and clinical competency requirements were based on a critical review of the data. A few exceptions were made, based on judgments of the advisory committee concerning trends in the workplace, but overall the project was driven by the survey data. The final results of the job analysis project are content specifications and clinical competency requirements that comprehensively assess the knowledge and skills required to perform the tasks of today's entry-level nuclear medicine technologist. The new content specifications and clinical competency requirements

for the 2011 examination can be viewed on the ARRT Web site (<https://www.rrt.org/index.html>) by following the links from the Examinations and Practice Analysis tabs, respectively.

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