COMPUTED TOMOGRAPHY
EDUCATIONAL NEEDS ASSESSMENT

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A Nationwide Survey of Registered CT Technologists
Conducted by
The American Society of Radiologic Technologists

Reported December 2005

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EXECUTIVE SUMMARY

A Computed Tomography Educational Needs Assessment questionnaire was mailed in late April 2005 to a random sample of 10,000 ARRT registrants who consider computed tomography their primary or secondary sphere of employment and/or who hold the American Registry of Radiologic Technologists (ARRT) certificate in CT. Each R.T. was offered the option of completing the questionnaire online. An invitation to complete the online questionnaire also was posted on the ASRT Web site home page.

Respondents and Their Facilities

- Almost 98% of the respondents indicated that they either perform CT scans, supervise others who perform CT scans, or perform and supervise CT scanning. Of the 47 who said that they neither perform nor supervise CT scans or whose involvement in scans was indeterminate, 7 nonetheless indicated that CT was their primary or secondary specialty. All subsequent analyses are based on the 1,923 R.T.s who either perform CT scans, supervise them or considered computed tomography their primary or secondary specialty.

- Respondents who perform CT scans have been doing so for a median of 8.8 years; those who supervise CT scanning indicated a median of 5.0 years in supervision.

- About two-thirds (68%) of the respondents indicated that they consider CT their primary specialty or sphere of employment. Another one-fourth (25%) consider it only their secondary specialty; 7.5% consider CT neither their primary nor secondary specialty. Almost two-thirds hold the ARRT certificate in computed tomography.

    - Of 13 services (including “Other”) mentioned in a checklist, the average (median) respondent indicated that his or her facility provided 6.4 of the services and that the respondent’s CT scans were used to provide 5.5 of the services. The most common services were general diagnostic CT (95% of facilities with an estimated 95.5% of the population produce scans used for general diagnostic purposes), postprocessing image manipulations (71% of facilities, 59% of technologists), orthopedic (71%, 64%), trauma (70%, 66.5%), pediatric (55%, 51%), neurologic (55%, 49%), and cardiovascular (44%, 42%). Least commonly provided services were fusion (12%, 8%), research protocols (14%, 14%) and virtual colonoscopy (20%, 17%).

    - Facilities varied enormously in their CT workloads, from zero to 1,000 CT scans per day (not including two respondents who reported 9,500 and 30,000 daily scans and who probably misread the question as referring to monthly or annual scans), with an estimated population median of 29 scans per day and 5th and 95th percentiles of 4 and 120 scans daily.

- About 31% of the respondents work in rural facilities, while 38% work in suburban facilities; and 31% work in urban facilities.

- More than three-fourths of respondents work in hospital settings and 17% in freestanding clinics. Only 2% reported working in educational settings.

- About 81% of the respondents are staff, senior or lead technologists or therapists. Four percent reported a title of chief or assistant chief technologist or therapist; and 8%, supervisors or managers.

- About 24% of R.T.s in the target population work for employers who require that CT technologists be certified. More than 80% of these technologists cited ARRT as the required certifying body, while 5% cited a state license as sufficient. About 39% of the population indicated that certification in CT entitles CT technologists working at their facility to higher pay.

Preparation of Computed Tomography Technologists

- About 64% of respondents indicated that they hold the ARRT certificate in computed tomography. However, correcting for the over-representation of respondents who consider CT their primary sphere of employment yields an estimated population percentage of only 51% certified.

- Of those who do not hold the ARRT certificate in computed tomography, almost three-fourths of respondents (72%) plan to take the CT certification exam in the future. And of these, only 9% reported one or more unsuccessful attempts before passing the certification exam.

  Respondents who consider CT their primary sphere of employment were substantially more likely (83%) to report that they plan to take the certification exam in the future than were other respondents not yet certified in CT (66%). Further, the percentage of currently certified respondents who took the certification exam unsuccessfully at least once before achieving certification (12%) was significantly greater than the percentage of currently uncertified respondents (7%) who have attempted but failed the exam at least once.

- Of the 669 respondents who are not ARRT-certified in CT and do not plan to take the CT certification exam in the future, 160 gave one or more reasons for not taking the exam. About 61% of those in the target population who aren't certified in CT and have no plans to take the certification exam cited the fact that certification would not lead to higher pay as a reason for not attempting the exam. About 49% reported that their state – and another 36% that their employer – does not require certification. And 45.5% reported that they do not need certification to validate their skill in and understanding of CT, while 31.5% reported that workplace competency assessment provides adequate validation and 24% said that their patients aren't interested in whether or not the technologist is certified. Only 14% cited a low likelihood of passing the exam as a reason for avoiding it.

  A number of these sample percentages differed substantially and significantly among technologists depending on whether CT was their primary specialty, secondary specialty only, or neither primary nor secondary.

- Of the 1,224 respondents who indicated that they hold the ARRT certificate in computed tomography, 1,219 checked one or more types of CT-specific training that prepared them to take the ARRT certification exam in CT. Of these 1,219 respondents, 95% mentioned on-the-job training; 57% selected published continuing education materials and 42.5% reported on-site applications training provided by a vendor. About 31% reported applications training from a co-worker who had taken vendor-supplied applications training and 23%, off-site, multiple-day applications training; and 39% cited continuing education courses at conferences. Only 22.5% reported clinical training and 14.5%, didactic coursework within a radiologic technology educational program.

- Of the 1,868 respondents who checked one or more of 11 types of training (including "other") that had prepared them for their first performance of an on-the-job CT scan, 96% indicated that on-the-job training had been one of the ways in which they prepared. From 28% to 36% cited published continuing education materials; clinical training within an R.T. educational program; on-site, vendor-provided applications training; and on-site training by a co-worker who had received applications training. Only 12.5% cited didactic coursework and 11% reported online CE materials. Even fewer – 4% – reported a fellowship in CT.

  However, 36% of respondents not certified in CT but only 26% of those holding the ARRT CT certificate reported having used "Clinical training as a student in a radiologic technology educational program" to prepare for their first on-the-job CT scan. Forty percent of noncertified but only 30% of CT-certified respondents reported having used "On-site applications training provided by a CT equipment vendor" ($F_{1,1906} = 19.811$, $P < .001$).

- More than two-thirds of the respondents (69%) either agreed or strongly agreed “that entry-level radiography programs should increase their emphasis on computed tomography (e.g., number of courses and/or hours within other courses devoted to CT)”.

Professional Development of CT Technologists

- A total of 1,906 R.T.s said they use one or more sources of information to keep up-to-date on advances in computed tomography. Weighting responses to correct for over-representation of technologists certified in CT and declaring CT as their primary specialty leads to the estimate that 73% of the target population uses continuing education materials to keep up with advances in CT. Nearly as many (68%) cited radiologists and other CT technologists as a source, while 60% noted professional journals and 53%, professional newsmagazines.

  Fewer than 5% use list servers for imaging professionals. Among the respondents who indicated that they use list servers, 78 cited one or more favorite list servers. One-half (39) of these mentioned AuntMinnie.com as at least one of their favorites and 18 (23%) mentioned CTisus.com.

  These percentages were statistically significantly affected by both credentialing and CT specialty level (though the interaction between those two factors was nonsignificant). CT-certified technologists were significantly less likely than noncertified technologists to cite other CT technologists and their department/facility manager and significantly more likely to cite vendor representatives, workshops/courses at professional conferences, CE materials, product demos, professional journals and professional newsmagazines as sources.

  Sources that were cited significantly more often by CT technologists who consider CT their primary specialty were employer-provided workshops, the respondents’ department managers, vendor representatives, CE materials and product demos at a CT facility. The only source that was cited significantly more often by those who considered CT neither their primary nor their secondary specialty was “Other CT technologists”.

- Respondents were asked how many credits of *CT-relevant* continuing education they earn and how many credits they would like to earn per biennium from each of 10 different sources (including “other”). Directed Readings accounted for a mean of 4.29 of the population’s biennial CE credits and applications training provided by a vendor for 4.0 credits (2.5 on-site, 1.5 off-site). Courses and workshops at state, regional or national conferences accounted for 2.0 credits, while courses from educational institutions, employer-provided in-services, and online CE opportunities counted for between 1.0 and 1.75 credits per biennium.

  Respondents who consider CT their primary specialty earned significantly more CT-relevant credits and wished to earn significantly more credits from a number of these sources than did the other two professional-involvement groups, with the net result that professional involvement did not significantly affect the *excess* of credits desired over credits earned.

- Altogether respondents report earning a mean of 16.6 CT-relevant CE credits per biennium; the mean number of credits they would like to earn is 19.6 per biennium. The sources for which the number of desired credits exceeds the number of credits earned per biennium are employer-provided in-services (1.1 more credits desired than earned), Directed Readings in ASRT journals and online CE via the ASRT/Sinclair Community College partnership (.8 more credits desired via each source), ASRT-provided continuing education and online CE opportunities other than ASRT/Sinclair (.6 credits more each) and courses and workshops at conferences (.3 credits more). On the other hand, the average (mean) respondent earns one-half credit more from courses taken from/at an educational institution than they would prefer to earn from that source.

- Three-fourths of the respondents offered one or more answers to the question, "How do you go about expanding your skill set in CT, i.e., developing skill in innovative or currently unfamiliar techniques and procedures?" Nearly 43% of these responses cited face-to-face sources (e.g., radiologists, fellow CT technologists). About 21% chose books and other hardcopy materials and 20%, classes, seminars, conferences, and/or vendor training. Only 8% cited software and/or online materials.

- Respondents were asked to "help us assess the value of developing a professional-practice benchmark to which to compare your skills in CT." It was explained that such a self-assessment tool would provide a 'score' for each of several aspects of CT. More than 90% of respondents felt that such a tool would be somewhat or very valuable "in planning your professional development." Nearly 95% felt that "including links to resources for enhancing your knowledge and skills in aspects of CT where you currently fall short of the benchmark" would be somewhat or very valuable. About 70% felt that benchmarks should be adjusted for or listed separately for different levels of experience in CT. And about 15% accepted the invitation to "add any other comments on the value/contents of a professional-practice benchmark" for CT technologists. Of those who added comments, 32% supported benchmarking, 12% indicated that benchmarking was not a good idea or might create more problems and 36% were ambivalent, largely because of the complexity of the factors involved.

- About 30% of the respondents feel that there are areas of CT that have become so unique and specialized that they warrant special recognition through certification. Almost 450 of those responding specified particular areas that should be certified separately. The most frequently cited areas were CT angiography (nominated by 34% of those who specified one or more areas), cardiac (26%), angiography (18%), 3-D (17%), and vascular (16%). No other area was nominated by 12% or more of this respondent group.

Differences Among Types and Locations of Facilities

Responses to many of the questions on the survey were affected significantly by the location of the respondent's workplace (rural, suburban or urban setting) and by whether that facility was a small (< 300-bed), medium-sized (101-300 bed) or large (> 300-bed) hospital, a freestanding clinic or an educational setting. In particular:

Involvement in CT

- Hospitals with fewer than 100 beds have less experienced CT-technologist staff (mean = 8.5 years performing CT scans) than do larger hospitals (10.4 years), and freestanding clinics have more experienced CT technologists (12.1 years) than do hospitals (9.9 years).

  Facilities located in rural areas are staffed by less experienced CT technologists (mean = 8.5 years performing CT scans) than are suburban and urban facilities (10.9 years).

- The percentage of CT technologists who consider CT their primary specialty increases monotonically and the percentage for whom CT is neither primary nor secondary decreases monotonically as size of hospital increases. Freestanding clinics and facilities in educational settings are similar to the overall average in these respects.

  Respondents who consider CT their primary specialty or sphere of employment reported working at a significantly higher percentage in suburban and urban facilities (74%) than in rural facilities (42%), and the percentage of respondents who consider it only their secondary specialty is higher in rural facilities (40%) than in suburban or urban facilities.

- The percentage of CT technologists who hold the ARRT certificate in CT increases monotonically as size of hospital increases and is significantly higher (74%) in freestanding clinics than in hospitals (57%).Educational facilities are similar to the overall average percent of CT-certified staff.

Professional Preparation

- The percentage of hospital-based respondents who mentioned using online CE materials to prepare for the certification exam was lower (12%) than the corresponding percentage for those working elsewhere (26%). However, this difference was much greater in urban (12% vs. 40%) and rural (7% vs. 25%) locations than in suburban locations (20% vs. 17%).

  The percentage of respondents who used CE courses at conferences to prepare for the certification exam was higher in mid-sized hospitals (43%) than in small or large hospitals (33%), and in freestanding clinics (48%) than in hospitals (37%). However, the difference between mid-sized and other hospitals in this respect was much greater in rural and suburban areas (56% mid-sized vs. 36% small or large) than in urban locations (23% vs. 32%), and greater in rural (62% vs. 30%) than in suburban (49.5% vs. 41%) locations. Further, the tendency for more respondents in freestanding clinics than those in hospitals to use CE courses at conferences was only true of rural and urban settings (37% vs. 47% and 28% vs. 43%, respectively), while in suburban locations it was lower for freestanding clinics (37%) than hospitals (46%).

  Reliance on on-site applications training provided by equipment vendors was rated higher in freestanding clinics than in urban hospitals (65% vs. 40%), and rural hospitals (53% vs. 42%) but lower for suburban locations (31% vs. 47%).

  Finally, reliance on off-site applications training was rated higher in mid-sized hospitals than in small or large hospitals in rural (46% vs. 18%) and suburban (33% vs. 18%) locations, but in urban locations small or large hospitals relied on off-site training more than mid-sized facilities (11% vs. 18%).

- While no single source of preparation for the first on-the-job CT scan differed significantly in frequency of use as a function of facility type, the difference between use of clinical and didactic courses and on-the-job training vs. use of off-site applications training, courses at conferences and published CE material was evident. In particular, respondents who work at hospitals rated about average in this respect, while respondents in freestanding clinics showed a significantly lower reliance on clinical and didactic courses and job training relative to the other cited sources – off-site applications training, conferences and published materials (mean difference = 0.5 sources). Respondents from educational and other types of facilities showed a significantly higher differential between the two types of sources (mean difference = 1.0 sources).

  There also was a statistically significant interaction between these two factors with respect to percentage of respondents using on-site applications training provided by a vendor. In rural and urban facilities this percentage was higher in freestanding clinics than in hospitals (43% vs. 36% in rural areas, 53% vs. 37 % in urban locations), while the opposite (30% vs. 39%) was true in suburban locations.

Professional Development

- Of the 14 listed sources of information (including “Other”), only four (employer-provided workshops, your department/facility manager, workshops/courses at professional conferences and product demos at a CT facility) were cited by significantly different percentages of respondents who work at different types of facilities, as follows:

  All four sources of information were cited by a significantly higher proportion of respondents working in large hospitals than those in small hospitals. Respondents working in educational settings cited employer-provided workshops and their department/facility manager at a rate substantially above the overall average – but not significantly so because of the group’s small sample size. Respondents in freestanding clinics cited their department/facility manager significantly less often and workshops/courses at professional conferences significantly less often than did those working in other facility types.

The frequency with which the department/facility manager was cited also was significantly affected by the interaction between facility type and location, $F_{10,1735} = 2.705$, $P = .008$. However, this was primarily because rural location respondents who work in facilities other than hospitals, freestanding clinics and educational settings are far more likely (more than 50%) to rely on their department/facility manager to keep them up-to-date than are respondents in general (16%). Yet in urban and suburban settings, respondents in "Other" facilities cited their department/facility manager as about average in keeping them up-to-date. Since the "Other" category may consist of substantially different types of facilities in rural as opposed to suburban and urban settings, it is difficult to know how to interpret this interaction.

Characteristics of Facilities

- Hospitals with 300 or fewer beds and facilities in educational settings were much less likely (15.5%) to require that their technologists be certified in CT than were large hospitals and freestanding clinics.

- The percentage of respondents reporting that CT certification yields higher pay for CT technologists at their facilities was not significantly affected by facility type or location if the facilities required certification, but differed significantly among facility types for those that do not require certification. Among respondents whose facilities do not require CT certification, CT technologists working in large (> 300-bed) hospitals were significantly less likely (23.5%) than those working in other types of facilities (35.6%) to report that CT certification entitles CT technologists to higher pay.

- For each of the 13 services on the checklist, as well as for total number of services provided, the proportion providing that service or the mean number of services provided increased monotonically from small to large hospitals. Consistent with that trend, the predominance of "basic" over "complex" services decreased monotonically with hospital size. Freestanding clinics scored similarly to the small-hospital proportion or mean for most services, and they were the least likely provider of interventional and trauma services by wide margins. Facilities located in educational settings were substantially above the overall mean for most services and for total number of services. Major exceptions for educational facilities were their relatively low likelihood of providing postprocessing image manipulation or cardiovascular services. Educational settings rated similarly to small-hospital facilities in providing substantially more "basic" than "complex" services.

  Provision of trauma and cardiovascular services, as well as involvement in research protocols, showed statistically significant interactions between facility type and location.

- For every CT service the proportion of respondents whose CT scans contribute to that service increased monotonically with size of hospital, as did the total number of services for which respondents' scans were used. Freestanding clinics were somewhat but nonsignificantly above average in the proportion of respondents whose scans supported virtually colonoscopy but below average in contributions to all other services, statistically significantly so for image-guided/interventional, trauma, pediatrics, CT simulation, postprocessing, and total number of services. Educational settings were somewhat but nonsignificantly below average in the proportion of respondents whose scans supported virtually colonoscopy and above average in contributions to all other services, statistically significantly so for trauma and orthopedic procedures and for research protocols.

  In addition, use of respondents' CT scans for general diagnostic CT and for postprocessing of images were each involved in a statistically significant interaction between facility type and facility location.

- Number of CT scans per day increased with hospital size, $F_{1,1710} = 276.457$, $P < .001$, and freestanding clinics were significantly below the overall mean, as were small hospitals.

Differences Among Staff, Management and Educators

The various job titles were combined into three management levels: Staff (staff/senior/lead technologists/therapists), Managers (assistant chief or chief technologist/therapist, supervisor/manager, administrator), and Educator (clinical or didactic instructor, clinical coordinator, program director). Corporate representatives were not considered in this analysis. "Other" responses were examined to determine, where possible, which of the three levels was implied.

Professional Profile

- Involvement in performing and/or supervising CT scans differed as expected across the three employment/management levels. However, a low percentage (6.9%) of (ARRT-registered) managers do not perform CT scans.

- Staff are significantly less likely (57.5%) than managers and educators (73%) to hold the ARRT certificate in computed tomography.

- Considering only noncertified respondents who report that they don't plan to take the CT certification exam in the future, only three educators fell into this category, so management-level comparisons were restricted to staff vs. managers. The only reasons cited by significantly different percentages of staff and managers was that "I supervise CT scans but don't perform them myself," which was cited by 24% of managers but by less than 1% of staff technologists/therapists.

Professional Preparation

- The only source of preparation for the certification exam that was used significantly differently was "Continuing education courses at conferences," which was cited by 32% of staff but by 49% of educators and managers.

- Two of the types of preparation for their first on-the-job certification exam (on-site applications training provided by an equipment vendor and off-site applications training involving a formal, multi-day curriculum) were used by a higher percentage of managers (45% and 23%, respectively) than of staff respondents (33% and 13%). Educators and staff respondents were similar in these two respects, but because of the small number of educators in the sample, staff and educator responses did not differ significantly.

Professional Development

- The three employment/management groups differed statistically significantly in their reliance on several of the 14 sources of information used to keep up-to-date on advances in CT: A significantly lower percentage of staff than of managers used vendor representatives, workshops/courses at professional conferences, CE materials, product demos, professional journals and newsmagazines, and list servers for this purpose. A higher percentage of staff than of managers used other CT technologists and department/facility managers to keep up-to-date. Educators' methods generally paralleled managers' and significantly differed from managers in the percentage who used a given source, except that educators were significantly more likely (20%) than either staff (3%) or managers (8.5%) to rely on list servers and to use other CT technologists somewhat more (76%) than either staff (72%) or managers (61%), though neither difference was statistically significant.

- The only statistically significant differences among management levels with respect to CT-relevant CE credits earned or that the respondent would like to earn were tendencies for staff-level respondents to earn fewer credits per biennium via off-site applications training and conferences than managers and administrators, who do not differ significantly in this respect from educators.

- The only statistically significant difference with respect to sources/methods used to increase respondent's skill set was that managers were more likely (38.8%) than either staff (27.8%) or staff and educators combined (27.2%) to employ formal, face-to-face training (i.e., classes, seminars, conferences, and/or vendor training).

- Staff technologists and therapists are less likely (27%) to feel that there are areas of CT warranting separate certification than are managers, who are in turn significantly less likely to feel so than are educators (48%). Among respondents who specified one or more areas warranting separate certification, managers, staff and educators did not differ in the particular areas of CT they mentioned. However, respondents listing an "Other" job title/description were significantly more likely (4 out of 8) to feel postprocessing warranted separate certification than were the other three groups, only 2% of whom mentioned postprocessing.

Characteristics of Facilities

- A higher percentage of educators (but still only 16.7% of them) than of staff and managers (1.6%) work in educational settings. A higher percentage of respondents who work in freestanding clinics (23.1%) hold managerial titles than is true in hospitals (15.4%).

- Staff were significantly more likely to be involved in cardiovascular CT than the other two management levels, while educators were more likely than the other two groups to be involved in trauma imaging and in postprocessing of images. Respondents at an "Other" management level were considerably more likely than staff, managers and educators to report contributing to an "Other" service.

- While there were no statistically significant differences among the management levels in the percent citing a particular service as the single most common one for which their CT scans are used, there were some differences in mean most-common-use scores (which give partial credit for being one of two or more "most common uses"). In particular, staff were significantly more likely than managers to identify pediatric or cardiovascular CT or postprocessing as the most frequently used services for CT scanning. Staff were less likely than managers to be primarily involved in CT simulation. And educators were significantly less likely than either staff or managers to say that general diagnostic CT was the most common use of their CT scans.

- A lower percentage (76%) of respondents from rural facilities are staff (rather than managers or educators) than is true of suburban and urban facilities.

- A significantly higher percentage of managers (46%) than of staff (36%) believe that holding a CT certificate entitles CT technologists at their facility to higher pay.

Purpose

The goal of this Computed Tomography Needs Assessment was to tap the expertise of current CT technologists. Primarily, the assessment sought to answer questions concerning CT education, such as the kind of education and training those who perform CT scans currently receive to prepare them for their responsibilities, the kind of education they would have liked to receive and how they keep abreast of the rapid pace of technological developments in computed tomography. In addition, questions sought to determine how technologists' acquisition of additional skills and attainment of increasing competency in existing skills may be fostered and recognized.

Sample Design

The American Registry of Radiologic Technologists (ARRT) supplied postal addresses for a random sample of 10,000 ARRT registrants who were certified in Computed Tomography and/or who considered CT their primary discipline/sphere of employment. A five-page questionnaire with accompanying cover letter/invitation to participate was mailed to each of these CT technologists. Invitees had the option of ignoring the invitation, completing the hardcopy questionnaire and returning it to the ASRT Research Department in the provided postage-paid envelope or by visiting ASRT's Web site (www.asrt.org) to complete the questionnaire online. At about the same time, an invitation for R.T.s involved in CT or CT supervision to respond to the online questionnaire was posted on the ASRT Web site. In addition, a reminder to respond was sent June 15 as a targeted part of ASRT's monthly *rEsources* newsletter to everyone who had been sent a postal invitation and for whom ASRT had an e-mail address.

METHODOLOGY

Return Rate

As of July 1, 2005, responses had been received from 1,963 individuals (875 hardcopy questionnaires, 699 online responses from individuals who had received a postal invitation to participate and were thus part of the random sample, and 389 online responses from R.T.s who did not report having received a postal invitation and thus were probably volunteers). The overall response rate from the 10,000 invitations was about 20%. This marked the first ASRT survey where online responses accounted for more of the returns than did hardcopy questionnaires returned via the mail.

However, 33 of the respondents indicated explicitly that they neither perform CT scans nor supervise those who perform CT scans, and another 7 respondents' involvement in CT scans could not be determined, nor did they claim CT as either a primary or a secondary specialty. These 40 respondents were excluded from all subsequent analyses, leaving a sample of 1,923 responses.

Sample Representation of Population

As indicated above, the sample population included all ARRT registrants who were either certified in CT or considered CT their primary or secondary sphere of employment. The ARRT made available a renewal-form database (absent identifying information), supplemented by information on certificates held by registrants, that could be used to determine the distributions of several demographic variables for this population. Comparing these distributions to the corresponding distributions of those variables in the sample revealed no large or statistically significant differences between population and sample with respect to type of facility, job title or years employed in the specialty. The job title/years employed comparison was restricted to respondents who considered CT their primary specialty; the larger number – years performing CT scans or years supervising CT scans was used. However, a substantially larger percentage of respondents than of the population were certified in CT and considered CT their primary discipline/specialty, as indicated in the following two tables:

CT as Primary Specialty/Discipline

		Population			Sample		
		Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
Valid	Neither primary nor Second.	5720	12.1	12.1	143	7.4	7.5
	Secondary spec/disc	20318	43.0	43.0	474	24.6	24.9
	Primary spec/disc	21240	44.9	44.9	1290	67.1	67.6
	Total	47278	100.0	100.0	1907	99.2	100.0
Missing		0	0.0	0.0	16	.8	
Total		47278	100.0	100.0	1923	100.0	

Credentialed in CT

		Population			Sample		
		Frequency	Percent	Valid Percent	Frequency	Percent	Valid Percent
Valid	No	24000	50.8	50.8	684	35.6	35.8
	Yes	23278	49.2	49.2	1224	63.7	64.2
	Total	47278	100.0	100.0	1908	99.2	100.0
Missing					15	.8	
Total					1923	100.0	

Any result that differed substantially and statistically significantly between credentialed and noncredentialed respondents or as a function of professional involvement in CT (CT the primary specialty, the secondary specialty, or neither) was also recomputed after weighting each response by the ratio between the population and sample percentages for the category within which the respondent fell. This provides a better estimate of the result that would have been obtained had everyone in the population participated in the survey.

Confusion on Procedures Question

Question 18 asked: For which of the following services are the CT procedures you perform used? [Please check all that apply, and type in the most common use of your CT scans in the space below. (Online version)] [Please mark all that apply, but place an “X” beside the most common use of your CT scans. (Hardcopy version)]

The response format for this question was confusing, especially for those responding to the hardcopy version. Many respondents left the check-boxes blank but placed X’s in several of the blank spaces beside the various uses. (These responses were treated as defining all of the services for which the respondent’s scans were used, rather than the most common uses.) Others both checked and X’ed the same services – these were treated as defining all services to which respondent’s scans contributed. Finally, many of both the hardcopy and online respondents X’ed or typed in more than one “most common” use, but fewer than the total number of services marked or checked. This pattern of responses was treated as indicating that the X’ed or typed-in services were tied for most common use; the single “vote” for most common response was therefore divided equally among these tied responses – but percentages were computed both with and without these multiple most-common cases.

DETAILED FINDINGS

Source of Data

Response Source

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Hardcopy	875	44.6	44.6	44.6
	Online – invited	699	35.6	35.6	80.2
	Online – volunteer	380	19.4	19.4	99.5
	Online – probably volunteer	9	.5	.5	100.0
	Total	1963	100.0	100.0	

Professional Profile

1. Do you perform CT scans as a part of your professional duties?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	60	3.1	3.1	3.1
	Yes	1889	96.2	96.9	100.0
	Total	1949	99.3	100.0	
Missing	System	14	.7		
Total		1963	100.0		

1. If "Yes," for how many years (not necessarily consecutive)?

		Sample Distribution				Estimated Population Distribution[a]	
No. of Years		Frequency	Percent	Valid Percent	Cumulative Percent	Percent	Cumulative Percent
Valid	0-2	222	11.3	12.2	12.2	12.8	12.8
	3-5	390	19.9	21.5	33.6	22.7	35.5
	6-10	444	22.6	24.4	58.0	25.2	60.7
	11-15	351	17.9	19.2	77.2	18.3	79.0
	16-20	232	11.8	12.8	90.0	10.2	90.8
	21-25	142	7.2	7.7	97.7	6.9	97.7
	26-30	40	2.0	2.2	99.9	2.2	99.9
	> 30[b]	1	.1	.1	100.0	.1	100.0
	Total	1822	92.8	100.0			
Missing	System	141	7.2				
Total		1963	100.0				

[a] Responses weighted to correct for the over-representation in our sample of CT technologists who consider CT their primary specialty.
[b] Maximum sample response was 60 years.

The mean number of years spent performing CT scans was significantly related to degree of professional involvement in CT.

1. If "Yes," for how many years (not necessarily consecutive)?

	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum
				Lower Bound	Upper Bound		
CT neither primary nor secondary specialty/discipline	133	7.2293	7.66251	5.9150	8.5436	.50	60.00
CT second. specialty only	438	9.8470	6.85928	9.2029	10.4912	1.00	30.00
CT primary spec. or sphere of employment	1233	10.9109	7.22507	10.5072	11.3146	.50	30.00
Total	1804	10.3812	7.23642	10.0470	10.7153	.50	60.00

Overall $F_{2,1801} = 17.424$, $P < .001$; difference between "neither" group and other two groups statistically significant at .001 level; difference between CT secondary and CT primary groups statistically significant at the .01 level.

Responses were weighted to correct for the over-representation in the sample of CT technologists who consider CT their primary specialty, yielding the estimated population distribution of and descriptive statistics for years involved in performing CT scans that appears in the last two columns of the table presented earlier.

2. Do you supervise others who perform CT scans?

		Frequency	Percent	Valid Percent
Valid	No	1104	56.2	57.0
	Yes	832	42.4	43.0
	Total	1936	98.6	100.0
Missing	System	27	1.4	
Total		1963	100.0	

2. If "Yes," for how many years (not necessarily consecutive)?

No. of years		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-2	209	10.6	25.4	25.4
	3-5	251	12.8	30.4	55.8
	6-10	191	9.7	23.2	79.0
	11-15	93	4.7	11.3	90.3
	16-20	60	3.1	7.3	97.6
	21-25	15	.8	1.8	99.4
	26-30	5	.3	.6	100.0
	> 30	0	.0	.0	100.0
	Total	824	42.0	100.0	
Missing	System	1139	58.0		
Total		1963	100.0		

Performance of CT Scans (Questions 1 and 2 Combined)

2. Do you supervise others who perform CT scans? Cross-tabulation1. Do you perform CT scans as a part of your professional duties? *							
		2. Do you supervise others who perform CT scans?					
1. Do you perform CT scans as a part of your professional duties?	Statistic	Missing q2 & q2yes	Missing q2 but stated no. of years	No but stated no. of years	No	Yes	Total
Missing q1 and q1yes	Count	**3**	**0**	**0**	**3**	3	9
Missing q1 but stated no. of years	Count	**0**	**0**	**1**	**3**	1	5
No but stated no. of years	Count	**0**	**0**	**0**	**4**	1	5
No	Count	**0**	**0**	**0**	33*	22	55
Yes	Count	15	6	12	1051	805	1889
Total	Count	18	6	13	1094	832	1963

Note: Entries in the section of the table in **boldface** represent combinations of responses that are ambiguous with respect to whether or not respondent either performs or supervises CT scans.
The cell containing an asterisk (*) represent respondents who explicitly said they do neither.

There were 1,916 respondents who reported either that they perform CT scans or that they supervise those who do or both. Thirty-three respondents indicated that they neither perform nor supervise CT scans. (See asterisked cell of the table.) An additional 14 respondents' answers to these two questions left uncertainty as to whether they performed and/or supervised CT scans. (See the **boldface** entries in the table.) However, seven of these 14 stated in question 3 that they considered CT their primary sphere of employment, thereby resolving the ambiguity. Unless otherwise stated, all subsequent analyses consider only the responses of the 1,923 R.T.s who clearly meet the criterion of either performing or supervising CT scans.

CT involvement and inclusion status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Scan involvement indeterminate – exclude	7	.4	.4	.4
	Neither scans nor supervises – exclude	33	1.7	1.7	2.0
	Scan indet but prim or secdry spec. – include	7	.4	.4	2.4
	Scans or supervises scans – include	1916	97.6	97.6	100.0
	Total	1963	100.0	100.0	

2% of the invitees and 2.1% of online volunteers were excluded from further analyses.

A significantly higher percentage (specifically, 48.9%) of respondents who are certified in CT indicated that they supervise CT scans than did noncertified respondents (33.7%); $\chi^2_1 = 40.950$, $P < .001$. Since the sample significantly over-represented CT-certified R.T.s, the frequency distribution for task involvement was re-run after weighting to correct for this over-representation, yielding the last ("Estimated Population Percent") column of the following table.

Involvement in CT scans

		Frequency	Percent	Valid Percent	Estimated Population Percent
Valid	Neither perform nor supervise CT scans	6	.3	.3	.3
	Perform, don't supervise scans	1084	56.4	56.4	58.6
	Superv, don't perf scans	27	1.4	1.4	1.2
	Both perform, supervise CT scans	805	41.9	41.9	39.8
	Total	1922	99.9	100.0	100.0
Missing	Missing or indeterminate	1	.1		
Total		1923	100.0		

Involvement in CT scans did not differ significantly as a function of whether the respondent considered CT her or his primary or secondary specialty.

3a. Do you consider computed tomography your primary sphere of employment?
3b. Do you consider it your secondary sphere of employment?

		Frequency	Percent	Valid Percent	Cumulative Percent	Population Percent
Valid	CT neither primary nor secondary specialty	143	7.4	7.5	7.5	12.1
	CT secondary spec. only	474	24.6	24.9	32.4	43.0
	CT primary specialty or sphere of employment	1290	67.1	67.6	100.0	44.9
	Total	1907	99.2	100.0		100.0
Missing	Missing	16	.8			
Total		1923	100.0			

4. Do you hold the ARRT certificate in Computed Tomography?

		Frequency	Percent	Valid Percent	Cumulative Percent	Population Percent
Valid	No	684	35.6	35.8	35.8	50.8
	Yes	1224	63.7	64.2	100.0	49.2
	Total	1908	99.2	100.0		100.0
Missing	System	15	.8			
Total		1923	100.0			

Relationship between involvement, certification in CT

			CT neither primary nor secondary spec/disc	CT secondary spec/disc only	CT primary discipl or sphere of employment	Total
4. Do you hold the ARRT certificate in Computed Tomography?	No	Count	128	161	392	681
		%	89.5%	34.1%	30.4%	35.8%
	Yes	Count	15	311	897	1223
		%	10.5%	65.9%	69.6%	64.2%
Total		Count	143	472	1289	1904
		%	100.0%	100.0%	100.0%	100.0%

About 7% of the respondents are not CT-certified and do not consider it their primary or secondary specialty/discipline but are nevertheless involved in either performing or supervising CT scans.

4. If "No," do you plan to take the CT certification exam in the future?

		Frequency	Percent	Valid Percent	Estimated Population Percent
Valid	No	163	23.8	24.4	28.3
	Yes	506	74.0	75.6	71.7
	Total	669	97.8	100.0	100.0
Missing	System	15	2.2		
Total		684	100.0		

Note: Does not include 21 respondents who answered this question even though they already are CT-certified.

Respondents who consider CT their primary sphere of employment were substantially more likely (83%) to report that they plan to take the certification exam in the future than were other as-yet-uncertified respondents (66%); $F_{1,663} = 27.12$, $P < .001$. Weighting responses to this question to correct for the sample's over-representation of primary-specialty respondents yields an estimate that 71.7% of currently uncertified CT technologists in the target population plan to take the certification exam in the future.

5. Have you ever taken the ARRT CT certification exam unsuccessfully?

		Frequency	Percent	Valid Percent	Estimated Population Percent
Valid	No	1673	87.0	89.9	90.7
	Yes	187	9.7	10.1	9.3
	Total	1860	96.7	100.0	
Missing	System	63	3.3		
Total		1923	100.0		

Relationship between unsuccessful certification exam and current certification

		4. Do you hold the ARRT certificate in Computed Tomography?		Total
5.Have you ever taken the ARRT CT certification exam unsuccessfully?	Statistic	No	Yes	
No (i.e., never failed the exam)	Number	631	1039	1670
	Percent certified	37.8	62.2	100.0
	Percent unsuccessful	93.1	88.1	89.9
Yes (i.e., failed the exam at least once)	Count	47	140	187
	Percent certified	25.1	74.9	100.0
	Percent unsuccessful	6.9	11.9	10.1

The percentage of currently certified respondents who took the certification exam unsuccessfully at least once before achieving certification (12%) was significantly greater than the percentage of currently uncertified respondents (7%) who have attempted but failed the exam at least once. Weighting the responses to correct for the over-representation of CT-certified respondents yields an estimated percentage of 9.3% of the target population who have recorded an unsuccessful attempt at the ARRT CT certification exam.

6. If you are not ARRT-certified in CT and you do not plan to take the ARRT certification exam in the future, why not? [Check all reasons that apply to you.]

Considering only respondents who are not currently ARRT-certified

		Sample			Estimated Population Percentages[a]	
		4. Do you plan to take the ARRT certification exam in the future?		Total	4. Do you plan to take the ARRT certification exam in the future?	
Reason not planning to take CT exam	Statistic	No	Yes		No	Yes
I don't consider my chances of passing the exam good enough to warrant the time and/or expense of taking it.	Count	24	7	31		
	%	15.0	14.6		14.1	14.6
I hold a CT license from the state in which I work.	Count	1	0	1		
	%	.6	.0		.4	.0
My state doesn't require certification to practice as a CT technologist.	Count	87	22	109		
	%	54.4	45.8		47.2	51.7
I don't need certification to validate my skill in/understanding of CT.	Count	82	16	98		
	%	51.3	33.3		47.3	35.4
My employer doesn't consider CT certification necessary.	Count	85	17	102		
	%	53.1	35.4		64.0	41.4
My employer doesn't require CT certification.	Count	62	22	84		
	%	38.8	45.8		24.1	40.5
Holding the ARRT CT certificate would not be rewarded with higher pay.	Count	105	26	131		
	%	65.6	54.2		59.3	53.4
I supervise CT technologists but do not	Count	7	2	9		

conduct CT scans myself.	%	4.4	4.2		5.0	6.1
My department's or facility's competency assessment(s) provides adequate validation of my skill in/ understanding of CT.	Count	55	12	67		
	%	34.4	25.0		32.1	36.3
My patients aren't interested in whether or not I am certified in CT.	Count	40	10	50		
	%	25.0	20.8		24.3	28.5
Other (Please specify below.)	Count	34	9	43		
	%	21.3	18.8		23.1	16.4
Total	Count	160	48	208		

[a]Weighted to correct for over-representation among noncertified respondents in the sample of those who consider CT their primary specialty.
Note: Percentages and totals are based on respondents. Those responding "Yes" are included in this table because many respondents who said they plan to take the examination also responded with reasons for not taking the examination (perhaps to explain why they had not taken the exam to-date or as observations of other CT technologists' reasons).

After weighting, estimates show that 61% of those in the target population who aren't certified in CT and have no plans to take the certification exam cited the fact that certification would not lead to higher pay as a reason for not attempting the exam, while 49% said that their state and 36% that their employer does not require certification. About 45% reported that they do not need certification to validate their skill in and understanding of CT and 31.5% that workplace competency assessment provides adequate validation. In addition, 24% of respondents said that their patients aren't interested in whether or not the technologist is certified. Only 14% cited a low likelihood of passing the exam as a reason for avoiding it.

Of the 669 respondents who are not ARRT-certified in CT and do not plan to take the CT certification exam in the future, 160 gave one or more reasons for not taking the exam. Of these 160 R.T.s, 66% cited the fact that certification would not lead to higher pay; 54% that their state and 53% that their employer does not require certification. And 51% said that they do not need certification to validate their skill in and understanding of CT, while 34% reported that workplace competency assessment provides adequate validation and 25% that their patients aren't interested in whether or not the technologist is certified. Only 16% cited a low likelihood of passing the exam as a reason for avoiding it.

A number of the sample percentages differed substantially and significantly depending on CT specialty level (CT as primary specialty vs. secondary only vs. neither primary nor secondary); $\chi^2_{20} = 78.231$, $P < .001$. In particular, 80% of those who consider CT their primary specialty but only 57% of the other two groups cited lack of higher pay for certified CT technologists. Seventy percent of those with CT as primary specialty but only 44% of the other two groups cited lack of state-required certification and lack of higher pay for certified CT technologists. And 69% of those with CT as their primary specialty but only 39% of the other two groups said they don't need certification to validate their skill. Among those who consider CT their secondary specialty, 17% don't plan to take the exam because their employer doesn't require certification, compared to 50% of the other two groups. And 29% of those who consider CT neither their primary nor secondary specialty, but 63% of the other two groups cited their employers' considering certification unnecessary.

Because of these significant differences responses were weighted to correct for sample/population differences in specialty level (primary vs. secondary vs. neither), yielding the estimated population percentages in the last two columns of the above table.

6. Other reasons given for not planning to take the CT certification exam

Reason not planning to take CT exam		Sample			Estimated Population Percentages[a]	
		4. Do you plan to take the ARRT certification exam in the future?		Total	4. Do you plan to take the ARRT certification exam in the future?	
	Statistic	No	Yes		No	Yes
Time	Count	6	4	10	3	2
	%	14.0	25.0		5.5	14.6
Secondary Sphere/Rarely do CT	Count	21	1	22		
	%	48.8	6.3		54.6	4.9
Inadequate Training/Inadequate Study Material Available	Count	0	4	4		
	%	.0	25.0		.0	26.9
Too Expensive	Count	2	0	2		
	%	4.7	.0		6.3	.0
Fear of Failing	Count	0	1	1		
	%	.0	6.3		.0	4.9
Already Certified/Enrolled to Take Exam	Count	0	3	3		
	%	.0	18.8		.0	22.0
Other	Count	14	3	17		
	%	32.6	18.8		33.6	26.9
Total	Count	43	16	59		

[a] Weighted to correct for over-representation among noncertified respondents in the sample of those who consider CT their primary specialty.

Note: Percentages and totals are based on respondents. Those responding “Yes” are included in this table because many respondents who said they plan to take the examination also responded with reasons for not taking the examination (perhaps to explain why they had not taken the exam to-date or as observations of other CT technologists’ reasons). For the verbatim responses underlying these codes, see Appendix B.

Preparation for Certification Exam and for First Performance of a Scan

4. If "Yes," what type(s) of CT-specific training prepared you to take the CT certification exam? [Check all that apply.]

CT-specific Training	Statistic	4. Do you hold the ARRT certificate in Computed Tomography?		Total
		No	Yes	
On-the-job training	Count	35	1156	1191
	%	87.5	94.8	
Clinical training as a student in a radiologic technology educational program	Count	17	274	291
	%	42.5	22.5	
Formal, didactic coursework within a radiologic technology educational program	Count	9	177	186
	%	22.5	14.5	
A fellowship in CT leading to eligibility for the CT certification exam	Count	3	54	57
	%	7.5	4.4	
On-site applications training provided by a CT equipment vendor	Count	18	518	536
	%	45.0	42.5	
On-site training provided by a co-worker who had received applications training	Count	18	374	392
	%	45.0	30.7	
Off-site applications training involving a	Count	5	280	285

multiple-day, formal curriculum	%	12.5	23.0	
Online continuing education materials	Count	6	226	232
	%	15.0	18.5	
Continuing education courses at conferences	Count	8	478	486
	%	20.0	39.2	
Published continuing education materials (e.g., Directed Readings, videos, CDs)	Count	10	699	709
	%	25.0	57.3	
Other (Please specify below.)	Count	2	242	244
	%	5.0	19.9	
Total	Count	40	1219	1259

Percentages and totals are based on respondents.

Of the 1,224 respondents who indicated that they hold the ARRT certificate in computed tomography, 1,219 checked one or more types of CT-specific training that prepared them to take the ARRT certification exam in CT. Of these 1,219 respondents, 95% mentioned on-the-job training; 57%, published continuing education materials; 42.5%, on-site applications training provided by a vendor; 31% applications training via a co-worker who had taken vendor-supplied applications training; 23%, off-site, multiple-day applications training; and 39%, continuing education courses at conferences. Only 22.5% cited clinical training and 14.5%, didactic coursework within a radiologic technology educational program.

These percentages did not differ substantially or statistically significantly as a function of whether the respondent considered CT a primary or secondary specialty (or neither).

4. Other Types of CT-specific training for certification exam (specified)

			4. Do you hold the ARRT certificate in Computed Tomography?		
			No	Yes	Total
Other	Books, Hardcopy Materials	Count	1	153	154
		% within q4	20.0	55.8	
	Classes, Seminars, Conferences, Vendor Training	Count	2	58	60
		% within q4	40.0	21.2	
	Radiologists/Colleagues	Count	0	15	15
		% within q4	.0	5.5	
	Self-study (Media Not Specified)	Count	0	16	16
		% within q4	.0	5.8	
	Software, Online Materials	Count	0	20	20
		% within q4	.0	7.3	
	Specified MTMI Program	Count	0	5	5
		% within q4	.0	1.8	
	Specified MIC Program	Count	0	13	13
		% within q4	.0	4.7	
	Other	Count	2	5	7
		% within q4	40.0	1.8	
Total		Count	5	274	279

Percentages and totals are based on respondents. For the verbatim responses underlying these codes, see Appendix B.

7. Whether or not you are certified in CT, please indicate the type(s) of training that prepared you for your first performance of an on-the-job CT scan. [Check all that apply to you.]

Type of training to prepare for first on-the-job CT scan	Responses		Percent of Cases
	N	Percent	
On-the-job training	1795	32.9	96.1
Clinical training as a student in radiologic technology educational program.	562	10.3	30.1
Formal, didactic coursework within a radiologic technology educational program.	234	4.3	12.5
A fellowship in CT leading to eligibility for the CT certification exam.	69	1.3	3.7
On-site applications training provided by a CT equipment vendor.	636	11.7	34.0
On-site training provided by a co-worker who had received applications training.	667	12.2	35.7
Off-site applications training involving a multiple-day, formal curriculum.	274	5.0	14.7
Online continuing education materials	211	3.9	11.3
Continuing education courses at conferences.	393	7.2	21.0
Published continuing education materials (e.g., Directed Readings, videos, CDs).	530	9.7	28.4
Other (Please specify below.)	77	1.4	4.1
Total	5448	100.0	291.6

Number of respondents reporting one or more types of preparation: 1,868.

None of the above percentages differ significantly among primary-specialty vs. secondary-specialty vs. neither-primary-nor-secondary respondents. However, 36% of uncertified respondents but only 26% of those holding the ARRT CT certificate reported having used “Clinical training as a student in a radiologic technology educational program” to prepare for their first on-the-job CT scan ($F_{1,1906} = 20.160$, $P < .001$) and 40% of noncertified but only 30% of CT-certified respondents report having used “On-site applications training provided by a CT equipment vendor” ($F_{1,1906} = 19.811$, $P < .001$). Weighting responses to correct for over-representation of CT-certified respondents yields estimates that 31% of the target population would cite clinical training within an educational program and 35% would cite on-site applications training as types of preparation for the initial on-the-job scan.

Of the 1,868 respondents who checked one or more types of training, 96% indicated that on-the-job training had been one of the ways in which they prepared for their first on-the-job CT scan. From 28% to 36% cited published continuing education materials; clinical training within an R.T. educational program; on-site, vendor-provided applications training; and on-site training by a co-worker who had received applications training. Only 12.5% cited didactic coursework; 11%, online CE materials; and 4%, a fellowship in CT.

7. Other types of training used to prepare for first on-the-job CT scan

Other Types of Training Used to Prepare First On-the-job CT Scan		Responses		Percent of Cases
		N	Percent	
	Books, Hardcopy Materials	29	28.2	28.4
	Classes, Seminars, Conferences, Vendor T	26	25.2	25.5
	Radiologists/Colleagues	23	22.3	22.5
	Self Study (Media Not Specified)	9	8.7	8.8
	Software, Online Materials	2	1.9	2.0
	Specified MIC Program	4	3.9	3.9
	Other	10	9.7	9.8
Total		103	100.0	101.0

For the verbatim responses underlying these codes, see Appendix B.

8. Do you believe that entry-level radiography programs should increase their emphasis on computed tomography (e.g., number of courses and/or hours within other courses devoted to CT)?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I strongly agree	430	22.4	23.0	23.0
	I agree	855	44.5	45.8	68.8
	I disagree	473	24.6	25.3	94.2
	I strongly disagree	109	5.7	5.8	100.0
	Total	1867	97.1	100.0	
Missing	System	56	2.9		
Total		1923	100.0		

Scoring 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree yields a mean level of agreement of 2.86 and a median of 2.89.

There was a small but statistically significant (.05 level) tendency for certified respondents to agree less (mean = 2.83) with the statement than do noncertified respondents (mean = 3.00), $F_{1,1861} = 4.235$, $P = .04$. Weighting responses to correct for over-representation of certified R.T.s yields an estimated population mean level of agreement of 2.87 and a median of 2.90. None of the estimated population percentages for specific levels of agreement differs from the observed sample percentages by more than 0.7%.

Professional Development

9. What sources of information do you use to keep up-to-date on advances in CT? [Check all that apply.]

Source of information to keep up-to-date in CT	Responses[a]		Percent of Cases	Estimated Population Percent[b]
	N	Percent		
Radiologists	1336	14.0	70.1	67.7
Other CT technologists	1274	13.3	66.8	68.4
Employer-provided workshops	350	3.7	18.4	16.5
Your department/facility manager	318	3.3	16.7	16.5
Vendor representatives	826	8.6	43.3	39.2
Workshops/courses at professional conferences	804	8.4	42.2	38.7
Continuing education materials	1481	15.5	77.7	72.7
Product demos at professional conferences	245	2.6	12.9	11.7
Product demos at a CT facility	218	2.3	11.4	9.4
Professional journals (e.g., *Radiologic Technology*), whether print or online	1221	12.8	64.1	60.3
Professional newsmagazines (e.g., *ASRT Scanner*, *Advance*), whether print or online	1088	11.4	57.1	53.1
General media (e.g., newspapers, news magazines), whether print or online	257	2.7	13.5	12.4
List servers for imaging professionals (If convenient, please list your favorites.)	92	1.0	4.8	4.3
Other (Please specify below.)	40	.4	2.1	1.6
Total	9550	100.0	501.0	472.5

[a]Total respondents citing one or more sources of information: 1,906.
[b]Weighting responses to correct for over-representation both of certified and of professionally involved CT technologists led to the estimated population percentages given in the last column of the table.

These percentages were statistically significantly affected by both credentialing and disciplinary involvement (though the interaction between those two factors was nonsignificant) as follows:

Differences between Certified, Noncertified Respondents

Source of information to keep up-to-date on advances in CT	4. Do you hold the ARRT certificate in Computed Tomography?	N	Proportion Citing This Source	Difference (t_{1906})	*P*
Radiologists	No	684	.6769	-1.509	.131
	Yes	1224	.7100		
Other CT technologists	No	684	.7105	3.115	.002
	Yes	1224	.6405		
Employer-provided workshops	No	684	.1652	-1.496	.135
	Yes	1224	.1928		
Your department/facility manager	No	684	.2120	4.037	< .001
	Yes	1224	.1405		
Vendor representatives	No	684	.3728	-3.941	< .001
	Yes	1224	.4657		
Workshops/courses at professional conferences	No	684	.3173	-6.900	< .001
	Yes	1224	.4779		
Continuing education	No	684	.6798	-7.564	< .001

materials	Yes	1224	.8284		
Product demos at professional conferences	No	684	.0906	-3.697	< .001
	Yes	1224	.1495		
Product demos at a CT facility	No	684	.0848	-2.885	.004
	Yes	1224	.1283		
Professional journals (e.g., *Radiologic Technology*), whether print or online	No	684	.5292	-7.522	< .001
	Yes	1224	.6993		
Professional newsmagazines (e.g., *ASRT Scanner, Advance*), whether print or online	No	684	.4649	-6.959	< .001
	Yes	1224	.6275		
General media (e.g., newspapers, newsmagazines), print or online	No	684	.1126	-2.117	.034
	Yes	1224	.1471		
List servers for imaging professionals.	No	684	.0249	-3.571	< .001
	Yes	1224	.0613		
Other (Please specify below.)	No	684	.0132	-1.681	.093
	Yes	1224	.0245		

Proportion Using Various Sources as a Function of CT as Specialty

CT as Specialty	N	Proportion Using this Source to Keep Up-to-date						
		Radiologists	Other CT technologists	Employer-provided workshops	Your department/ facility manager	Vendor representa-tives	Workshops/ courses at professional conferences	Continuing education materials
CT neither primary nor secondary specialty/disc.	143	.6434	.7902	.1189	.1329	.3497	.3566	.7063
CT secondary spec./disc. only	474	.6688	.6709	.1561	.1308	.3713	.4072	.7236
CT primary spec./disc. or sphere of employment	1290	.7171	.6512	.2008	.1837	.4643	.4318	.8016
Statistically significant differences ($P < .01$)		None	Neither > other two	Primary > other two	Primary > other two	Primary > other two	None	Primary > other two

CT as Specialty	N	Proportion Using this Source to Keep Up-to-date						
		Product demos at professional conferences	Product demos at a CT facility	Professional journals	Professional news-magazines	General media	List servers for imaging professionals	Other
CT neither primary nor second specialty	143	.0839	.0490	.6224	.4895	.1399	.0490	.0070
CT secondary specialty only	474	.1350	.0802	.6076	.5464	.1160	.0485	.0148
CT primary specialty or sphere of employment	1290	.1310	.1333	.6512	.5860	.1411	.0481	.0248
Statistically significant differences ($P < .01$)		None	Primary > other two	None	None	None	None	None

Weighting responses to correct for over-representation of CT technologists who were certified and claimed CT as their primary specialty leads to the estimate that 73% of the target population uses CE materials to keep up with advances in CT and 68% rely on radiologists and other CT technologists. Sixty percent use professional journals and 53%, professional newsmagazines. Fewer than 5% use list servers for imaging professionals. Among the respondents who indicated that they use list servers, 78 cited one or more favorite list servers. One-half (39) of these 78 mentioned AuntMinnie.com as at least one of their favorites and 18 (23%) mentioned CTisus.com.

9. If convenient, please list your favorites.

		Responses		Percent of Cases
		N	Percent	
	CTISUS	20	24.4	26.7
	Aunt Minnie	40	48.8	53.3
	ASRT	3	3.7	4.0
	Siemens	4	4.9	5.3
	ADVANCE	3	3.7	4.0
	Other	12	14.6	16.0
Total		82	100.0	109.3

Other sources of help staying up-to-date

9. Please specify:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Books, Hardcopy Materials	7	.4	17.5	17.5
	Seminars, Vendor Training	13	.7	32.5	50.0
	Software, Online Materials	11	.6	27.5	77.5
	Self Study/Work Experience	1	.1	2.5	80.0
	Other	8	.4	20.0	100.0
	Total	40	2.1	100.0	
Missing	System	1883	97.9		
Total		1923	100.0		

For the verbatim responses underlying these codes, see Appendix B.

10. In a typical biennium (two-year period), how many of your continuing education credits *relevant to CT* come from each of the following sources? How many CT-relevant credits would you *like* to receive biennially from each source?

		Directed Readings in ASRT journals		Online CE via ASRT/Sinclair Community College partnership		Other ASRT-provided continuing education (e.g., homestudies, videos)		Courses taken from/at an educational institution		On-site, employer-provided in-services	
Per biennium:		Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn
N	Valid	1923	1923	1923	1923	1923	1923	1923	1923	1923	1923
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		4.75	5.58	.29	1.05	1.16	1.80	1.85	1.39	1.53	2.62
Median[a]		.90	.76	.04	.13	.15	.23	.14	.14	.33	.39
Mode		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Std. Deviation		7.62	8.49	2.07	3.71	3.89	4.72	8.40	4.91	4.01	5.39
Percent zeroes		52.3	56.7	95.9	88.2	86.8	81.1	87.7	87.8	74.7	71.9
Maximum		100.00	100.00	48.00	36.00	45.00	24.00	150.00	90.00	50.00	24.00
Percentiles[a]	5	.05	.04	.03	.03	.03	.03	.03	.03	.03	.03
	95	23.45	23.70	.98	7.58	9.72	11.80	11.70	10.82	9.05	13.71

[a] Calculated from grouped data.

		On-site applications training provided by a vendor		Off-site applications training provided by a vendor		Courses and workshops at state, regional or national conferences		Online CE opportunities other than those provided by the ASRT/Sinclair partnership		Other (Please specify below.)	
Per biennium:		Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn
N	Valid	1923	1923	1923	1923	1923	1923	1923	1923	1923	1923
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		2.68	2.61	1.72	1.72	2.21	2.50	1.07	1.66	.74	.28
Median[a]		.48	.38	.16	.20	.27	.28	.14	.19	.10	.06
Mode		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Std. Deviation		5.52	5.48	5.47	4.85	5.28	5.74	3.72	4.71	4.25	2.23
Percent zeroes		67.3	72.1	86.0	83.6	78.8	78.0	87.9	83.8	95.3	97.9
Maximum		50.00	30.00	75.00	28.00	42.00	40.00	34.00	25.00	96.00	35.00
Percentiles[a]	5	.04	.04	.03	.03	.03	.03	.03	.03	.03	.03
	95	13.84	12.42	12.90	11.89	12.98	15.46	8.34	11.69	1.98	2.82

[a] Calculated from grouped data.

Neither number of CE-relevant credits earned nor number preferred was affected significantly by certification status. Both were, however, significantly affected by whether the respondent considered CT her or his primary or secondary specialty or neither, as follows:

		CT-relevant Credits Earned via Directed readings in ASRT journals		Online CE via ASRT/Sinclair Community College partnership		Other ASRT-provided continuing education (e.g., home studies, videos)		Courses taken from/at an educational institution	
Per biennium:	N	Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn
CT neither primary nor secondary specialty	143	2.8322	3.7552	.3147	1.2587	.9371	1.6224	1.1818	2.1958
CT secondary specialty only	474	3.5483	3.9198	.2595	.9346	1.0232	1.5359	1.6624	1.0928
CT primary specialty or sphere of employment	1290	5.4681	6.4427	.2969	1.0705	1.2550	1.9341	2.0233	1.4205
Statistically significant differences ($P < .01$)		Primary > other 2	Primary > other 2	None	None	None	None	None	None

Per biennium:	N	On-site, employer-provided in-services		On-site applications training provided by a vendor		Off-site applications training provided by a vendor		Courses and workshops at state, regional or national conferences	
		Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn
CT neither primary nor second. spec.	143	.8671	1.6643	2.5315	2.7972	1.2238	1.6014	1.6224	1.9371
CT secondary specialty only	474	1.0527	2.1034	1.9631	2.1129	1.1920	1.2468	1.7616	1.7806
CT primary specialty or sphere of employment	1290	1.7887	2.9546	2.9788	2.8016	1.9898	1.9178	2.4667	2.8450
Statistically significant differences (*P*< .01)		Primary > other 2	Primary > other 2	Primary > secdry	None	Primary > other 2	Primary > secdry	Primary > other 2	Primary > other 2

Per biennium:	N	Online CE opportunities other than those provided by the ASRT/Sinclair partnership		Other (Please specify below.)	
		Earned	Would like to earn	Earned	Would like to earn
CT neither primary nor secondary specialty	143	1.1958	1.4196	.7413	.4266
CT secondary specialty only	474	.8703	1.3101	.8776	.0844
CT primary specialty or sphere of employment	1290	1.1457	1.8267	.6876	.3349
Statistically significant differences (*P*< .01)		None	None	None	Primary > secondary

Weighting responses to correct for over-representation of technologists selecting CT as a primary specialty yields the following estimates of the descriptive statistics for the target population:

		Directed Readings in ASRT journals		Online CE via ASRT/Sinclair Community College partnership		Other ASRT-provided continuing education (e.g., home studies, videos)		Courses taken from/at an educational institution		On-site, employer-provided in-services	
Per biennium:		Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn
N	Valid	1923	1923	1923	1923	1923	1923	1923	1923	1923	1923
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		4.29	5.00	.28	1.03	1.11	1.71	1.75	1.36	1.35	2.41
Median[a]		.85	.70	.04	.13	.15	.22	.13	.14	.30	.37
Mode		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Std. Deviation		7.09	7.87	1.95	3.63	3.74	4.59	7.85	4.80	3.68	5.15
Percent zeroes		53.9	58.5	95.9	88.1	87.0	81.6	88.1	87.8	76.7	73.1
Maximum		100.00	100.00	48.00	36.00	45.00	24.00	150.00	90.00	50.00	24.00
Percentiles[a]	5	.05	.04	.03	.07	.06	.10	.02	.03	.03	.03
	95	22.87	23.27	.98	7.46	9.29	11.55	11.37	10.55	7.51	12.85

[a] Calculated from grouped data.

		On-site applications training provided by a vendor		Off-site applications training provided by a vendor		Courses and workshops at state, regional or national conferences		Online CE opportunities other than those provided by the ASRT/Sinclair partnership		Other (Please specify below.)	
Per biennium:		Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn	Earned	Would like to earn
N	Valid	1923	1923	1923	1923	1923	1923	1923	1923	1923	1923
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		2.47	2.49	1.54	1.58	2.04	2.27	1.02	1.55	.77	.24
Median[a]		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Mode		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Std. Deviation		5.28	5.31	5.33	4.59	4.98	5.38	3.64	4.58	4.72	2.07
Percent zeroes		69.4	72.7	87.2	84.2	79.2	787.5	88.3	84.5	95.4	98.2
Maximum		50.00	30.00	75.00	28.00	42.00	40.00	34.00	25.00	96.00	35.00
Percentiles[a]	5	.04	.04	.03	.03	.03	.03	.03	.03	.03	.03
	95	12.93	12.33	12.26	11.18	12.48	13.65	7.68	11.33	1.98	2.80

[a] Calculated from grouped data.

Excess of CT-relevant credits desired over CT-relevant credits earned per biennium

		Directed Readings in ASRT journals	Online CE via ASRT/ Sinclair Community College partnership	Other ASRT-provided CE (e.g., home studies, videos)	Courses taken from/at an educational institution	On-site, employer in-services	On-site applications training from vendor	Off-site applications training from vendor	Courses and workshops at conferences	Online CE opportunities other than ASRT/ Sinclair partnership	Other
N	Valid	1923	1923	1923	1923	1923	1923	1923	1923	1923	1923
	Missing	0	0	0	0	0	0	0	0	0	0
Mean		.82	.76	.63	-.47	1.10	-.06	.00		.5871	-.4535
Median[a]		.35	.10	.12	.01	.17	.02	.05	.0693	.0835	-.0476
Mode		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Std. Deviation		9.12	3.62	4.99	8.33	5.74	6.26	6.21	6.1432	4.7473	4.0025
Minimum		-35.00	-48.00	-45.00	-150.00	-50.00	-50.00	-75.00	-42.00	-34.00	-96.00
Percent negative		17.3	1.7	6.6	8.1	12.0	17.6	8.5	10.5	5.7	3.2
Percent zeroes		48.5	87.4	77.4	82.6	65.1	63.4	79.2	73.9	81.8	95.8
Percent positive		34.3	10.9	16.0	9.3	23.0	19.0	12.3	15.6	12.5	0.9
Maximum		96.00	24.00	24.00	24.00	24.00	24.00	28.00	24.00	25.00	24.00
Percentiles[a]	5	-20.27	-.92	-4.03	-7.81	-5.00	-10.87	-8.62	-10.45	-2.19	-1.92
	95	15.28	5.99	9.47	5.97	11.30	9.78	8.18	10.58	9.07	1.83

[a] Calculated from grouped data.

10. Other sources of CT-relevant CE credits mentioned by respondents

10. Please specify:

		Responses		Percent of Cases
		N	Percent	
	Specified Vendor Materials	22	13.1	13.2
	Specified GE Tips/GE related Materials	9	5.4	5.4
	Conferences/Seminars/ Workshops	29	17.3	17.4
	Specified Continuing Education Classes	22	13.1	13.2
	Hardcopy Reading Material	17	10.1	10.2
	Software, Online Material	7	4.2	4.2
	Specified CPR	8	4.8	4.8
	Do Not Need CE at this Time	25	14.9	15.0
	Other	29	17.3	17.4
Total		168	100.0	100.6

For the verbatim responses underlying these codes, see Appendix B.

11. How do you go about expanding your skill set in CT, i.e., developing skill in innovative or currently unfamiliar techniques and procedures?

	Responses		Percent of Cases
	N	Percent	
Books, Hardcopy Materials	450	21.1	31.4
Classes, Seminars, Conferences, Vendor Training	421	19.8	29.4
Radiologists/Fellow Colleagues	907	42.6	63.3
Self Study/Work Experience	134	6.4	9.5
Software, Online Materials	162	7.7	11.3
Not Enough Time/Resources	30	1.4	2.1
Other	26	1.2	1.8
Total	2129	100.0	148.6

For the verbatim responses underlying these codes, see Appendix B.

12. Please help us assess the value of developing a professional-practice benchmark to which to compare your skills in CT. Such a self-assessment tool would provide a "score" for each of several aspects of CT, such as:

General diagnostic CT.
CT simulation – therapy treatment planning.
Current CT technology (multislice scanners).
Postprocessing software and applications.
Radiation protection (ALARA) /protocol and dose.
CT/ PACS/ DICOM manipulation.
Patient safety.
Interventional.
Cardiovascular (CTA, EBCT).
Fusion modalities.
Anatomy, normal and abnormal.
Positioning.
Contrast procedures.

12a. How valuable would such a tool be in planning your professional development?

		Frequency	Percent	Valid Percent
Valid	Very valuable	995	51.7	55.9
	Somewhat valuable	646	33.6	36.3
	Not very valuable	110	5.7	6.2
	Of no value to me	29	1.5	1.6
	Total	1780	92.6	100.0
Missing	System	143	7.4	
Total		1923	100.0	

12 b. Including links to resources for enhancing your knowledge and skills in aspects of CT where you currently fall short of the benchmark would be:

		Frequency	Percent	Valid Percent
Valid	Very valuable	980	51.0	55.9
	Somewhat valuable	679	35.3	38.7
	Not very valuable	79	4.1	4.5
	Of no value to me	16	.8	.9
	Total	1754	91.2	100.0
Missing	System	169	8.8	
Total		1923	100.0	

12 c. Should benchmarks be adjusted for or listed separately for different levels of experience in CT?

		Frequency	Percent	Valid Percent
Valid	No	521	27.1	30.2
	Yes	1204	62.6	69.8
	Total	1725	89.7	100.0
Missing	System	198	10.3	
Total		1923	100.0	

Responses to these three questions were not affected statistically significantly (at the .01 level) by certification or by degree of professional involvement.

12d. Any other comments on the value/contents of a professional-practice benchmark?

		Frequency	Percent	Valid Percent
Valid	Benchmarking Not a Good Idea\Create More Problems	32	1.7	12.3
	Ambivalent Due to Complex Factors Involved	94	4.9	36.2
	Benchmarking Important/Good Idea	84	4.4	32.3
	Other	50	2.6	19.2
	Total	260	13.5	100.0
Missing	System	1663	86.5	
Total		1923	100.0	

For the verbatim responses underlying these codes, see Appendix B.

13. Are there areas of CT that have become so unique and specialized that they warrant special recognition through certification?

		Frequency	Percent	Valid Percent
Valid	No	1207	62.8	70.6
	Yes	502	26.1	29.4
	Total	1709	88.9	100.0
Missing	System	214	11.1	
Total		1923	100.0	

Responses to this question were not affected statistically significantly (at the .01 level) by certification or by degree of professional involvement.

13. If "Yes," what are the areas that should be certified separately?

Area	Proportion nominating area as warranting separate certification
3-D	.1734
Pet	.0788
Angiography	.1779
Vascular	.1622
Postprocessing	.1126
Pediatrics	.0225
Fusion	.0495
CT Angiography	.3356
Cardiac	.2568
Interventional	.0743
Other	.0991
Number nominating one or more areas	444

For the verbatim responses underlying these codes, see Appendix B.

Workplace Characteristics

14. Does your employer require that CT technologists be certified?

		Frequency	Percent	Valid Percent
Valid	No	1259	65.5	69.8
	Yes	544	28.3	30.2
	Total	1803	93.8	100.0
Missing	System	120	6.2	
Total		1923	100.0	

The percentage of “Yes” responses differed significantly as a function both of certification status and of CT specialty level (though not their interaction): 12.4% of technologists who consider CT neither their primary nor secondary specialty, 25.8% of those who consider it secondary only and 34% of those whose primary specialty is CT indicated that certification is required by their employers. And 12.6% of noncertified CT technologists but 39% of those who are certified indicated that their employers require certification.

Weighting to correct for over-representation of technologists certified in CT and declaring CT as their primary specialty yields an estimated population percentage of 24.4% whose employers require certification.

14. If "Yes," by what certifying body?

		Frequency	Percent	Valid Percent
Valid	ARRT	480	25.0	81.4
	State license	90	4.7	15.3
	Other	20	1.0	3.4
	Total	590	30.7	100.0
Missing	System	1333	69.3	
Total		1923	100.0	

Distribution across these three categories was not significantly affected by certification status or by professional involvement.

Other certifying bodies (specified):

		Frequency	Percent	Valid Percent
Valid	Not required	3	.2	4.1
	Encouraged by employer to be certified/ working to become certified	19	1.0	25.7
	ARRT only	4	.2	5.4
	State license only	4	.2	5.4
	ARRT and state license	17	.9	23.0
	Only some CT techs need to be certified	4	.2	5.4
	ACR	1	.1	1.4
	Radiography certification sufficient	12	.6	16.2
	Comment on desirability, politics of certification	6	.3	8.1
	Other response	4	.2	5.4
	Total	74	3.8	100.0
Missing	System	1849	96.2	
Total		1923	100.0	

For the verbatim responses underlying these codes, see Appendix B.

15. Does holding a CT certificate entitle CT technologists at your facility to higher pay?

		Frequency	Percent	Valid Percent
Valid	No	1106	57.5	62.0
	Yes	677	35.2	38.0
	Total	1783	92.7	100.0
Missing	System	140	7.3	
Total		1923	100.0	

The percentage of "Yes" responses differed significantly as a function both of certification status and of degree of stated involvement (though not their interaction). Of those who neither list CT as primary nor secondary specialty, 38.5% said yes, while, 44.4% of those with secondary CT specialty said yes and 35.6% of those whose primary specialty is CT indicated that certification yields increased pay at their facilities; $F_{2,1776} = 4.969$, $P = .007$. (Only the difference between secondary- and primary-specialty respondents is statistically significant at the .01 level.) And 29.8% of noncertified CT technologists but 42.6% of those who are certified indicate that their employers require certification; $F_{1,1777} = 28.758$, $P < .001$.

Weighting to correct for over-representation of certified and professionally-involved technologists yields an estimated population percentage of 38.7% for whom certification as a CT yields higher pay. Somewhat surprisingly, this percentage is significantly *higher* (52.7%) for respondents working at facilities that require CT certification than at those working at facilities with no such requirement, only 33.1% of whom reward certification with higher pay, $\chi^2_1 = 51.068$, $P < .001$.

16. Which of the following best describes your workplace?

		Frequency	Percent	Valid Percent
Valid	Hospital with fewer than 100 beds	361	18.8	20.4
	Hospital with 100-300 beds	537	27.9	30.3
	Hospital with more than 300 beds	433	22.5	24.4
	Corporate (e.g., vendor representative)	14	.7	.8
	Freestanding clinic	298	15.5	16.8
	Educational setting	30	1.6	1.7
	Mobile unit	9	.5	.5
	Veterinary facility	1	.1	.1
	Locum tenens	12	.6	.7
	Other (Please specify below)	78	4.1	4.4
	Total	1773	92.2	100.0
Missing	System	150	7.8	
Total		1923	100.0	

The only aspect of the distribution of facility types that was significantly affected by either certification status or professional involvement was the distribution of hospital size among respondents who work in hospitals, which was affected significantly as follows:

16. Which of the following best describes your workplace?		CT neither primary nor second. specialty/discipl	CT secondary specialty only	CT primary specialty or sphere of employment	Total
Hospital with fewer than 100 beds.	Count	59	156	143	358
	%	50.9	48.9	16.0	27.0
Hospital with 100-300 beds.	Count	41	113	383	537
	%	35.3	35.4	42.9	40.5
Hospital with more than 300 beds.	Count	16	50	366	432
	%	13.8	15.7	41.0	32.6
Total	Count	116	319	892	1327
	%	100.0	100.0	100.0	100.0

Overall $\chi^2_4 = 185.423$, $P < .001$.

Among respondents who work in hospitals, 16% of those who consider CT their primary specialty, as compared to 49% of those who do not, work in hospitals with fewer than 100 beds; $\chi^2_1 = 185.423$, $P < .001$. Similarly, 41% of R.T.s who consider CT their primary specialty but only 15% of those that consider it secondary or neither primary nor secondary work in hospitals with more than 300 beds. Weighting responses to correct for over-representation of technologists with CT as a primary specialty yields estimated target-population percentages of 26% employed in small hospitals; 29% in hospitals medium-sized hospitals and 20%, in large hospitals.

Other workplace description (specified)
See Separate Verbatim-Response Listings

		Frequency	Percent	Valid Percent
Valid	Outpatient Facility	25	1.3	17.6
	Imaging Center	12	.6	8.5
	Emergency/Trauma/Ambulatory	14	.7	9.9
	Private Facility	17	.9	12.0
	Other	74	3.8	52.1
	Total	142	7.4	100.0
Missing	System	1781	92.6	
Total		1923	100.0	

17. Which of the following services are provided by the CT facility where you work? [Please mark all that apply.]

Service provided by your facility	Responses		Percent of Cases	Estimated Population Percent[a]
	N	Percent		
General diagnostic CT	1817	15.1	94.5	94.6
Fusion	210	1.7	11.2	11.7
Image-guided surgery/interventional	1019	8.5	54.2	47.3
Trauma	1352	11.2	72.0	70.0
CT colonography/virtual colonoscopy	454	3.8	24.2	20.2
Orthopedic	1458	12.1	77.6	71.1
Postprocessing image manipulation	1469	12.2	78.2	70.9
Pediatric	1159	9.6	61.7	55.5
Cardiovascular (EBCT, CTA)	999	8.3	53.2	44.2
Neurologic	1039	8.6	55.3	50.4
CT simulation - therapy treatment planning	646	5.4	34.4	27.6
Research protocols	327	2.7	17.4	13.9
Other (Please specify below.)	87	.7	4.6	3.3
Total	12036	100.0	640.6	

[a] Weighted by ratio of population percent to sample percent in each credentials status/ disciplinary involvement combination so as to correct for under- and over-representation of the six categories in the sample.
1,879 (97.7%) of the respondents listed one or more services provided by their facilities.

Respondents who consider CT their primary specialty work at facilities that provide, on average, 6.4 CT-related services, while other respondents work at facilities that provide a mean of 5.4 services; $F_{1,1904} = 80.569$, $P < .001$, accounting for 97% of the differences among the three groups.

However, although CT specialty level and certification status did not interact significantly in their effects on any single service, there was a statistically significant interaction with respect to the distribution of services between basic services (general diagnostic, trauma, orthopedic, and pediatric) vs. complex services (fusion, postprocessing, cardiovascular, neurologic, and CT simulation), as displayed in the following table:

Basic vs. Complex Services as a Function of Certification and Disciplinary Involvement

CT Involvement	ARRT-Certified in CT?	N	Mean No. of Basic Services[a]	Mean No. of Complex Services[b]	No. of Basic minus No. of Complex Services
CT Primary Specialty	Yes	897	3.064	2.468	.595
	No	392	2.974	2.464	.510
CT Secondary Only	Yes	311	2.814	2.035	.778
	No	161	3.006	1.547	1.460
CT Neither Primary nor Secondary	Yes	15	2.467	1.867	.600
	No	128	2.992	1.609	1.383
$F_{2,1898}$ for main effect of specialty involvement			2.546, $P = .079$	40.391, $P < .001$	31.863, $P < .001$
$F_{1,1898}$ for main effect of certification status			3.361, $P = .072$	3.361, $P = .067$	13.572, $P < .001$

$F_{2, 1898}$ for certification x involvement interaction	4.744, $P = .009$	3.499, $P = .030$	15.753, $P < .001$
$F_{1, 1898}$ for (Certified or Primary) vs. Other 2 cells	2.540, $P = .111$	25.683, $P < .001$	49.392, $P < .001$
Percent of variation among 6 means accounted for by (Certified or Primary) vs. other 2 groups contrast	23.3	76.4	95.3

Because of the interaction between the two factors (CT specialty and certification status), responses were weighted by the ratio between population and sample percentages in each of the six categories to obtain the estimated target-population percentages indicating that their facility provides a given service. (See the last column of the table for question 17.)

Other services provided by facility (specified)
See Separate Verbatim-Response Listings

18. For which of the following services are the CT procedures you perform used? [Please check all that apply, and type in the most common use of your CT scans in the space below. (Online version)] [Please mark all that apply, but place an "X" beside the most common use of your CT scans. (Hardcopy version)]

The response format for this question was confusing, especially for those responding to the hardcopy version. Many respondents left the check-boxes blank but placed X's in several of the blank spaces beside the various uses. (These responses were treated as defining all of the services for which the respondent's scans were used, rather than the most common uses.) Others both checked and X'ed the same services – these were treated as defining all services to which respondent's scans contributed. Finally, many of both the hardcopy and online respondents X'ed or typed in more than one "most common" use, but fewer than the total number of services marked or checked. This pattern of responses was treated as indicating that the X'ed or typed-in services were tied for most common use; the single "vote" for most common response was therefore divided equally among these tied responses – but percentages were computed both with and without these multiple most-commons cases.

All Services to Which Respondent's CT Scans Contribute

Service for which Respondent's CT Scans Are Used	Responses		Percent of Respondents Whose Scans Contribute to the Service	Estimated Population Percent Contributing to Service
	N	Percent		
General diagnostic CT.	1762	16.6	95.5	95.3[a]
Trauma	1284	12.1	69.6	66.5[b]
Image-guided surgery/interventional.	864	8.2	46.8	41.4[a]
Orthopedic	1315	12.4	71.3	63.8[b]
CT colonography	364	3.4	19.7	17.3[a]
Pediatric	978	9.2	53.0	50.6[a]
Postprocessing image manipulation.	1212	11.4	65.7	59.0[b]
Neurologic	960	9.1	52.0	48.6[a]
Cardiovascular (EBCT, CTA).	857	8.1	46.4	41.7[a]
Research Protocols	296	2.8	16.0	13.6[a]
CT simulation - therapy treatment planning.	470	4.4	25.5	22.5[a]
PET/CT fusion imaging	155	1.5	8.4	8.1[a]

Other (Please specify below.)	69	.7	3.7	3.6[a]
Total	10586	100.0	573.8	

[a] Weighted to correct for over-representation of professionally involved technologists.
[b] Weighted to correct for over- and under-representation of the six certification X CT as specialty combinations.

	Sample Responses		
	Single Most Common Use Cited		Mean Most Common Use Score[a] (N = 1005)
	No. Citing	Percent	
General diagnostic	641	88.0	.7267
Trauma	29	4.0	.0613
Image-guided	2	.3	.0118
Orthopedic	3	.4	.0252
Colon	4	.5	.0189
Pediatric	7	1.0	.0128
Postprocessing	16	2.2	.0529
Neurologic	3	.4	.0229
Cardio	8	1.1	.0260
Research protocols	3	.4	.0235
CT simulation	2	.3	.0034
Fusion	1	.1	.0023
Other	9	1.2	.0122[a]
Total	728	100.0%	.9999

[a] Estimated population mean = .0138.

As with services provided by the respondent's facility, total number of CT services for which the respondent's scans are used was affected significantly only by the level of CT specialty: Respondents who consider CT their primary specialty provide scans that contribute, on average, to 6.7 CT-related services, while the other two groups work at facilities that provide a mean of 5.4 services; $F_{1,1837} = 77.722$, $P < .001$, accounting for 98% of the differences among the three groups. Weighting number of services for which scans are used to correct for over-representation of technologists with CT as their primary specialty yields an estimated target-population mean of 5.98 uses.

There were statistically significant differences ($P < .01$) among these three levels with respect to the percentage whose scans were used for nine of the 13 listed services (all but general diagnostic, trauma, fusion and "other"). As degree of specialty increased (from not involved in CT to primarily CT), every one of the services for which this factor was statistically significant showed the percentage of respondents whose scans were used for that service increasing as degree of CT specialty increased.

As for certification, the trend held only for CT-certified respondents for use in orthopedic CT and in postprocessing; for both of these services noncertified respondents were least likely to contribute to that service if they considered CT their secondary specialty; $F_{2,1831}$ for the interaction between credentialing and specialty involvement = 7.1249 and 4.679, $P = .001$ and .009, respectively. Finally, contribution to trauma CT also displayed a statistically significant interaction between these two factors, with likelihood of contributing to trauma CT decreasing slightly with CT involvement among noncertified CT technologists, but increasing greatly (from 28.6% of neither primary or secondary specialty identified to 69% of those who consider CT their primary specialty) among the certified; $F_{2,1831}$ for this interaction = 8.424, $P < .001$.

Considering these demographic effects, estimated population percentages were computed by weighting usage percentages for trauma, orthopedic and postprocessing to correct for over- and under-representation of the six certification X CT involvement combinations, while all other usage percentages were weighted to correct for over-representation of respondents who indicated CT as their primary specialty.

The majority of respondents cited general diagnostic CT as the most common use for CT scans in their facilities. Among those who cited a single "most common" use, 88% cited general diagnostic and no other single most common use was cited by more than 4% of the respondents. Adding in those who cited multiple most common uses (and distributing a single "vote" for most common equally among those named) yields a most-common-use score that approximates the proportion who would have nominated a given use as most common if they had been forced to choose a single use; general diagnostic has a mean score equivalent to being chosen by 73% of respondents; no other use has a mean above .062 (equivalent to being chosen by 6%).

Neither statistic was significantly affected by credentialing or specialty involvement except for the mean most-common-use score for "Other" use, which was significantly lower (.009) for those who consider CT their primary or secondary specialty than for those who do not (.071); $P = .001$ by Fisher's exact test. Correcting for the sample's over-representation of those with CT as primary and secondary specialty yields an estimated population mean most-common-use score of .0138.

18. Other services for which respondent's CT scans are used (specified)

		Responses		Percent of Cases
		N	Percent	
	CT Angio.	4	4.1	4.7
	3-D Imaging	2	2.1	2.3
	Heart	17	17.5	19.8
	Biopsy	11	11.3	12.8
	PET	1	1.0	1.2
	Urology	1	1.0	1.2
	DentaScan	5	5.2	5.8
	Trauma	5	5.2	5.8
	Oncology	9	9.3	10.5
	Other	42	43.3	48.8
Total		97	100.0	112.8

For the verbatim responses underlying these codes, see Appendix B.

Total Number of Services Provided

		Sample		Population Estimates	
		By your facility	By you/ based on your scans	By your facility	By you/ based on your scans
N	Valid	1923	1923	1923	1923
	Missing	0	0	0	0
Mean		6.1862	5.2933	5.9068	5.0356
Median[a]		6.4324	5.4534	6.0000	5.0000
Mode		8.00	8.00	5.00	5.00
Std. Deviation		2.90155	3.09833	2.84155	3.01574

Percent zeroes		8.4	8.4	3.6	8.1
Maximum		13	13	13	13
Percentiles[a]	5	.733	.109	.726	.123
	95	10.6668	10.3008	10.4351	10.0057
$F_{2,1898}$ for professional involvement		33.793***	31.730***	---	---

[a] Calculated from grouped data.

The higher level of CT specialty (primary) the respondent indicated, the higher (on average) was the number of services provided by his or her facility and the number of services to which her or his CT scans contributed. Population estimates were thus obtained by weighting responses to this question so as to correct for the sample's over-representation of respondents who consider CT their primary sphere of employment.

19. How many CT scans are performed at your facility daily?

Number of CT scans/day		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	6	.3	.3	.3
	.25 - 5	93	4.8	5.1	5.5
	6 - 10	191	9.9	10.6	16.1
	11 - 15	173	9.0	9.5	25.6
	16 - 20	157	8.2	8.7	34.3
	21 - 30	270	14.0	15.0	49.3
	31 - 40	189	9.8	10.5	59.7
	41 - 50	179	9.3	10.0	69.7
	51 - 75	225	11.7	12.5	82.1
	76 - 100	197	10.2	10.9	93.0
	101 - 200	104	5.4	5.8	98.8
	212.00	1	.1	.1	98.8
	225.00	3	.2	.2	99.0
	250.00	4	.2	.2	99.2
	300.00	4	.2	.2	99.4
	400.00	3	.2	.2	99.6
	450.00	1	.1	.1	99.7
	500.00	1	.1	.1	99.7
	501.00	1	.1	.1	99.8
	800.00	1	.1	.1	99.8
	201 - 1000	20	1.0	1.1	99.9
	9500.00	1	.1	.1	99.9
	30000.00	1	.1	.1	100.0
	Total	1806	93.9	100.0	
Missing	System	117	6.1		
Total		1923	100.0		

The reports of 9,500 and 30,000 CT scans per day seem improbable and may have resulted from misreading of the question. The summary statistics for number of CT scans per day are therefore reported both with and without those two extreme responses.

Statistic		19. How many CT scans are performed at your facility daily?		
		Outliers Included	Outliers Excluded	Population Estimates (Outliers Excluded)
N	Valid	1806	1804	47,278
	Missing	117	119	0
Mean		69.63	47.81	42.42
Median[a]		32.93	32.79	29.32
Mode[b]		30.00	30.00	30.00
Std. Deviation		741.03	55.54	51.53
Percent zeroes		0.3%	0.3%	0.3%
Maximum		30000.00	1000.00	1000.00
Percentiles	5	5.2189	5.2151	4.20
	95	131.00	129.4286	120.44

[a] Calculated from grouped data.
[b] Multi-modal; the numerically smallest mode is indicated.

With the outliers excluded, mean number of CT scans performed daily increases monotonically with level of CT involvement as follows:

19. How many CT scans are performed at your facility daily?

Involvement in CT	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum
				Lower Bound	Upper Bound		
CT neither primary nor secondary specialty	132	26.7045	21.982	22.9196	30.4895	2.00	125.00
CT second. spec. only	448	32.8890	43.644	28.8365	36.9414	.00	500.00
CT primary spec. or sphere of employment	1220	55.6711	60.144	52.2929	59.0494	.00	1000.00
Total	1800	47.8767	55.584	45.3071	50.4462	.00	1000.00

Overall $F_{2,1797} = 39.476$, $P < .001$. Primary-specialty mean is significantly higher than the other two means ($F_{1,1797} = 135.443$, $P < .001$, accounting for 96% of the variation among the 3 means), which do not differ significantly from each other at the .01 level.

Weighting responses to correct for over-representation of professionally involved technologists yields the estimated target-population statistics given in the last column of the table before last.

20. Is the location of your facility primarily:

		Frequency	Percent	Valid Percent	Cumulative Percent	Estimated Population Percent
Valid	Rural	455	23.7	25.1	25.1	30.8
	Suburban	717	37.3	39.6	64.8	38.0
	Urban	638	33.2	35.2	100.0	31.2
	Total	1810	94.1	100.0		100.0
Missing	System	113	5.9			
Total		1923	100.0			

Respondents who consider computed tomography their primary specialty are much less likely (17%) to be working at a rural facility than are the other two groups (42%), $\chi^2_1 = 132.35$, $P < .001$.

CT Specialty as:		20. Is the location of your facility primarily: Rural	Suburban	Urban	Total
CT neither primary nor secondary specialty/discipline	Count	64	36	34	134
	%	47.8	26.9	25.4	100.0
CT secondary specialty only	Count	182	167	102	451
	%	40.4	37.0	22.6	100.0
CT primary specialty or sphere of employment	Count	207	513	500	1220
	%	17.0	42.0	41.0	100.0
Total	Count	453	716	636	1805
	%	25.1	39.7	35.2	100.0

Weighting responses so as to correct for over-representation of CT-primary technologists in our sample yields the estimated target-population percentages given in the last column of the table before last.

21. Which of the following titles best describes your current job position?

	Broad Category	Job Title/Description	Frequency	Percent	Valid Percent
Valid	Staff Technologist/ Therapist	Staff Technologist/Therapist	1172	60.9	65.0
	Educator	Clinical Instructor	14	.7	.8
		Didactic Instructor	6	.3	.3
		Clinical Coordinator	5	.3	.3
		Program Director	3	.2	.2
		Senior/Lead Technologist/Therapist	291	15.1	16.1
	Chief/ Asst Chief Technologist/ Therapist	Assistant Chief Technologist/Therapist	15	.8	.8
		Chief Technologist/Therapist	61	3.2	3.4
	Supervisor/ Manager/ Administrator	Supervisor/Manager	142	7.4	7.9
		Administrator	14	.7	.8
	Other	Corporate Representative	6	.3	.3
		Other (Please specify below.)	73	3.8	4.1
		Total	1802	93.7	100.0
Missing		System	121	6.3	
Total			1923	100.0	

For further analyses, related low-frequency job titles were combined to yield six categories of job titles/descriptions. The percentages of respondents fitting into these categories differed significantly as a function both of certification status and of CT involvement, but not their interaction.

Job Title/Description		4. Do you hold the ARRT certificate in Computed Tomography? No	Yes	Total	$F_{1,1797}$ for difference between certified, noncertified
Staff Technologist, Therapist	Count	488	681	1169	50.744 (P < .001)
	%	75.5	59.1	65.0	
Educator	Count	6	22	28	2.592 (P = .108)
	%	.9	1.9	1.6	
Senior, Lead Tech, Therapist	Count	68	223	291	24.015 (P < .001)
	%	10.5	19.3	16.2	
Chief or Asst Chief Tech, Therapist	Count	18	58	76	5.162 (P = .023)
	%	2.8	5.0	4.2	
Supervisor, Manager, Administrator	Count	40	116	156	7.850 (P = .005)
	%	6.2	10.1	8.7	
Other	Count	26	53	79	.322 (P = .570)
	%	4.0	4.6	4.4	
Total	Count	646	1153	1799	
	%	100.0	100.0	100.0	

Weighting observations to correct for over-representation of R.T.s who were certified in C.T. and who indicated CT as their primary specialty yields the estimated population percentages given in the following table:

Job Description/Title	
Staff Technologist/Therapist	65.8
Educator	1.6
Senior/Lead Technologist/Therapist	13.2
Chief or Asst Chief Technologist/Therapist	4.3
Supervisor/Manager/Administrator	10.1
Other	5.0
Total	100.0

Title, 6 categories. Disciplinary involvement in CT Cross-tabulation

		CT Specialty as: CT neither primary nor second. spec./ disciple.	CT secondary specialty only	CT primary specialty or sphere of employment	Total	F for differences among levels of CT specialty
Staff Technologist, Therapist	Count	85	265	819	1169	5.205 (P = .006)
	%	64.4	58.9	67.4	65.0	
Educator	Count	3	10	15	28	1.285 (P = .227)
	%	2.3	2.2	1.2	1.6	
Senior, Lead Tech, Therapist	Count	8	54	229	291	11.152 (P < .001)
	%	6.1	12.0	18.8	16.2	

Chief or Asst Chief Tech, Therapist	Count	9	21	46	76	1.498 (*P* = .224)
	%	6.8	4.7	3.8	4.2	
Supervisor, Manager, Administrator	Count	19	70	67	156	24.464 (*P* = .006)
	%	14.4	15.6	5.5	8.7	
Other	Count	8	30	40	78	5.042 (*P* = .007)
	%	6.1	6.7	3.3	4.3	
Total	Count	132	450	1216	1798	
	%	100	100	100	100	

21. Other job titles (specified)

		Responses		Percent of Cases
		N	Percent	
	Staff Technologist/Therapist	41	18.1	26.5
	Clinical Instructor	9	4.0	5.8
	Senior/Lead Technologist/Therapist	15	6.6	9.7
	Didactic Instructor	2	.9	1.3
	Clinical Coordinator	3	1.3	1.9
	Chief Technologist/Therapist	2	.9	1.3
	Program Director	3	1.3	1.9
	Supervisor/Manager	17	7.5	11.0
	Corporate Representative	1	.4	.6
	Administrator	6	2.7	3.9
	Other (Please specify below.)	16	7.1	10.3
	Traveling, temp, contract, float	17	7.5	11.0
	Weekend/nights	5	2.2	3.2
	CT specialist	38	16.8	24.5
	PACS	5	2.2	3.2
	Other specialty(ies)	46	20.4	29.7
Total		226	100.0	145.8

For the verbatim responses underlying these codes, see Appendix B.

			4. Do you hold the ARRT certificate in Computed Tomography?		
			No	Yes	Total
	Staff Technologist/Therapist	Count	24	17	41
		% within q4	39.3	18.3	
	Clinical Instructor	Count	3	5	8
		% within q4	4.9	5.4	
	Senior/Lead Technologist/Therapist	Count	3	11	14
		% within q4	4.9	11.8	
	Didactic Instructor	Count	0	2	2
		% within q4	.0	2.2	
	Clinical Coordinator	Count	0	3	3
		% within q4	.0	3.2	
	Chief Technologist/Therapist	Count	0	2	2
		% within q4	.0	2.2	
	Program Director	Count	0	3	3
		% within q4	.0	3.2	
	Supervisor/Manager	Count	6	11	17
		% within q4	9.8	11.8	
	Corporate Representative	Count	0	1	1
		% within q4	.0	1.1	
	Administrator	Count	1	5	6
		% within q4	1.6	5.4	
	Other (Please specify below.)	Count	4	12	16
		% within q4	6.6	12.9	
	Traveling, temp, contract, float	Count	7	10	17
		% within q4	11.5	10.8	
	Weekend/nights	Count	4	1	5
		% within q4	6.6	1.1	
	CT specialist	Count	20	18	38
		% within q4	32.8	19.4	
	PACS	Count	0	5	5
		% within q4	.0	5.4	
	Other specialty(ies)	Count	17	29	46
		% within q4	27.9	31.2	
Total		Count	61	93	154

Percentages and totals are based on respondents.

DIFFERENCES AMONG TYPES AND LOCATIONS OF FACILITIES

Degree of Involvement in Computed Tomography

Years of Experience Conducting CT Scans

1. If "Yes," for how many years (not necessarily consecutive)?

	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum
				Lower Bound	Upper Bound		
Rural	428	8.5424	6.45706	7.9290	9.1559	.50	60.00
Suburban	673	10.8678	7.28616	10.3163	11.4192	1.00	30.00
Urban	609	10.9236	7.39162	10.3354	11.5119	.50	30.00
Total	1710	10.3056	7.19506	9.9644	10.6469	.50	60.00

Note: Responses weighted to correct for over-representation of professionally involved technologists (those who consider CT their primary specialty/sphere of employment).

Facilities located in rural areas are staffed by less-experienced CT technologists (mean = 8.5 years performing CT scans) than are suburban and urban facilities (10.9 years), $F_{1,1707} = 11.256$, $P = .001$, accounting for 99.8% of the variation among the three means.

1. If "Yes," for how many years (not necessarily consecutive)?

	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Minimum	Maximum
				Lower Bound	Upper Bound		
Hospital, < 100 beds	344	8.5363	6.46572	7.8507	9.2220	.50	60.00
Hospital, 100-300 beds	506	10.4071	7.18195	9.7798	11.0344	1.00	30.00
Hospital, > 300 beds	410	10.4146	7.38258	9.6979	11.1314	1.00	30.00
Freestanding clinic	292	12.0822	7.39649	11.2303	12.9341	1.00	30.00
Educational setting	27	10.5800	7.36716	7.6656	13.4944	.66	23.00
Other	104	10.1683	6.81966	8.8420	11.4945	.50	26.00
Total	1683	10.3052	7.18421	9.9617	10.6487	.50	60.00

Note: Responses weighted to correct for over-representation of professionally involved technologists (those who consider CT their primary specialty/sphere of employment).

Hospitals with fewer than 100 beds have less experienced CT-technologist staff (mean = 8.5 years) than do larger hospitals (10.4 years), $F_{1,1677} = 17.322$, $P < .001$; and freestanding clinics have more-experienced CT technologists (12.1 years) than do hospitals (9.9 years), $F_{1,1677} = 24.602$, $P < .001$.

Years of Experience Supervising CT Scans

Did not differ statistically significantly among facility types or among locations.

CT as Primary or Secondary Specialty

Type of facility X Disciplinary involvement in CT Cross-tabulation

Type of facility	Statistic	Disciplinary involvement in CT			Total
		CT neither primary nor secondary specialty/disc.	CT secondary specialty only	CT primary specialty or sphere of employment	
Hospital, < 100 beds	Count	80	163	135	378
	%	21.2	43.1	35.7	100.0
Hospital, 100-300 beds	Count	55	112	380	547
	%	10.1	20.5	69.5	100.0
Hospital, > 300 beds	Count	22	46	358	426
	%	5.2	10.8	84.0	100.0
Freestanding clinic	Count	21	78	177	276
	%	7.6	28.3	64.1	100.0
Educational setting	Count	1	8	20	29
	%	3.4	27.6	69.0	100.0
Other	Count	3	30	80	113
	%	2.7	26.5	70.8	100.0
Total	Count	182	437	1150	1769
	%	10.3	24.7	65.0	100.0

Note: Responses weighted to correct for over-representation of CT-certified technologists.

The percentage of CT technologists who consider CT their primary specialty increases monotonically and the percentage for whom CT is neither primary nor secondary decreases monotonically as size of hospital increases ($F_{1,1702}$ = 11.495, P < .001 and 3.857, P = .002, respectively). Freestanding clinics and facilities in educational settings are similar to the overall average in these respects.

20. Is the location of your facility primarily: Disciplinary involvement in CT Cross-tabulation

Facility location		Disciplinary involvement in CT			Total
		CT neither primary nor secondary specialty/disc.	CT secondary specialty only	CT primary specialty or sphere of employment	
Rural	Count	86	189	199	474
	%	18.1	39.9	42.0	100.0
Suburban	Count	48	163	497	708
	%	6.8	23.0	70.2	100.0
Urban	Count	46	97	482	625
	%	7.4	15.5	77.1	100.0
Total	Count	180	449	1178	1807
	%	10.0	24.8	65.2	100.0

Note: Responses weighted to correct for over-representation of CT-certified technologists.

The percentage of respondents who consider CT their primary specialty or sphere of employment is higher in suburban and urban facilities (74%) than in rural facilities (42%), $\chi^2_1 = 154.196$, $P < .001$; and the percentage of respondents who consider it only their secondary facility is higher in rural facilities (40%) than in suburban or urban facilities, $\chi^2_1 = 24.738$, $P < .001$.

Certification Status

Current Certification Status

4. Do you hold the ARRT certificate in Computed Tomography?

	N	Proportion CT-certified	95% Confidence Interval for Mean	
			Lower Bound	Upper Bound
Hospital, < 100 beds	462	.5058	.4601	.5516
Hospital, 100-300 beds	514	.5838	.5410	.6266
Hospital, > 300 beds	356	.6493	.5995	.6990
Freestanding clinic	306	.7388	.6892	.7883
Educational setting	29	.6331	.4479	.8182
Other	106	.6224	.5284	.7163
Total	1773	.6065	.5837	.6292

Note: Responses weighted to correct for over-representation of professionally involved technologists (those who consider CT their primary specialty/sphere of employment).

The percentage of CT technologists who hold the ARRT certificate in CT increases monotonically as size of hospital increases ($F_{1,1776} = 26.863$, $P < .001$) and is significantly higher (74%) in freestanding clinics than in hospitals (57%). Facilities in educational settings are similar to the overall average percent certified.

Certification was not affected statistically significantly by rural/suburban/urban location of facility, nor by the interaction between that factor and type of facility.

Percent of Noncertified CT Technologists Planning to Take CT Certification Exam in Future

This percentage was not affected statistically significantly by either facility type or facility location (or their interaction).

Percent Who Have Taken Certification Exam Unsuccessfully

This percentage was not affected statistically significantly by either facility type or facility location (or their interaction).

Reasons for Not Planning to Take Certification Exam in Future

There were too few respondents from educational and “other” facilities who neither hold CT certification nor plan to take the CT exam for meaningful comparisons with other types of facilities. Respondents who work in hospitals with more than 300 beds were similarly sparse. Restricting attention to hospitals and freestanding clinics and combining the 101-300 and > 300-bed categories, offered no reasons that differed significantly as a function of type or location of facility.

Types of Training

Training in Preparation for Certification Exam

There were so few respondents from educational facilities who hold CT certification that further subdividing them by rural/suburban/urban location resulted in cell sizes too small (3 to 7) for meaningful comparisons. Therefore, educational facilities combined with the "other" category for purposes of examining the joint effects of facility type and facility location. Two of the sources of training (online continuing education materials and continuing education courses at conferences) differed significantly across facility types ($F_{4,1079} = 5.975$, $P < .001$ and 3.774, $P = .005$, respectively), but the direction and magnitude of these facility-type differences differed significantly as a function of the facility's location ($F_{8,1079} = 6.349$, $P < .001$ and 6.810, $P < .001$, respectively).Two other sources of training (on-site applications training provided by an equipment vendor and off-site applications training involving a formal, multiple-day curriculum) showed no statistically significant main effect of facility type or location but displayed statistically significant interactions between those two factors ($F_{8,1079} = 3.614$, $P < .001$ and 3.242, $P < .001$, respectively). These effects are displayed in the following table:

Proportion of CT-Certified Respondents Citing Various Sources of Preparation for Certification Exam X Type and Location of Facility

20. Is the location of your facility primarily:	Type of facility, 5 categories	On-site applications training provided by a CT equipment vendor	Off-site applications training involving a multiple-day, formal curriculum	Online continuing education materials	Continuing education courses at conferences
Rural	Hospital, < 100 beds (N = 228)	.3781	.1969	.0537	.3164
	Hospital, 100-300 beds (N = 66)	.5922	.4594	.1126	.6186
	Hospital, > 300 beds (N = 14)	.2482	.1489	.0496	.0993
	Freestanding clinic (N = 21)	.5319	.3235	.2255	.4681
	Educational setting & other facility types (N = 11)	.6082	.1798	.3041	.5482
Suburban	Hospital, < 100 beds (N = 38)	.4058	.2523	.3153	.4236
	Hospital, 100-300 beds (N = 138)	.5234	.3302	.1608	.4947
	Hospital, > 300 beds (N = 60)	.3834	.1290	.2141	.4050
	Freestanding clinic (N = 115)	.3057	.2229	.1356	.3674
	Educational setting & other types (N = 27)	.3663	.1395	.2422	.2790
Urban	Hospital, < 100 beds (N = 14)	.4007	.2482	.0496	.2748
	Hospital, 100-300 beds (N = 111)	.4289	.1121	.0723	.2280
	Hospital, > 300 beds (N = 145)	.3473	.1712	.1573	.3263
	Freestanding clinic (N = 76)	.6525	.2101	.4294	.6484

	Educational setting & other facility types (N = 31)	.3640	.2097	.3188	.3640
Facility Type Main Effect	Hospital, < 100 beds (N = 279)	.3829	.2068	.0888	.3289
	Hospital, 100-300 beds (N = 316)	.5046	.2806	.1195	.4268
	Hospital, > 300 beds (N = 219)	.3511	.1582	.1662	.3339
	Freestanding clinic (N = 212)	.4521	.2283	.2496	.4779
	Educational setting & other facility types (N = 69)	.4048	.1776	.2866	.3611
Overall mean, averaging across facility type and facility location (N = 1094)		.4265	.2207	.1567	.3891

The percentage of hospital-based respondents who mentioned using online CE materials to prepare for the certification exam was lower (12%) than the corresponding percentage for those working elsewhere (26%), $F_{1,1079} = 18.29$, $P < .001$. However, this difference was much greater in urban (12% vs. 40%) and rural (7% vs. 25%) locations than in suburban locations (20% vs. 17%), interaction $F_{1,1079} = 18.661$, $P < .001$.

The percentage of respondents who used CE courses at conferences to prepare for the certification exam was greater at mid-sized hospitals (43%) than at either small or large hospitals (33%), $F_{1,1079} = 9.492$, $P < .001$; and in freestanding clinics (48%) than in hospitals (37%), $F_{1,1079} = 8.276$, $P = .004$.

However, the difference between mid-sized and extreme-sized hospitals was much greater in rural and suburban areas (56% mid-sized vs. 36% small or large) than in urban locations (23% vs. 32%), $F_{1,1079} = 10.601$, $P < .001$; and greater in rural (62% vs. 30%) than in suburban (49.5% vs. 41%) locations, $F_{1,1079} = 9.194$, $P = .002$. Further, the tendency for this percentage to be greater in freestanding clinics than in hospitals was only true of rural and urban locations (37% vs. 47% and 28% vs. 43%, respectively), while in suburban locations it was lower for freestanding clinics (37%) than in hospitals (46%), $F_{1,1079} = 13.035$, $P < .001$.

Reliance on on-site applications training provided by equipment vendors was higher in free-standing clinics than in hospitals in urban locations (65% vs. 40%), and rural (53% vs. 42%) locations but lower for suburban locations (31% vs. 47%), $F_{1,1079} = 7.084$, $P = .008$ for the difference between suburban and other locations.

Finally, reliance on off-site applications training was greater in mid-sized hospitals than in small or large hospitals in rural (46% vs. 18%) and suburban (33% vs. 18%) locations, but the opposite was true (11% vs. 18%) in urban locations, $F_{1,1079} = 13.652$, $P < .001$.

Training to Prepare for First On-the-Job CT Scan

While no single source of preparation for the first on-the-job CT scan differed significantly in frequency of use as a function of facility type, the difference between use of clinical and didactic courses and on-the-job training vs. use of off-site applications training, courses at conferences and published CE materials differed, $F_{5,1735} = 5.214$, $P < .001$. In particular, respondents who work at hospitals rated average in this respect, while respondents in freestanding clinics showed a significantly lower reliance on clinical, didactic and on-the job training relative to use of off-site applications training and courses, as well as published CE materials (mean difference = 0.5 sources, $F_{1,1735} = 22.487$, $P < .001$). Educational and other types of facilities showed a

significantly higher differential between the two types of sources (mean difference = 1.0 sources, $F_{1,1735} = 17.817$, $P < .001$).

There also was a statistically significant interaction between these two factors with respect to percentage of respondents using on-site applications training provided by a vendor: in rural and urban facilities this percentage was higher in freestanding clinics than in hospitals (43% vs. 36% in rural areas, 53% vs. 37 % in urban locations), while the opposite (30% vs. 39%) was true in suburban locations, $F_{1,1735} = 8.483$, $P = .004$.

Belief That CT Should Be Given More Emphasis in Primary Programs

Respondents who work in small hospitals agree more strongly (mean of 3.00 on a scale where 1 = disagree strongly and 4 = agree strongly) and respondents in medium-size hospitals, less strongly (mean = 2.74) than do respondents working in other types of facilities that there should be more emphasis on computed tomography in entry-level radiography programs, $F_{1,1710} = 13.712$ and 4466.249, respectively, $P < .001$ in each case.

Professional Development

Sources of information Used to Keep Up-to-date on Advances in CT

Of the 14 listed sources of information (including "Other"), only four (employer-provided workshops, your department/facility manager, workshops/courses at professional conferences, and product demos at a CT facility) were cited by significantly different percentages of respondents who work at different types of facilities, as follows:

Type of Facility	N	Proportion Who Obtain Information to Keep Up-to-date on Developments in CT from …			
		Employer-provided workshops	Your department/ facility manager	Workshops/ courses at professional conferences	Product demos at a CT facility
Hospital, < 100 beds	482	0.0918	0.1400	0.2941	0.0532
Hospital, 100-300 beds	513	0.1718	0.1445	0.4230	0.0966
Hospital, > 300 beds	340	0.2760	0.2870	0.4174	0.1599
Freestanding clinic	274	0.1495	0.1201	0.4969	0.0729
Educational setting	28	0.2790	0.2480	0.4214	0.1311
Other	104	0.1202	0.1593	0.4813	0.0940
Total	1741	0.1651	0.1698	0.4012	0.0936
$F_{1,1735}$ for large vs. small hospitals		49.196 ($P < .001$)	30.481 ($P < .001$)	12.397 ($P < .001$)	26.471 ($P < .001$)
$F_{1,1735}$ for freestanding clinics vs. overall mean		1.869 ($P = .172$)	7.086 ($P = .008$)	5.736 ($P = .021$	2.353 ($P = .125$)
$F_{1,1735}$ for educational setting vs. overall mean		2.766 ($P = .097$)	1.190 ($P = .276$)	.000 ($P = .991$)	.413 ($P = .592$)

All four sources of information were cited by a significantly higher proportion of respondents working in large hospitals than those in small hospitals. Respondents working in educational settings cited employer-provided workshops and their department/facility manager at a rate substantially above the overall average – but not significantly so due to the group's small sample size. Respondents in freestanding clinics cited their department/facility manager significantly less often and workshops/courses at professional conferences significantly less often than did those working in other facility types.

The frequency with which the department/facility manager was cited also was significantly affected by the interaction between facility type and location, $F_{10,1735} = 2.705$, $P = .008$. However, this interaction was due primarily to the fact that in rural locations respondents who work in facilities other than hospitals, freestanding clinics and educational settings are far more likely (more than 50%) to rely on their department/facility manager to keep them up-to-date than are respondents in general (16%), while in urban and suburban settings respondents in "Other" facilities cite their department/facility manager at about the overall average rate. Since the "Other" category may consist of substantially different types of facilities in rural as opposed to suburban and urban settings, it is difficult to know how to interpret this interaction.

How Respondent Expands Skill Set

The approaches respondents took to expanding their skill sets did not differ significantly as a function of either facility type or its rural/suburban/urban location.

Perceived Utility of CT Benchmarking Tool

Responses to questions concerning benchmarking were not significantly affected by facility type or designated location. Nor did these two factors affect the percentage of respondents who commented on the value/contents of a professional-practice benchmark.

Areas of CT Warranting Separate Certification

The percentage of respondents who believed some areas of CT warrant separate certification did not differ significantly among facility types or rural/suburban/urban locations. Nor did these two factors significantly affect the percentage of respondents nominating particular areas as warranting separate certification.

CT Technologists Required to be Certified?

The percentage of respondents whose facilities require that CT technologists be certified was significantly different for different types of facilities but did not differ significantly as a function of rural, suburban or urban location.

Type of facility, 6 categories. 14. Does your employer require that CT technologists be certified?

			14. Does your employer require that CT technologists be certified?		Total
			No	Yes	
Type of facility, 6 categories	Hospital, < 100 beds	Count	414	68	482
		%	85.9	14.1	100.0
	Hospital, 100-300 beds	Count	425	86	511
		%	83.2	16.8	100.0
	Hospital, > 300 beds	Count	228	111	339
		%	67.3	32.7	100.0
	Freestanding clinic	Count	160	114	274
		%	58.4	41.6	100.0
	Educational setting	Count	23	4	27
		%	85.2	14.8	100.0
	Other	Count	72	30	102

		%	70.6	29.4	100.0
Total		Count	1322	413	1735
		%	76.2	23.8	100.0

Hospitals with 300 or fewer beds and facilities in educational settings were much less likely (15.5%) to require certification than were large hospitals and freestanding clinics (37%), $\chi^2_1 = 95.985$, $P < .001$.

Among those who reported which certifying body provided the certification, the balance between ARRT and state licensure was not significantly different among facility types or locations.

Does CT Certification Qualify Technologist for Higher Pay?

The percentage of respondents reporting that CT certification yields higher pay for CT technologists at their facilities was not significantly affected by facility type or location if the facility requires certification, but differed significantly among facility types for those that do not require certification:

14. Does your employer require that CT technologists be certified?	Type of Facility	Statistic	No	Yes	Total
No	Hospital, < 100 beds	Count	245	164	409
		%	59.9	40.1	100.0
	Hospital, 100-300 beds	Count	285	134	419
		%	68.0	32.0	100.0
	Hospital, > 300 beds	Count	169	52	221
		%	76.5	23.5	100.0
	Freestanding clinic	Count	97	59	156
		%	62.2	37.8	100.0
	Educational setting	Count	16	7	23
		%	69.6	30.4	100.0
	Other	Count	48	18	66
		%	72.7	27.3	100.0
	Total	Count	860	434	1294
		%	66.5	33.5	100.0

Among respondents whose facilities do not require CT certification, CT technologists working in large hospitals were significantly less likely (23.5%) than those working in other types of facilities (35.6%) to report that CT certification entitles CT technologists to higher pay, $\chi^2_1 = 11.981$, $P < .001$.

Characteristics of Respondent's Facility

Services Provided by Facility

All of the services included in the checklist except for general diagnostic CT were provided by significantly different percentages of the respondents from the various types of facilities:

Type of Facility	N	General diagnostic CT	Fusion	Image-guided surgery /inter-ventional	Trauma	CT colonography/ virtual colonoscopy	Orthopedic	Post-processing image manipu-lation
Hospital, < 100 beds	496	.9707	.0552	.3268	.8160	.0873	.5962	.6113
Hospital, 100-300 beds	519	.9739	.1099	.6515	.8173	.1942	.8063	.7822
Hospital, > 300 beds	336	.9779	.2115	.7868	.8850	.3877	.8503	.8904
Freestanding clinic	267	.9507	.0770	.0892	.2310	.2092	.6430	.6703
Educational setting	28	.9540	.2152	.7557	.9359	.2611	.9178	.6142
Other	110	.9376	.1133	.2499	.4704	.2531	.7129	.6858
Total	1757	.9676	.1108	.4765	.7207	.2080	.7264	.7288
Overall $F_{5,1750}$ for differences among 6 types of facility		1.546, *P* = .172	11.601, *P* < .001	113.504, *P* < .001	120.822, *P* < .001	23.853, *P* < .001	21.038, *P* < .001	19.792, *P* < .001

Type of Facility	N	Pediatric	Cardio-vascular (EBCT, CTA).	Neurologic	CT simulation - therapy treatment planning.	Research protocols	Other	Total No. of services (of the 13 listed)	No. "Basic" Services minus No. "Complex" Services
Hospital, < 100 beds	496	.4860	.2367	.2558	.0923	.0156	.0140	4.5641	1.6332
Hospital, 100-300 beds	519	.5980	.5290	.5732	.3782	.0848	.0330	6.5316	.9078
Hospital, > 300 beds	336	.7423	.7407	.7878	.5573	.3818	.0335	8.2329	.6496
Freestand-ing clinic	267	.3900	.3628	.5167	.1377	.1258	.0403	4.4438	.5759
Educational setting	28	.6295	.4074	.7292	.3970	.3970	.1079	7.3220	1.4712
Other	110	.5533	.4064	.5675	.2297	.1799	.0810	5.4408	.8516
Total	1757	.5600	.4519	.5181	.2860	.1393	.0331	5.9272	1.0185
Overall $F_{5,1750}$ for differences among 6 types of facility		19.173, *P* < .001	52.197, *P* < .001	57.247, *P* < .001	62.436, *P* < .001	60.360, *P* < .001	3.820, *P* = .002	132.484, *P* < .001	40.850, *P* < .001

For each of the 13 services, as well as for total number of services provided, the proportion providing that service or the mean number of services provided increased monotonically from small to large hospitals. Consistent with that trend, the predominance of "basic" over "complex" services decreased monotonically with hospital size. Freestanding clinics and small hospitals showed similar proportions or means for most services and they were the least likely to provide interventional and trauma services by wide margins. Facilities located in educational settings were substantially above the overall mean for most services and for total number of services. A major exception for education facilities was a relatively low likelihood of providing postprocessing image manipulation or cardiovascular services. Educational settings were similar to small hospitals in providing substantially more "basic" than "complex" services.

In addition, two of the services differed significantly among rural, suburban and urban locations:

Location of Facility	N	Cardiovascular (EBCT, CTA)	Research protocols
Rural	598	.3324	.0605

Suburban	686	.4358	.0884
Urban	556	.5996	.3026
Total	1839	.4517	.1441
Overall $F_{2,1836}$ for differences among 3 facility locations		44.042, *P* < .001	90.612, *P* < .001

Finally, the above two services plus the proportion of facilities that provide trauma CT services showed statistically significant interactions between facility type and location:

Location of Facility	Type of Facility	N	Trauma	Cardio-vascular (EBCT, CTA)	Research protocols
Rural	Hospital, < 100 beds	371	.8296	.2176	.0091
	Hospital, 100-300 beds	119	.8820	.6371	.0253
	Hospital, > 300 beds	24	.8947	.7429	.4769
	Freestanding clinic	30	.3993	.3379	.2862
	Educational setting	12	1.0000	.2725	.4565
	Other	16	.0956	.2696	.0000
Suburban	Hospital, < 100 beds	99	.7928	.2275	.0340
	Hospital, 100-300 beds	239	.8730	.4738	.0747
	Hospital, > 300 beds	84	.8819	.6870	.1912
	Freestanding clinic	151	.2107	.3787	.0716
	Educational setting	5	.8878	.4489	.2245
	Other	49	.4806	.3874	.1777
Urban	Hospital, < 100 beds	22	.7271	.5679	.0457
	Hospital, 100-300 beds	150	.6876	.5296	.1543
	Hospital, > 300 beds	213	.8820	.7666	.4683
	Freestanding clinic	84	.2126	.3464	.1678
	Educational setting	11	.9522	.5733	.4320
	Other	40	.5477	.5284	.2672
$F_{10,1836}$ for interaction between facility location and type			4.092, *P* < .001	2.460, *P* = .002	4.548, *P* < .001

Provision of trauma CT by "Other" facilities was similar to the average for all facilities in urban and suburban locations, but was much lower (9.5%) than average (80%) in rural areas, $F_{2,1836}$ for this component of the interaction = 11.105, $P < .001$. Provision of cardiovascular CT services by mid-sized hospitals was similar to the large-hospital percentage in rural areas, about equally different from the small and large-sized hospital percentages in suburban areas, and was the lowest percentage (though not significantly lower than for small hospitals) in urban settings, $F_{2,1836} = 5.284$, $P = .005$. Finally, the greater tendency for large hospitals to employ research protocols than smaller hospitals was much less pronounced in suburban than in urban or rural locations, $F_{2,1836} = 9.445$, $P < .001$. Facilities described as "Other" were 23% below the overall proportion of rural facilities employing research protocols (in fact, at 0%), 9% above the overall proportion for suburban facilities, and 1% below the urban-facility overall proportion, $F_{2,1836} = 5.123$, $P = .006$.

Services for Which the Respondent's Scans Are Used

As with CT services provided by the facility, the services to which the respondent's scans contribute were strongly affected by facility type:

		Proportion of Respondents Whose CT Scans Contribute to Each Service					
Type of Facility	N	General diagnostic CT	Image-guided surgery/ interven-tional	CT colonography/ virtual colonoscopy	Pediatric	Neurologic	Cardio-vascular
Hospital, < 100 beds	457	.3086	.3086	.0927	.4525	.2694	.2565
Hospital, 100-300 beds	504	.5426	.5426	.1517	.5691	.5095	.4415
Hospital, > 300 beds	348	.6922	.6922	.2853	.6698	.7165	.6502
Freestanding clinic	301	.1075	.1075	.1945	.3271	.4677	.3486
Educational setting	29	.5115	.5115	.1356	.5613	.6428	.4573
Other	105	.2092	.2092	.1779	.3845	.4886	.3910
Total	1744	.4155	.4155	.1716	.5057	.4817	.4159
Overall $F_{5,1756}$ for differences among 6 types of facility		2.180, $P = .054$	73.510, $P < .001$	11.334, $P < .001$	20.390, $P < .001$	36.531, $P < .001$	29.242, $P < .001$

		Proportion of Respondents Whose CT Scans Contribute to Each Service				
Type of Facility	N	Research Protocols	CT Simulation	Fusion	Other CT Services	Mean no. Of Services
Hospital, < 100 beds	457	.0374	.0803	.0323	.0190	4.9667
Hospital, 100-300 beds	504	.0912	.3062	.0748	.0288	6.5359
Hospital, > 300 beds	348	.2903	.3501	.1225	.0449	7.6932
Freestanding clinic	301	.1176	.1382	.0710	.0472	4.6893
Educational setting	29	.3210	.3798	.1854	.0452	7.1367
Other	105	.1841	.2406	.1253	.0889	5.4182
Total	1744	.1309	.2241	.0774	.0365	5.9800
Overall $F_{5,1738}$ for differences among 6 types of facility		28.819, $P < .001$	26.587, $P < .001$	6.417, $P < .001$	2.998, $P = .011$	65.475, $P < .001$

		Proportion of Respondents Whose CT Scans Contribute to Each Service		
Type of Facility	N	Trauma	Orthopedic	Post-processing
Hospital, < 100 beds	481	.7092	.5550	.4979
Hospital, 100-300 beds	485	.7821	.6702	.6697
Hospital, > 300 beds	321	.8156	.7387	.6971
Freestanding clinic	259	.2432	.6101	.4846
Educational setting	27	.8634	.8823	.5953
Other	106	.5168	.5993	.5395
Total	1677	.6693	.6400	.5878
Overall $F_{5,1671}$ for differences among 6 types of facility		72.089, $P < .001$	8.277, $P < .001$	12.270, $P < .001$

For every CT service, the proportion of respondents whose CT scans contribute to that service increased monotonically with size of hospital, as did the total number of services for which respondents' scans were used. Freestanding clinics were somewhat but nonsignificantly above average in the proportion of respondents whose scans supported virtually colonoscopy but below average in contributions to all other services, statistically significantly so for image-

guided/interventional, trauma, pediatrics, CT simulation, postprocessing, and total number of services. Educational settings were somewhat but nonsignificantly below average in the proportion of respondents whose scans supported virtually colonoscopy and above average in contributions to all other services, statistically significantly so for trauma and orthopedic procedures and for research protocols.

In addition, use of respondents' CT scans for general diagnostic CT and for postprocessing of images were each involved in a statistically significant interaction between facility type and facility location. In the case of general diagnostic, this was due to 100% of suburban respondents listing their facility type as "Other" indicating that their scans are used for general diagnostic, vs. percentages of 89% and 81% in rural and suburban areas, respectively (in each case the lowest percentage of any of the six facility types); $F_{2,1738}$ for the difference among locations in the "Other" vs. other 5 types difference = 7.453, $P < .001$.

Use for postprocessing increased substantially and monotonically with size of hospital for hospitals located in rural and suburban areas, but was highest for mid-sized (100 – 300 bed) hospitals in urban areas; $F_{2,1738}$ for the difference among locations in the mid-sized vs. small or large hospital difference = 4.712, $P = .009$.

Primary Service for Which Respondent's CT Scans Are Used

Neither facility type nor facility location significantly affected the single service a respondent reported as the most common use for CT scans.

However, including respondents who designated more than one "most common" service and distributing each response equally among all services designated as most common yields mean most-common scores for general diagnostic and trauma CT that differ significantly as a function of facility type.

		Mean Most-common Score	
Type of Facility	N	General diagnostic CT	Trauma
Hospital, < 100 beds	197	.8152	.0315
Hospital, 100-300 beds	308	.7160	.0691
Hospital, > 300 beds	231	.6115	.1212
Freestanding clinic	149	.8453	.0007
Educational setting	18	.6106	.0736
Other	62	.7769	.0565
Total	965	.7331	.0626
Overall $F_{5,959}$ for differences among 6 types of facility		10.392, $P < .001$	8.545, *P < .001*

Mean most-common score for general diagnostic decreased with hospital size while the mean for trauma CT increased, $F_{1,959} = 32.308$ and 23.261, respectively, $P < .001$ in both cases. Further, freestanding clinics had the highest mean most-common score for GD and the lowest mean most-common score for trauma CT, $F_{1,959} = 15.031$ and 28.730, respectively, $P < .001$ in both cases.

Number of CT Scans Performed Daily at Respondent's Facility

19. How many CT scans are performed at your facility daily?

	N	Mean[a]	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Mini-mum	Maximum
					Lower Bound	Upper Bound		
Hospital, < 100 beds	456	17.7087	19.97536	.93549	15.8702	19.5471	1.50	212.00
Hospital, 100-300 beds	499	45.5436	28.10495	1.25873	43.0705	48.0167	.00	250.00
Hospital, > 300 beds	340	87.6378	75.61352	4.10039	79.5724	95.7033	.00	1000.00
Freestanding clinic	296	19.6872	19.47250	1.13127	17.4608	21.9135	.00	200.00
Educational setting	27	64.0251	50.08992	9.63995	44.2099	83.8403	3.00	200.00
Other	99	41.6638	79.52161	8.00148	25.7847	57.5430	.00	501.00
Total	1717	42.0938	50.94525	1.22962	39.6821	44.5055	.00	1000.00

[a] Omits respondents reporting > 9,000 scans per day.

The overall $F_{5,1710}$ for the differences among these six means = 118.273, $P < .001$. In particular, number of CT scans per day increased with hospital size, $F_{1,1710} = 276.457$, $P < .001$. Freestanding clinics were significantly below the overall mean (similar to small hospitals in this respect), $F_{1,1710} = 120.100$, $P < .001$.

STAFF, MANAGERS AND EDUCATORS

The investigation of differences among respondents holding different titles focused on the management level implied by the respondent's job title, as defined in the following table:

	21. Management level implied by title				Total
21. Which of the following titles best describes your current job position?	Staff/Senior/ Lead Tech/Therapist	Supervisor/ Manager/ Administrator	Educator	Other	
Staff Technologist/Therapist	1172	0	0	0	1172
Senior/Lead Technologist/Therapist	291	0	0	0	291
Clinical Instructor	0	0	14	0	14
Didactic Instructor	0	0	6	0	6
Clinical Coordinator	0	0	5	0	5
Program Director	0	0	3	0	3
Assistant Chief Technologist/Therapist	0	15	0	0	15
Chief Technologist/Therapist	0	61	0	0	61
Supervisor/Manager	0	142	0	0	142
Administrator	0	14	0	0	14
Corporate Representative	0	0	0	6	6
Other (Please specify below.)	43	17	2	6	68
Total	1506	249	30	12	1797

If a respondent checked "Other" as the job title that most aptly described her or his current position, the respondent's verbatim response to the request to "Please specify below" was examined to see which of the three management levels it implied.

In the remainder of this section the three employment/management levels will be referred to as Staff, Managers and Educators.

Professional Profile

Involvement in CT Scans

Involvement in CT scans. Employment/Management level implied by title

Involvement in CT scans		21. Management level implied by title				Total
		Staff/Senior/ Lead Tech/Therapist	Supervisor/ Manager/ Administrator	Educator	Other	
Neither perform nor supervise CT scans	Count	5	1	0	0	6
	%	.3	.4	.0	.0	.3
Perform, don't supervise scans	Count	1040	21	12	6	1079
	%	67.1	9.1	41.4	40.0	59.1
Supervise, don't perform scans	Count	5	15	3	1	24
	%	.3	6.5	10.3	6.7	1.3
Both perform, supervise CT scans	Count	501	194	14	8	717
	%	32.3	84.0	48.3	53.3	39.3
Total	Count	1551	231	29	15	1826
	%	100.0	100.0	100.0	100.0	100.0

Note: Weighted to correct for over-representation of CT-certified respondents.

A low percentage (6.9%) of (ARRT-registered) managers do not perform CT scans.

Certification in Computed Tomography

4. Do you hold the ARRT certificate in Computed Tomography?

Management Level	N	Proportion CT-certified
Staff/Senior/Lead Technologist/Therapist	1462	.5751
Supervisor/Manager/Administrator	302	.7234
Educator	38	.7900
Other	17	.7198
Total	1818	.6055

Note: Weighted to correct for over-representation of respondents who consider CT their primary specialty.

Staff are significantly less likely (57.5%) than managers and educators (73%) to hold the ARRT certificate in computed tomography, $F_{1,1814} = 17.222$, $P < .001$.

Unsuccessful Attempts to Pass the CT Certification Exam

The percentage of respondents who have ever attempted the certification exam unsuccessfully did not differ significantly as a function of management level.

Reasons Not Planning to Take CT Certification Exam in Future

Considering only noncertified respondents who report that they don't plan to take the CT certification exam in the future, only three educators fell into this category, so management-level comparisons were restricted to staff vs. managers. The only reasons cited by significantly different percentages of staff and managers was that "I supervise CT scans but don't perform them myself," which was cited by 24% of managers but by fewer than 1% of staff technologists/therapists, $F_{1,147} = 29.288$, $P < .001$.

Preparation for Certification Exam and for First On-the-Job CT Scan

Certification Exam

The only source of preparation for the certification exam that was used significantly differently was "Continuing education courses at conferences," which was cited by 32% of staff but by 49% of educators and managers, $F_{1,147} = 5.272$, $P = .005$.

First On-the-Job CT Scan

Two of the types of preparation for their first on-the-job certification exam (on-site applications training provided by an equipment vendor and off-site applications training involving a formal, multi-day curriculum) were used by a higher percentage of managers (45% and 23%, respectively) than of staff respondents (33% and 13%), $F_{1,1809} = 13.720$ and 15.761, $P < .001$ in both cases. Educators and staff respondent results were similar, but because of the small number of educators in the sample, their percentage did not differ statistically significantly from staff percentages.

Should Entry-level Radiography Programs Increase their Emphasis on CT?

Staff, managers, and educators did not differ significantly in their mean levels of endorsement of increased emphasis on computed tomography in entry-level radiography programs.

Professional Development

Sources of Information Used to Keep Up-to-date on Advances in CT

The three employment/management groups differed statistically significantly in their reliance on several of the 14 sources of information:

Management Level	N	Source of Information Cited					
		Radiologists	Other CT technologists	Employer-provided workshops	Department/ facility manager	Vendor represent-atives	Workshops/ courses at professional conferences
Staff/Senior/Lead Tech/Therapist	1466	0.680	0.723	0.170	0.192	0.367	0.347
Supervisor/Manager/ Administrator	274	0.747	0.613	0.131	0.056	0.541	0.610
Educator	33	0.816	0.759	0.352	0.181	0.557	0.621
Statistically significant differences ($P < .01$)		None	Staff vs. Mgrs	None	Staff vs. Mgrs	Staff vs. Mgrs, Educators	Staff vs. Mgrs, Educators

Management	N	Source of Information Cited

Level		Continuing education materials	Product demos at professional conferences	Product demos at a CT facility	Profess-ional journals	Profess-ional news-magazines	General media	List-servers	Other
Staff/Senior/Lead Tech/Therapist	1466	0.726	0.101	0.085	0.579	0.519	0.126	0.031	0.016
Supervisor/ Manager/ Administrator	274	0.816	0.185	0.120	0.798	0.652	0.102	0.085	0.014
Educator	33	0.845	0.328	0.245	0.713	0.643	0.183	0.203	0.000
Statistically significant differences ($P < .01$)		Staff vs. Mgrs, Educators	Staff vs. Mgrs, Educators	None	Staff vs. Mgrs, Educ's	Staff vs. Mgrs, Educators	None	Staff vs. Mgrs vs. Educ's	None

CT-Relevant CE Credits Earned and Would Like to Earn

The only statistically significant differences among management levels with respect to CT-relevant CE credits earned or that the respondent would like to earn were tendencies for staff-level respondents to earn fewer credits per biennium via off-site applications training and conferences than do managers and administrators ($F_{1,1819} = 16.597$ and 12.539, $p < .001$ in each case) who do not differ significantly in this respect from educators.

Medium for CE	Management Level	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Min	Maximum
					Lower Bound	Upper Bound		
Off-site applications training provided by a vendor	Staff/Senior/Lead Tech/Therapist	1467	1.30	4.53	1.06	1.53	.00	45.0
	Supervisor/Manager/ Administrator	302	2.68	7.97	1.78	3.58	.00	75.0
	Educator	38	2.32	6.59	.15	4.49	.00	25.0
	Other	17	3.51	10.10	-1.68	8.71	.00	50.0
	Total	1823	1.57	5.39	1.32	1.81	.00	75.0
Courses and workshops at state, regional, or national conferences	Staff/Senior/Lead Tech/Therapist	1467	1.84	4.74	1.60	2.09	.00	42.0
	Supervisor/Manager/ Administrator	302	2.96	5.67	2.32	3.60	.00	32.0
	Educator	38	3.35	5.71	1.47	5.23	.00	20.0
	Other	17	5.81	9.55	.90	10.72	.00	38.0
	Total	1823	2.10	5.02	1.87	2.33	.00	42.0

How Approaches to Expanding Skill Set Differ Across Management Levels

		21. Management level implied by title			Total	Statistically significant differences
How increase skill set?	Statistic	Staff/Senior/Lead Tech/Therapist	Supervisor/ Manager/ Administrator	Educator		
Books, Hardcopy Materials	Count	350	79	8	436	None
	%	31.8	33.3	25.9		
Classes, Seminars, Conferences, Vendor Training	Count	305	92	9	406	S vs. M, S,E vs. M
	%	27.8	38.8	30.6		

Radiologists/Fellow workers/Colleagues	Count	717	142	18	878	None
	%	65.3	59.9	59.5		
Self Study/Work Experience	Count	101	27	1	129	None
	%	9.2	11.3	2.2		
Software, Online Materials	Count	124	30	4	157	None
	%	11.3	12.5	13.0		
Not Enough Time/Resources	Count	25	5	0	30	None
	%	2.3	2.0	.0		
Other	Count	25	1	1		None
	%	2.2	.3	2.2		
Total Respondents	Count	1122	238	31	1391	
Total Responses	Count	1647	613	41	2274	
	%	146.8	257.6	132.3		

Percentages and totals are based on respondents and are weighted to correct for over-representation of respondents who consider CT their primary specialty.

Attitudes Toward Professional-Practice Benchmarking

Responses to these three questions did not differ statistically significantly among the three employment/management levels.

Areas of CT that Warrant Special Recognition Through Certification

13. Are there areas of CT that have become so unique and specialized that they warrant special recognition through certification?

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Staff/Senior/Lead Tech/Therapist	1393	.2714	.44482	.01192	.2480	.2947	.00	1.00
Supervisor/Manager/ Administrator	239	.3975	.49041	.03172	.3350	.4600	.00	1.00
Educator	31	.4839	.50800	.09124	.2975	.6702	.00	1.00
Other	13	.5385	.51887	.14391	.2249	.8520	.00	1.00
Total	1676	.2953	.45633	.01115	.2735	.3172	.00	1.00

Staff technologists and therapists are less likely (27%) to feel that there are areas of CT warranting separate certification than are managers (40%; $F_{1,1672} = 14.190$, $P < .001$ for this difference), who are in turn significantly less likely than are educators to feel some areas warrant special certification (48%; $F_{1,1672} = 15.793$, $P < .001$).

Among respondents who specified one or more areas warranting separate certification, managers, staff, and educators did not differ in the particular areas of CT they mentioned. However, respondents listing an "Other" job title/description were significantly more likely (four out of eight) to feel postprocessing warranted separate certification than were the other three groups, only 2% of whom mentioned postprocessing; $\chi^2_1 = 14.295$, $P < .001$.

Certification Required by Employer?

The percentage of respondents whose employer requires that CT technologists be certified did not differ significantly among the three employment/management levels. Nor did the percentage citing the ARRT as the certifying body specified by the employer.

Does Certification Yield Higher Pay?

15. Does holding a CT certificate entitle CT technologists at your facility to higher pay?

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Staff/Senior/Lead Tech/Therapist	1389	.3622	.48081	.01290	.3369	.3875	.00	1.00
Supervisor/Manager/ Administrator	262	.4590	.49927	.03082	.3983	.5196	.00	1.00
Educator	33	.4655	.50658	.08836	.2855	.6455	.00	1.00
Total	1684	.3793	.48535	.01183	.3561	.4025	.00	1.00

A significantly higher percentage of managers (46%) than of staff (36%) believe that holding a CT certificate entitles CT technologists at their facility to higher pay, $F_{1,1681} = 8.387$, $P = .004$.

Characteristics of Respondent's Facility

Type of Facility

21. Management level implied by title 16. Which of the following best describes your workplace? Cross-tabulation

Management Level Statistics		16. Which of the following best describes your workplace? Hospital with fewer than 100 beds.	Hospital with 100-300 beds.	Hospital with more than 300 beds.	Free-standing clinic.	Educational setting.	Total
Staff/Senior/Lead Tech/Therapist	Count	358	416	292	229	22	1317
	% of workplace types	27.2	31.6	22.2	17.4	1.7	100.0
	% of management levels	80.1	82.9	84.6	76.6	73.3	81.1
Supervisor/Manager/ Administrator	Count	82	73	44	69	3	271
	% of workplace types	30.3	26.9	16.2	25.5	1.1	100.0
	% of management levels	18.3	14.5	12.8	23.1	10.0	16.7
Educator	Count	7	13	9	1	5	35
	% of workplace types	20.0	37.1	25.7	2.9	14.3	100.0
	% of management levels	1.6	2.6	2.6	.3	16.7	2.2
Total	Count	447	502	345	299	30	1623
	% of workplace types	27.5	30.9	21.3	18.4	1.8	100.0
	% of management levels	100.0	100.0	100.0	100.0	100.0	100.0

A higher percentage of educators (16.7%) than of staff and managers (1.6%) work in educational settings. (Fisher's exact test for this difference yields $P < .001$.) A higher percentage of respondents who work in freestanding clinics (23.1%) hold managerial titles than is true in hospitals (15.4%), $F_{1,1618} = 10.798$, $P = .003$. There also was a tendency for the percentage of staff who are managers to be higher (18.3%) in small hospitals than in medium-sized and large hospitals (13.7%), but this difference is not statistically significant at the .01 level, $F_{1,1618} = 4.657$, $P = .031$.

Services Provided by Facility

Among facilities that provide at least one CT service, the management-level distribution (percent of staff vs. managers vs. educators) is not affected substantially or statistically significantly by the total number of services the facility provides nor by the balance between "basic" services (general diagnostic, trauma, orthopedic, pediatric, and research protocols) and "complex" services (fusion, postprocessing image manipulation, cardiovascular, neurologic, and CT simulation).

Services Respondent's CT Scans Support

Respondent's management level had a statistically significant effect on the likelihood that he or she provides CT scans that are used for four of the thirteen services:

Management Level	N	Trauma	Post-processing	Cardio-vascular	Other
Staff/Senior/Lead Tech/Therapist	1439	.6843	.5964	.4400	.0335
Supervisor/Manager/Administrator (Mgr)	314	.5124	.5075	.3346	.0423
Educator (Educ.)	39	.9408	.7902	.2817	.0178
Other	16	.7725	.5795	.2682	.1870
Total	1809	.6608	.5850	.4179	.0360
Statistically significant differences ($P < .01$)		All 3 pairwise diffs	All 3 pairwise diffs	Staff vs. Educ., Mgr	Other mgt level vs. 3 specific levels

Staff are significantly more likely to be involved in cardiovascular CT than the other two management levels, while educators are more likely than the other two groups to be involved in trauma imaging and in postprocessing of images. Respondents at an "Other" management level were considerably more likely than staff, managers, and educators to report contributing to an "Other" service.

While there are no statistically significant differences among the management levels in the percent citing a particular service as the single most common one for which their CT scans are used, there are some differences in mean most-common-use scores (which give partial credit for being one of two or more "most common uses").

Management Level	N	General Diagnostic	Trauma	CT Simulation
Staff/Senior/Lead Tech/Therapist	1446	.5934	.0361	.0153
upervisor/Manager/Administrator (Mgr)	331	.5418	.0070	.0480
Educator (Educ.)	40	.3054	.1008	.0255
Other				
Total	1817	.5776	.0322	.0215
Statistically significant differences ($P < .01$)		Educ. vs. Staff, Mgr	Staff vs. Mgr	Staff vs. Mgr

Staff were significantly more likely than managers to identify pediatric or cardiovascular CT or postprocessing as the most frequently used CT services. Staff are less likely than managers to be primarily involved in CT simulation. And educators were significantly less likely than either staff or managers to say that general diagnostic CT is the most common use of their CT scans.

Number of CT Scans Performed Daily at Respondent's Facility

This did not differ significantly among the three employment/management levels.

Rural vs. Suburban vs. Urban Location

A lower percentage (76%) of respondents from rural facilities are staff (rather than managers or educators) than is true of suburban and urban facilities (83% staff), $\chi^2_1 = 11.632$, $P < .001$.

APPENDIX A

COVER LETTER AND SURVEY INSTRUMENT

asrt
American Society of
Radiologic Technologists

April 22, 2005

Dear Computed Tomography Technologist:

ASRT would appreciate your help in assessing the educational needs of CT technologists.

What kind(s) of education and training do those who perform CT scans (whether certified in CT or not) currently receive to prepare them for their responsibilities? What kind(s) of education would they like to have received? How do they keep abreast of the rapid pace of technological development in computed tomography? How might their acquisition of additional skills and their attainment of increasing competency in existing skills be fostered and recognized?

Who better to answer these questions than technologists such as you who have been exposed to CT education and who have had to apply that education? That's why we are asking a random sample of ARRT registrants who are certified in CT and/or who consider CT their primary or secondary sphere of employment to complete the CT Education Needs Assessment. The information you and your fellow CT technologists provide will be shared with the computed tomography community via a report posted on the ASRT Web site. The report's accuracy and impact on planning CT educational efforts will depend on your willingness to share your views on these issues by completing the CT Education Needs Assessment.

There are two ways you can participate in this survey. We prefer (because of its lower cost and greater ease of data entry) that you complete the questionnaire online by going to www.asrt.org and clicking on "CT Education Needs Assessment" in the "Education" section of the page. (Please enter the survey code, "CTEducNeeds," as your response to the second question on the online form; see the guide on the back of this page for help in finding the link to the questionnaire.) Alternatively, you may complete the hardcopy questionnaire enclosed with this note and return it to the ASRT Research Department in the enclosed postage-paid reply envelope. Please respond within the next two weeks if possible.

Thanks for your help with this important survey.

Kevin J. Powers, Ed.S., R.T.(R)(M)
Director of Education

Enclosure

15000 Central Ave. SE, Albuquerque, NM 87123-3917 • 505-298-4500 • 800-444-2778 • Fax 505-298-5063 • www

CT Technologists' Educational Needs

1. Do you perform computed tomography (CT) scans as a part of your professional duties?
   O Yes O No
   If "Yes," for how many years (not necessarily consecutive)? _____

2. Do you supervise others who perform CT scans?
   O Yes O No
   If "Yes," for how many years (not necessarily consecutive)? _____

Note: If your answer to both question 1 and question 2 is "No," please accept our apologies for taking up your time. You may discard this questionnaire or pass it along to a colleague who is involved in performing CT scans or supervising those who do.

3. Do you consider computed tomography your primary sphere of employment?
   O Yes O No
   Do you consider it your secondary sphere of employment?
   O Yes O No

4. Do you hold the ARRT certificate in Computed Tomography?
   O Yes O No
   If "Yes," what type(s) of CT-specific training prepared you to take the CT certification exam? [Check all that apply.]
   - O On-the-job training.
   - O Clinical training as a student in a radiologic technology educational program.
   - O Formal, didactic course work within a radiologic technology educational program.
   - O A fellowship in CT leading to eligibility for the CT certification exam.
   - O On-site applications training provided by a CT equipment vendor(s).
   - O On-site training provided by a co-worker who had received applications training from a vendor.
   - O Off-site applications training involving a multiple-day, formal curriculum.
   - O Online continuing education materials.
   - O Continuing education courses at conferences.
   - O Published continuing education materials (e.g., Directed Readings, videos, CDs).
   - O Other (Please specify.)_____

   If "No," do you plan to take the CT certification exam in the future? O Yes O No

5. Have you ever taken the ARRT CT certification exam unsuccessfully? O Yes O No

6. If you are not ARRT-certified in CT and you do not plan to take the ARRT certification exam in the future, why not? [Check all reasons that apply to you.]

O I don't consider my chances of passing the exam good enough to warrant the time and/or expense of taking it.
O I hold a CT license from the state in which I work.
O My state doesn't require certification to practice as a CT technologist.
O I don't need certification to validate my skill in/understanding of CT.
O My employer doesn't require CT certification.
O My employer doesn't consider CT certification important.
O Holding the ARRT CT certificate would not be rewarded with higher pay.
O I supervise CT technologists but do not perform CT scans myself.
O My department's or facility's competency assessment(s) provides adequate validation of my skill in/understanding of CT.
O My patients aren't interested in whether or not I am certified in CT.
O Other (Please specify.)_____

7. Whether or not you are certified in CT, please indicate the type(s) of training that prepared you for your first performance of an on-the-job CT scan.

O On-the-job training.
O Clinical training as a student in a radiologic technology educational program.
O Formal, didactic course work within a radiologic technology educational program.
O A fellowship in CT.
O On-site applications training provided by a CT equipment vendor(s).
O On-site training provided by a co-worker who had received applications training from a vendor.
O Off-site applications training involving a multiple-day, formal curriculum.
O Online continuing education materials.
O Continuing education courses at conferences.
O Published continuing education materials (e.g., Directed Readings, videos, CDs).
O Other (Please specify.)_____

8. Do you believe that entry-level radiography programs should increase their emphasis on computed tomography (e.g., number of courses and/or hours within other courses devoted to CT)?

O I strongly agree. O I agree. O I disagree. O I strongly disagree.

9. What sources of information do you use to keep up-to-date on advances in CT? [Check all that apply.]

O Radiologists. O Other CT technologists. O Employer-provided workshops.
O Your department/facility manager. O Vendor representatives.
O Workshops/courses at professional conferences. O Continuing education materials.
O Product demos at professional conferences. O Product demos at a CT facility.
O Professional journals (i.e.., *Radiologic Technology*), whether print or online.
O Professional newsmagazines (e.g., *ASRT Scanner*, *Advances*), whether print or online.
O General media (e.g., newspapers, newsmagazines), whether print or online.
O List servers for imaging professionals (If convenient, please list your favorites.) _____
_____
O Other (Please specify.)_____

10. In a typical biennium (two-year period), how many of your continuing education credits *relevant to CT* come from each of the following sources? How many CT-relevant credits would you *like* to receive biennially from each source?

Source	Credits earned per biennium via source	Credits you would like to earn via source
Directed Readings in ASRT journals		
Online CE via ASRT/Sinclair Community College partnership		
Other ASRT-provided continuing education (e.g., home studies, videos)		
Courses taken from/at an educational institution		
On-site, employer-provided in-services		
On-site applications training provided by a vendor		
Off-site applications training provided by a vendor		
Courses and workshops at state, regional, or national conferences		
Online CE opportunities other than those provided by the ASRT/Sinclair partnership		
Other (Please specify.)_____		

11. How do you go about expanding your skill set in CT, i.e., developing skill in innovative or currently unfamiliar techniques and procedures?

_____

_____

_____

12. Please help us assess the value of developing a professional-practice benchmark to which to compare your skills in CT. Such a self-assessment tool would provide a "score" for each of several aspects of CT, such as:

General diagnostic CT.
CT simulation – therapy treatment planning.
Current CT technology (multislice scanners).
Postprocessing software and applications.
Radiation protection (ALARA) /protocol and dose.
CT/ PACS/ DICOM manipulation.
Patient safety.
Interventional.
Cardiovascular (CTA, EBCT).
Fusion modalities.
Anatomy, normal and abnormal.
Positioning.
Contrast procedures.

a. How valuable would such a tool be in planning your professional development?
O Very valuable. O Somewhat valuable. O Not very valuable. O Of no value.

b. Including links to resources for enhancing your knowledge and skills in aspects of CT where you currently fall short of the benchmark would be:
O Very valuable. O Somewhat valuable. O Not very valuable. O Of no value.

c. Should benchmarks be adjusted for or listed separately for different levels of experience in CT?
O Yes O No

d. Any other comments on the value/contents of a professional-practice benchmark?
_____
_____

13. Are there areas of CT that have become so unique and specialized that they warrant special recognition through certification?

O Yes O No

If "Yes," what are the areas that should be certified separately?

_____

_____

14. Does your employer require that CT technologists be certified?

O Yes O No

If "Yes," by what certifying body?

O ARRT O State license O Other (Please specify.)_____

15. Does holding a CT certificate entitle CT technologists at your facility to higher pay?

O Yes O No

16. Which of the following best describes your workplace?

O Hospital with fewer than 100 beds. O Hospital with 101-300 beds.
O Hospital with more than 300 beds. O Corporate (i.e., vendor representative).
O Freestanding clinic. O Educational setting.
O Mobile unit. O Veterinary facility.
O Locum tenens.
O Other (Please specify.)_____

17. Which of the following services are provided by the CT facility where you work? [Please mark all that apply.]

O General diagnostic CT. O Fusion.
O Image-guided surgery/interventional. O Trauma.
O CT colonography/virtual colonoscopy. O Orthopedic.
O Postprocessing image manipulation. O Pediatric.
O Cardiovascular (EBCT, CTA). O Neurologic.
O CT simulation – therapy treatment planning. O Research protocols.
O Other (Please specify.)_____

18. For which of the following services are the CT procedures *you* perform used? [Please mark all that apply, but place an "X" beside the most common use of your CT scans.]

O General diagnostic CT. O Fusion.
O Image-guided surgery/interventional. O Trauma.
O CT colonography/virtual colonoscopy. O Orthopedic.
O Postprocessing image manipulation. O Pediatric.
O Cardiovascular (EBCT, CTA). O Neurologic.
O CT simulation – therapy treatment planning. O Research protocols.
O Other (Please specify.)_____

19. How many CT scans are performed at your facility daily? _____

20. Is the location of your facility primarily:

O Rural O Suburban O Urban

21. Which of the following titles best describes your current job position?

[ ] Staff technologist/therapist
[ ] Senior/lead technologist/therapist
[ ] Assistant chief technologist/therapist
[ ] Chief technologist/therapist
[ ] Supervisor/manager
[ ] Administrator
[ ] Clinical instructor
[ ] Didactic instructor
[ ] Clinical coordinator
[ ] Program director
[ ] Corporate representative
[ ] Other (Please specify.)_____

Thanks very much for your feedback!

Use the link illustrated below to access the online CT Education Needs Assessment survey form. Thank you.