American Society of
Radiologic Technologists

ENROLLMENT SNAPSHOT OF RADIOGRAPHY, RADIATION THERAPY AND NUCLEAR MEDICINE PROGRAMS

2007

Reported November 2007

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EXECUTIVE SUMMARY

Return Rate

In mid-September 2007, an invitation to complete an online version of the Enrollment Snapshot of Radiography, Radiation Therapy and Nuclear Medicine Programs 2007 (Enrollment Snapshot 2007) was sent by mail and e-mail (if possible) to each of the 983 radiography, radiation therapy and nuclear medicine programs listed by the American Registry of Radiologic Technologists (ARRT). As of October 16, 2007, 648 of 983 questionnaires were returned, which represented an overall return percentage of 65.9%. Specifically, 496 of 729 (68%) radiography programs, 66 of 122 (54.1%) radiation therapy programs, 73 of 132 (55.3%) nuclear medicine technology programs, and 12 other/unspecified programs had responded to the survey.

Enrollment

Of the 187 certificate-only programs, 94 (50.8%) indicated that they have an articulation agreement with a community college or with a four-year college or university.

Entering-class enrollments in these three disciplines appear to be leveling off – including nuclear medicine, which had experienced a double-digit rise in enrollment from 2005 to 2006. Information from program directors of almost two-thirds of ARRT-listed educational programs in these specialties estimates fall 2007 first-year enrollments at 16,612 radiography students, 1,577 radiation therapy students and 1,781 nuclear medicine technology students. These represent increases of 1.2% for radiography and 3.3% for radiation therapy; they represent a *decrease* of 1.3% for nuclear medicine technology programs relative to 2006 enrollments.

Overall, 66% of program directors reported full enrollment in fall 2007 compared to 77.4% in fall 2006, 76.7% in fall 2005, 77.5% in fall 2004, about 75% in fall 2003, 66% in fall 2002, and 50% in fall 2001.

The rate at which directors of programs at full enrollment reported turning away qualified students projects to an unmet national demand of about 31,403 students, while programs not at full enrollment reported unused capacity totaling only 2,283 students. The ratio of number of qualified students turned away to total number admitted was about 1.72 among radiography programs, .59 in radiation therapy, and 1.08 in nuclear medicine. About 10.9% of radiography program directors, 18.5% of radiation therapy program directors and 8.2% of nuclear medicine program directors reported that they plan to increase enrollments.

Teaching Digital Imaging

About 17% of radiography programs' associated clinical sites still employ film-screen systems while 82% are completely filmless, with a predominance of computed radiography (CR) systems over digital radiography (DR) systems. Radiation therapy and nuclear medicine technology program directors who considered this question relevant indicated that 61% of radiation therapy programs' associated clinical sites are filmless, with a predominance of DR over CR systems and about 34% still employing film-screen systems. About 26% of nuclear medicine programs' associated clinical sites still employ film-screen systems, while 79% are filmless and more than four times as many nuclear medicine technology clinical sites employ DR systems as use CR.

About 35% of program directors believe that their programs "have adequate resource materials on the topic of digital imaging to adequately prepare instruction." This broke down to about 33% for radiography, 52% for radiation therapy and 60% for nuclear medicine technology. This percentage was lower (33%) among associate-degree programs than among certificate (46%) and baccalaureate (42%) programs. When asked what resource materials are lacking in this area, 76.3% of the program directors checked "textbooks" and 48.2%, "on-campus laboratory equipment."

Continuing Education Courses

Overall, about 26% of the programs offer courses that are approved for Category A continuing education credit. Of the approximately 74% that do not offer credit, 19% are planning to offer courses approved for Category A or A+ credit.

Supply and Demand

Information gathered by this and previous years' enrollment snapshots on entering-class enrollments, program attrition rates, certification-exam failure rates, percent of graduates taking U.S. jobs, and (for nuclear medicine technology programs) percent of program graduates who take the ARRT vs. the Nuclear Medicine Technology Certification Board (NMTCB) certifying exam was combined with information gleaned from the ARRT's renewal-form database as to the percentage of new certificants in each discipline who are still in that discipline one, two, …, 10 years later to generate projections as to how many additional technologists would be added to and retained in the U.S. labor force between 2004 and 2014. These projections indicate that if all of these factors remain at their fall 2007 levels over that period, radiography will fall about 4% short of the number of additional radiographers the Bureau of Labor Statistics (BLS) feels will be needed. The number of radiation therapists added to and retained in the U.S. workforce will, on the other hand, exceed the BLS-estimated need by about 55%, and nuclear medicine will add and retain more than double the number of additional nuclear medicine technologists the BLS believes will be needed.

BACKGROUND AND OBJECTIVES

This is the seventh in a series of annual reports from ASRT on entering-class enrollments in educational programs for radiographers, radiation therapists and nuclear medicine technologists. Given the importance of anticipating trends in the supply of radiologic technologists and the lag between R.T. recruitment and education and students sitting for certification exams, the ASRT intends to capture an annual "snapshot" of the earliest stage of the recruitment process by surveying directors of educational programs.

The ASRT Enrollment Snapshot of Radiography, Radiation Therapy and Nuclear Medicine Programs, November 2001[1] provided the first empirical evidence that the downward trend in entering-class enrollments observed since 1994 had reversed. Snapshot 2002[2] verified that this trend continued in the 2002-2003 academic year, and combined these entering-enrollment figures with demographic data for radiologic technologists supplied by the ARRT to provide the first indications of whether current recruitment and retention rates were sufficient to meet U.S. Bureau of Labor Statistics demand estimates in these three specialties. The data indicated that, if nothing changed, the profession would meet the BLS-estimated demand for nuclear medicine technologists and radiation therapists, but would fall far short of the need for additional radiographers. Snapshot 2003[3] added a question as to the percentage of each program's graduates who enter the U.S. workforce. The analysis showed further increases in entering enrollments and updated the projections of numbers of new radiographers, radiation therapists, and nuclear medicine technologists that would be added through 2010. Snapshot 2004[4] revealed that the number of students entering increased, though at a lower rate than in the previous four years. Overall, "the best current estimate is that radiation therapy is producing new practitioners substantially above the correct rate to meet the 2012 demand estimated by BLS, while nuclear medicine will nearly triple the estimated need and radiography is likely to come up somewhat short (by about 14%) of the projected demand unless enrollments or retention rates are increased." Snapshot 2005[5] updated those projections to a 7% shortfall for radiography (relative to the BLS's 2004 – 2014 target), a 47% overshooting of the estimated need for additional radiation therapists, and about twice as many additional nuclear medicine technologists as the BLS estimates will be needed. The Snapshot 2006[6] supply-demand estimates were a 6% shortfall for radiography and "overshooting" by 25% in radiation therapy and nearly 200% in nuclear medicine. Snapshot 2006 was also the first to ask directors of nuclear medicine programs to estimate the percentage of their recent graduates who have taken the ARRT (N) exam, the NMTCB certifying exam, both exams, or neither. This information provides a better "handle" on estimating the total number of new nuclear medicine technology certificants (whether NMTCB- or ARRT-registered or both) to expect two from now.

The 2007 Enrollment Snapshot's primary objective was to document recent trends in the number of students entering educational programs in the primary disciplines of radiologic technology: radiography, radiation therapy and nuclear medicine. Program directors were asked to report their entering class sizes during the past three years. However, entering an educational program doesn't guarantee a student's entry into the R.T. work force; therefore, the survey also asked program directors to report their programs' attrition rates in recent years. Further, graduating from an ARRT-recognized educational program does not guarantee entry into the U.S. radiologic technology labor pool, so program directors also were asked to indicate the country in which their program is located and the approximate percentage of their recent graduates who have taken jobs in the United States. The 2007 Snapshot, like Snapshots 2005 and 2006, asked directors of certificate programs to indicate whether or not their programs have an

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[1] American Society of Radiologic Technologists. Enrollment snapshot of radiography, radiation therapy and nuclear medicine programs, November 2001. Available at: www.asrt.org/media/pdf/enrollment_survey01.pdf. Accessed October 2007.
[2] American Society of Radiologic Technologists. Enrollment snapshot of radiography, radiation therapy and nuclear medicine programs, September 2002. Available at: www.asrt.org/media/pdf/enrollment_survey02.pdf. Accessed October 2007.
[3] American Society of Radiologic Technologists. Enrollment snapshot of radiography, radiation therapy and nuclear medicine programs, fall 2003. Available at: www.asrt.org/media/pdf/enrollment_survey_03.pdf. Accessed October 2007.
[4] American Society of Radiologic Technologists. Enrollment snapshot of radiography, radiation therapy and nuclear medicine programs, 2004. Available at: www.asrt.org/media/pdf/enrollment_survey_04.pdf. October 2007.
[5] American Society of Radiologic Technologists. Update to ASRT Enrollment Survey 2005: Projected Additions to the Work Force, 2004-2014. Available at: www.asrt.org/media/pdf/research/EnrollmentGapUpdate.pdf, Accessed October 2007.
[6] American Society of Radiologic Technologists. Enrollment snapshot of radiography, radiation therapy and nuclear medicine programs, 2006. Available at: http://www.asrt.org/media/pdf/research/enrollmentsurvey06.pdf , Accessed October 2007.

articulation agreement with a community college. This 2007 Snapshot, like the 2006 report, asked directors of nuclear medicine programs to estimate the percentage of their recent graduates who have taken the ARRT (N) exam, the NMTCB certifying exam, both exams, or neither.

Program directors were surveyed about the future of their programs, including plans for increasing or decreasing enrollments and any possibility that the program might close within the next few years. Program directors also were asked to indicate the state of their programs' readiness to provide instruction on digital imaging and whether (and if so, to whom) the program offers courses carrying Category A or A+ credit.

METHODOLOGY

In mid-September 2007 the ASRT mailed an invitation to complete an online questionnaire concerning entering-class enrollments to every radiography, radiation therapy and nuclear medicine program listed in the ARRT's list of education programs.[1] The same invitation also was sent by e-mail to every program director for whom an e-mail address was available (98.9% of program directors). In early October a reminder of the need for participation in the enrollment survey was sent by e-mail to all program directors for whom an apparently valid e-mail address was available and who had not explicitly told us that they had responded to the survey.

The questionnaire asked program directors about recent entering-class enrollments, plans for increases or decreases in program capacity, whether the program might be closed within the next few years, the program's attrition rate during the past few years and adequacy of the program's resources for providing instruction in digital imaging (CR and DR). For this year's survey, an additional question regarding course offerings that are approved for Category A continuing education credit also was included. (See Appendix A for the full questionnaire.)

The intention was to produce a quick "snapshot" of the supply side of the supply and demand balance for radiologic technology disciplines. As with the 2004, 2005 and 2006 Snapshots, this year's questionnaire asked the program director in which country his or program is located and what percentage of recent (past five years) graduates have taken jobs in the United States. As with the 2006 Snapshot, this year's questionnaire asked directors of certificate programs whether the program has an articulation agreement with a community college. Similar to last year, this year's questionnaire also asked nuclear medicine program directors the percentage of recent (past two years) graduates taking the ARRT (N) exam, the NMTCB certification exam, or both.

As of October 16, 2007, 496 (68.0%) radiography programs, 66 (54.1%) radiation therapy programs, 122 (55.3%) nuclear medicine technology programs and 12 programs not specified by the program director had responded. The returns – 648 of 983 questionnaires – represented an overall response rate of 65.9%.

A statistical note is in order: The high response rate (which was at least 54% for each discipline for each of the three years for which enrollment figures were provided) means that the width of confidence intervals around sample means and the likelihood that the direction of a given sample difference matches the corresponding difference in the population are affected not only by absolute sample size (number of program directors responding to the question) but also by the *proportional* sample size. In particular, confidence intervals (the range of values within which there's a 95% chance that the true population value lies) are narrower by a factor of $\sqrt{1-\frac{n-1}{N-1}} \approx \sqrt{.442} = .665$ than those that would be calculated without this *finite population correction*. Similarly, standard errors (estimated standard deviations of sampling distributions) are smaller by that same factor, so that *t*-ratios are larger by a factor of 1/.665 = 1.504 and *F*-ratios are larger by a factor of $1/.665^2 = 2.261$ than they would be without the finite population correction.

In short, having sampled a high percentage of all programs provides greater confidence that the results are representative of the population of all radiography, radiation therapy and nuclear medicine technology educational programs.

[1] American Registry of Radiologic Technologists. ARRT-recognized educational programs. Available at: www.arrt.org/index.html?content=http://www.arrt.org/nd/listOfSchools.ndm/listSchools&iframe=yes . Accessed September 2007.

DETAILED RESULTS

Type of Program

	Frequency	Valid Percent
Radiography	496*	76.7
Radiation Therapy	66	10.2
Nuclear Medicine	73	11.3
Other	3	.5
Radiography and Radiation Therapy	1	.2
Radiography and Other	6	.9
Radiography, Radiation Therapy and Nuclear Medicine	2	.3
Total	647	100.0
Missing	1	
Total	648	

*One respondent did not give any enrollment data

Overall Number of Programs in Each Modality (including multiple-level programs)

	Responses		Percent of Cases
	N	Percent	N
Radiography	505	76.6%	78.1%
Radiation Therapy	70	10.6%	10.8%
Nuclear Medicine Technology	75	11.4%	11.6%
Other	9	1.4%	1.4%
Total	659	100.0%	101.9%

Please specify other type of program:

	Frequency	Percent
BLANK	623	96.1
Advanced Imaging certificates in CT, MR, VIT, and CIT. Certificates or as part of the B.S degree.	1	.2
Also have MR, CT, Interventional and US options	1	.2
Articulations to complete associates or BSRT(R)	1	.2
AS degree and Certificate @ [name of community college]	1	.2
Associate Degree	1	.2
B.S. degree includes completion of Radiography (2 years) and 3rd year in choice of: Radiation Therapy, CT, MR, Education, Management or Interdisciplinary	1	.2
Bachelor Degree in CT and MR	1	.2
Certificate	1	.2
CT/MR postradiography ....BS degree completion	1	.2
Currently, we have 83 students enrolled in our RT(T) Program. We have 71 clinical affiliates in 23 states.	1	.2
Diagnostic Medical Sonography	2	.3
Diagnostic Medical Sonography, Cardiac Sonography	1	.2
I'm also the program director for a nuclear medicine school.	1	.2
MR,CT,CVI certificates	1	.2
MR	1	.2
MR and CT	1	.2
MR and Mammography also offered as separate graduate programs	1	.2
MR, CT SCAN	1	.2
Multicredential, study two modalities over last 24 months of a BS degree. Currently have modalities of MR, NMT, General SONO, Echo and Vascular SONO, and CT	1	.2
Our major is Medical Imaging, but it focuses on Radiography with a sr. year internship in an advanced modality.	1	.2
Radiography Radiologist Assistant	1	.2
Sonography	1	.2
Sonography	1	.2
Ultrasound	1	.2
Total	648	100.0

Educational Levels

	Frequency	Percent	Valid Percent	Cumulative Percent
Certificate only	187	28.9	28.9	28.9
Associate degree only	327	50.5	50.6	79.6
Bachelor's degree only	68	10.5	10.5	90.1
Other	6	.9	.9	91.0
Certificate and Associate degree	23	3.5	3.6	94.6
Certificate and Bachelor's degree	19	2.9	2.9	97.5
Certificate and Other	1	.2	.2	97.7
Associate degree and Bachelor's degree	8	1.2	1.2	98.9
Bachelor's degree and Other	1	.2	.2	99.1
Certificate, Associate degree, and Bachelor's degree	3	.5	.5	99.5
Associate degree, Bachelor's degree and Other	3	.5	.5	100.0
Total	646	99.7	100.0	
Missing	2	.3		
Total	648	100.0		

Overall Number of Programs at Each Level (including multiple-level programs)

	Responses		Percent of Cases
	N	Percent	N
Certificate	234	32.9%	36.2%
Associate degree	364	51.2%	56.3%
Bachelor's degree	102	14.3%	15.8%
Other	11	1.5%	1.7%
Total	711	100.0%	110.1%

Please specify other educational level of your program:

	Frequency	Percent
BLANK	601	92.7
2 years Community College	1	.2
All Associate degree students have the option of completing a BSRS degree.	1	.2
Also have a certificate program	1	.2
Also offer a certificate for those individuals who have a BS or BA degree and has met the pre-requisites	1	.2
And advanced diploma (fully integrated)	1	.2
Articulation with local university for Associate and Baccalaureate Degrees	1	.2
Articulations to complete associates or BSRTR	1	.2
AS in Medical Radiography BS in Radiologic Imaging Sciences Master of Imaging Sciences	1	.2
Associate of Applied Science	1	.2
Associate of Applied Science Degree	1	.2
Associates of Applied Technology	1	.2
Both Sonography programs are certificate	1	.2
Campuses offering a BS degree in Radiologic Sciences	1	.2
Can be articulated as B.S. through [name] college.	2	.3
Certificate	1	.2
Certificate if already have a BS degree or a 3 + 1 Bachelors completion program. Articulation with a University.	1	.2
Certificate imbedded in a Bachelor's university	1	.2
Certificate program was a special rural initative project which ended May07. Students had/have the option to complete additional courses for the AAS degree. Numbers listed below are for the AAS program only.	1	.2
Certificate program with bachelor articulation at a local university; currently do not have articulation with a	1	.2

	community college for associate degree.		
	Certificate through us and BS degree through the University	1	.2
	Comment regarding enrollment: No new students admitted 2007. Search for new program director underway.	1	.2
	Cooperative Agreement with College for an Associate degree.	1	.2
	DEC	1	.2
	Diploma	4	.6
	Dual track. Assoc. and B.S. Degree option.	1	.2
	Have articulation agreement with a university.	1	.2
	Have both AS and BS options	1	.2
	Hospital sponsored program, we have an articulation with [Name] University for an Associate in Science degree.	1	.2
	However, beginning next year we will require the general education core before entry into the program.	1	.2
	I have a two tiered program certificate for radiographers and associates for lay people.	1	.2
	In addition to our NMT certificate program, we also offer a Bachelor of Science degree in Radiologic Science with a concentration in Nuclear Medicine Technology.	1	.2
	It is an advanced level certificate program through a community college. Applicants must be a certified radiographer or nuclear medicine technologist to qualify for admission.	1	.2
	Masters of Arts	1	.2
	Must be registered rad techs or registry eligible before entering!	1	.2
	OPTION to earn associate degree through articulation agreement with local college.	1	.2
	Our program is a 2 + 2 program with [Name] University of Pa. We award a Certificate and Clarion awards the B.S. in Radiologic Sciences.	1	.2
	Our students achieve a B.Sc.(MRS) - Bachelor of Science in Medical Radiation Sciences, AND a Diploma in Radiological Technology ||| Our Medical Radiation Science program is articulated with the University of [name].	1	.2
	Radiography Certificate, B.S. Degree in Diagnostic Imaging upon completion.	1	.2
	Students have the option to continue their education and pursue a Bachelor of Health Science degree.	1	.2
	We affiliate with 3 universities, so our students graduate with a BS degree in Rad. Tech.	1	.2
	We also offer a Master's degree with the Radiologist Assistant Program	1	.2
	We are affiliated with the University of [name] at [name]. About half our graduates obtain the B.S. in Radiological Science	1	.2
	Will graduate with Masters in Dec 2007	1	.2
	Total	648	100.0

Articulation Agreements

If yours is a certificate program, do you have an articulation agreement with a community college?

Educational level combo	Articulation Agreement with Community College?	Frequency	Percent	Percent of Those Who Answered the Question
Certificate only	No	93	49.7	50.3
	Yes	92	49.2	49.7
	Total	185	98.9	100.0
	Missing	2	1.1	
	Total Certificate Only	187	100.0	
Certificate and Other Educational Level(s)	No	14	30.4	37.8
	Yes	23	50.0	62.2
	Total	37	80.4	100.0
	Missing	9	19.6	
	Total Certificate and Other Level(s)	46	100.0	
Certificate Not Offered (e.g., Associate Only or Associate and Bachelor's)	No	49	11.9	77.8
	Yes	14	3.4	22.2
	Total	63	15.3	100.0
	Missing	350	84.7	
	Total Not Offering Certificate	413	100.0	
Total		646*		

*****Two respondents did not indicate their educational level. Two respondents who answered "No" indicated that their programs articulate with *universities.*

Relationship Between Specialty and Educational Level of Program

Educational level combos	Statistic	Only one program				Total
		Radiography	Radiation Therapy	Nuclear Medicine	Other	
Certificate only	Count	144	19	22	2	187
	Percent	29.1%	28.8%	30.1%	66.7%	29.4%
Associate degree only	Count	295	18	13	0	326
	Percent	59.6%	27.3%	17.8%	.0%	51.2%
Bachelor's degree only	Count	26	18	20	0	64
	Percent	5.3%	27.3%	27.4%	.0%	10.0%
Other	Count	2	4	0	0	6
	Percent	.4%	6.1%	.0%	.0%	.9%
Certificate and Associate degree	Count	13	4	6	0	23
	Percent	2.6%	6.1%	8.2%	.0%	3.6%
Certificate and Bachelor's degree	Count	3	3	10	1	17
	Percent	.6%	4.5%	13.7%	33.3%	2.7%
Certificate and Other	Count	1	0	0	0	1
	Percent	.2%	.0%	.0%	.0%	.2%
Associate degree and Bachelor's degree	Count	7	0	0	0	7
	Percent	1.4%	.0%	.0%	.0%	1.1%
Bachelor's degree and Other	Count	0	0	1	0	1
	Percent	.0%	.0%	1.4%	.0%	.2%
Certificate, Associate degree, and Bachelor's degree	Count	2	0	1	0	3
	Percent	.4%	.0%	1.4%	.0%	.5%
Associate degree, Bachelor's degree, and Other	Count	2	0	0	0	2
	Percent	.4%	.0%	.0%	.0%	.3%
Total	Count	495	66	73	3	637
	Percent	100.0%	100.0%	100.0%	100.0%	100.0%

There are too few other-specialty and combined-specialty programs to meaningfully compare their educational levels with those of the single-specialty programs. Similarly, programs involving a certificate and/or an associate degree in

combination with a bachelor's degree were combined into a single category for analysis, and programs with an "other" educational level were not considered. Restricting attention to the pure programs results in radiography programs as more likely (59.6%) than radiation therapy and nuclear medicine programs (23.5%) to offer only an associate degree [$\chi^2(1) = 60.43$, $P < .001$]. Conversely, they are less likely (5.3% vs. 28.8%) to confer only a bachelor's degree [$\chi^2(1) = 58.33$, $P < .001$] or to offer a combination of a certificate and an associate degree [2.6% vs. 7.2%; $\chi^2(1) = 6.48$, $P = .01$].

Relationship Between Country and Program Discipline(s)

Program Discipline(s)		In what country is your program located?				Total
		U.S.	Australia	Canada	Other	
Radiography	Count	488	0	5	2	495
	Percent	98.6%	.0%	1.0%	.4%	100.0%
Radiation Therapy	Count	62	0	4	0	66
	Percent	93.9%	.0%	6.1%	.0%	100.0%
Nuclear Medicine	Count	73	0	0	0	73
	Percent	100.0%	.0%	.0%	.0%	100.0%
Other	Count	3	0	0	0	3
	Percent	100.0%	.0%	.0%	.0%	100.0%
Radiography and Radiation Therapy	Count	1	0	0	0	1
	Percent	100.0%	.0%	.0%	.0%	100.0%
Radiography and Other	Count	6	0	0	0	6
	Percent	100.0%	.0%	.0%	.0%	100.0%
Radiography, Radiation Therapy and Nuclear Medicine	Count	0	1	1	0	2
	Percent	.0%	50.0%	50.0%	.0%	100.0%
Total	Count	633	1	10	2	646
	Percent	98.0%	.2%	1.5%	.3%	100.0%

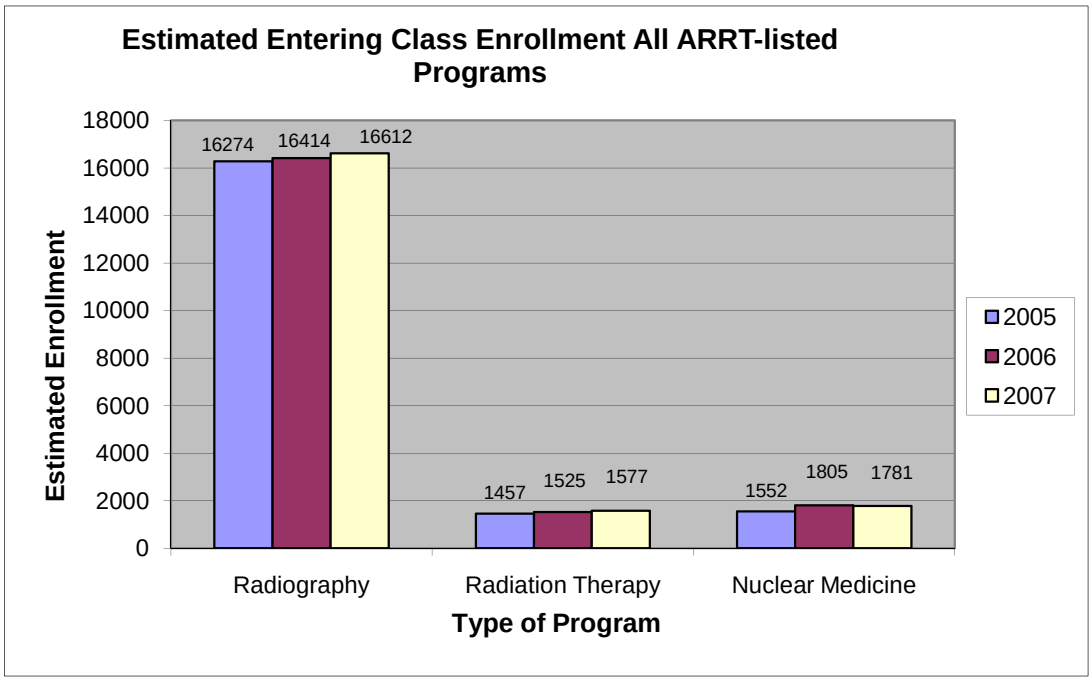
[a] One of the three programs described as "Other" country indicated that their program is located in Puerto Rico. The other two did not specify the "Other" country.

A significantly higher percentage of radiation-therapy-only programs (6.1%) were located outside the U.S. (all but one in Canada) than was true of nuclear-medicine-only and radiography-only programs (0.1%) [$\chi^2(1) = 11.34$, $P < .001$].

ENROLLMENT TRENDS

Entering-Class Enrollments, All ARRT-listed Programs

All three types of radiologic technology programs experienced increased total entering-class enrollments from 2005 to 2007 (as estimated from retrospective reports of those years' enrollments), even though from 2006 to 2007 radiation therapy programs slightly *decreased* in estimated total enrollment by 1.33% :



1. What were your freshman enrollment figures for 2005, 2006 and 2007?
5. What was the attrition rate for your program over the past few years?

			1. How many students entered your program each of the following years?			5. Attrition rate	
Only one program			2005	2006	2007	5. (In percent):	5. (=100% minus attrition for responses > 50%)[a]
Radiography	N	Valid	490	495	495	486	486
		Missing	6	1	1	10	10
	Mean		22.76	22.70	22.79	17.8437	13.5313
	Median[b]		20.18	20.19	20.09	12.3824	11.9926
	Mode		20	20	16	10.00	10.00
	Sum		11153	11238	11280	8672.05	6576.19
	Percentiles[b]	5	6.90	6.69	6.97	.0272	.0272
		25	14.15	14.01	14.24	6.8600	6.5600
		75	29.48	28.93	29.08	20.2500	19.4792
		95	47.00	48.38	47.17	74.1000	31.0333
	Std. Deviation		12.864	12.754	12.705	19.65662	9.47783
Radiation Therapy	N	Valid	65	66	66	64	64
		Missing	1	0	0	2	2
	Mean		12.89	12.92	12.92	15.1963	12.0400
	Median		9.85	9.38	9.73	8.0000	7.6000
	Mode		9	5[a]	7[a]	.00	.00
	Sum		838	853	853	972.56	770.56
	Percentiles	5	1.00	2.65	3.09	.01	.01
		25	6.64	5.88	6.89	2.3333	2.3333
		75	15.21	15.00	14.00	21.5000	19.6667
		95	33.50	33.60	30.40	57.6000	35.7500
	Std. Deviation		12.358	13.481	12.978	19.42547	12.00179
Nuclear Medicine	N	Valid	72	73	73	71	71
		Missing	1	0	0	2	2
	Mean		13.86	13.78	13.49	8.2817	7.4366
	Median		10.44	10.78	10.57	5.8889	5.8889
	Mode		8	6[a]	8	.00	.00
	Sum		998	1006	985	588.00	528.00
	Percentiles	5	4.03	3.77	4.22	.01	.01
		25	7.38	7.04	7.19	.5625	.5625
		75	16.25	15.54	15.19	10.3750	10.3750
		95	35.33	33.50	29.55	30.3000	28.1667
	Std. Deviation		12.588	12.711	12.941	11.83367	8.23373
Other	N	Valid	3	3	3	3	3
		Missing	0	0	0	0	0
	Enrollment figures		12, 20, 32	10, 18, 27	6, 18, 18	0, 5, 10	0, 5, 10
	Mean		21.33	18.33	14.00	5.0000	5.0000
	Median		20.00	18.00	14.00	5.0000	5.0000
	Mode		12[a]	10[a]	18	.00[a]	.00[a]
	Sum		64	55	42	15.00	15.00
	Std. Deviation		10.066	8.505	6.928	5.00000	5.00000

[a] Multiple modes exist. The smallest value is shown.
[b] Calculated from grouped data.

Trends in Mean Entering-class Size as a Function of Modality and Educational Level

A 3 (modality) x 5 (educational level) x 3 (year) ANOVA of differences in mean entering-class size was conducted, with the third factor a repeated-measures (within program) factor. (The analysis was restricted to programs that reported enrollment figures for all three years.)

Averaged across disciplines and educational levels, mean reported entering-class size was between 20.67 and 20.69 each year. This mean changed by less than 0.1%) from 2005 to 2006 and from 2006 to 2007. Unsurprisingly, neither difference is statistically significant at the .05 Bonferroni-correction level, even when the finite-population correction is applied to account for the fact that at least 55% of the population to which the percentages are generalized was included in the sample. Moreover, none of the three program types showed statistically significant year-to-year changes in mean entering-class size, as indicated in the following table:

Modality of Program	Mean Number of Students in Entering Class			Increase 2005 - 2006	Increase 2006 - 2007
	2005	2006	2007		
Radiography (N = 484)	22.64	22.68	22.72	0.04 (0.1%) *P* =. 0.21[a]	0.04 (0.2%) *P* = 0.56
Radiation Therapy only (N = 61)	12.96	12.78	12.75	-0.18 (-1.4%) *P* = 0.39	-0.03 (-0.2%) P =0.63
Nuclear Medicine only (N = 71)	13.88	13.90	13.59	0.02 (0.1%) *P* = 0.82	-0.31 (-2.2%) *P* = 0.40

[a]All *P* values in this table include the finite-population correction.

Number of Programs Experiencing Increase vs. Decrease in Enrollment

"Pure" Program Type	Change in enrollment, 2005 to 2006				Change in enrollment, 2006 to 2007		
	Decreased	Remained the Same	Increased		Decreased	Remained the Same	Increased
Radiography	122	246	122		148	213	133
Radiation Therapy	26	25	14		22	15	29
Nuclear Medicine	24	29	19		25	31	17

The number of radiography programs that reported increases and decreases from 2005 to 2006 was the same (122), but there were more (15) programs reporting decreases than increases from 2006 to 2007. For 2005 to 2006, radiation therapy reported a decrease of enrollment with 12 more decreases, but from 2006 to 2007, this changed with seven more increases being reported. Nuclear medicine programs reported decreases both from 2005 to 2006 (five more decreases than increases) and from 2006 to 2007 (eight more decreases than increases).

Crucial Results from Previous Tables and Graph:

	Year	Total Reported Enrollment	"Pure" Programs Reporting Enrollments	No. of ARRT-recognized programs	Estimated Total, All Programs	Percent Change	All Programs Reporting Enrollments*	Return Rate (% of that year's PDs who responded)*	Sent this year	No. of Programs Reporting Enrollments for 1 or more years*
Radiography	2005	11153	490	715	16274	---	490	68.53%	729	495 (67.9% overall response rate)
	2006	11238	495	723	16414	0.85%	495	68.46%		
	2007	11280	495	729	16612	1.19%	495	67.90%		
Radiation Therapy	2005	838	65	105	1457	---	65	61.90%	122	66 (54.1% overall response rate)
	2006	853	66	118	1525	4.46%	66	55.93%		
	2007	853	66	122	1577	3.30%	66	54.10%		
Nuclear Medicine	2005	998	72	122	1552	---	72	59.02%	132	73 (55.3% overall response rate)
	2006	1006	73	131	1805	14.02%	73	55.73%		
	2007	985	73	132	1781	-1.33%	73	55.30%		

*Includes combination programs that contained this discipline (i.e., a program that contained both radiography and radiation therapy components). Other statistics were based only on single-specialty programs for the specific discipline. Also does not include one program that responded but did not provide enrollment data for that year.

Radiography's 68% return rate was significantly higher than the 55% return rate for nuclear medicine and radiation therapy programs combined ($\chi^2(1) = 14.283$, $P < .001$).

Reports from the program directors who responded to this year's Snapshot (including their retrospective reports on 2005 and 2006 enrollments) indicate that all three program types had minor increases from 2006 to 2007 in total number of programs. However, average entering-class size showed different patterns of change for these three disciplines. Radiography programs' mean class size was essentially constant across this three-year period, leading to a 1% increase in total nationwide entering-class enrollment from 2005 to 2006, followed by another 1% from 2005 to 2006. Radiation therapy programs' small drop in mean entering-class size from 2005 to 2006 was more than offset by the increased number of radiation therapy programs for a net gain of about 4% in nationwide entering-class enrollment. This was followed by another increase of 3% for the 2006 to 2007 entering-class enrollment. Finally, nuclear medicine experienced increases in mean entering-class size in 2006, along with the addition of several new programs in 2006. This led to dramatic increases in total nuclear medicine technology program entering-class enrollment of about 14%. With a slight drop in mean entering-class size from 2006-2007, and with the addition of only one new program in 2007, enrollments dipped about 1% from 2006 to 2007.

Comparison with Enrollment Trends Reported in *Snapshot 2006*

The changes in total entering-class enrollments from 2005 to 2006 reported above are generally consistent with those reported in ASRT's *Enrollment Snapshot 2006* for radiography (.8% based on 2007's retrospective reports vs. .5% reported in *Snapshot 2006*) and nuclear medicine (14% vs. 10.5%). However, the 4.5% 2005-to-2006 increase in total radiation therapy entering-class enrollments computed from this year's report seems at odds with the 3% decrease from 2005 to 2006 reported last year.

This discrepancy could be a result of sampling fluctuation (i.e., due to chance differences between the sample of radiation therapy program directors who responded to this year's *Snapshot* and those who responded to last year's). The 95% confidence interval around this year's estimate of the 2005 total-enrollment figure for radiation therapy programs is ± 199 students – i.e., the true total enrollment in the 105 radiation therapy programs that were in operation in 2005 could be as high as 1,656 students. Had that figure been 1,656, that would have generated an estimated 2005-to-2006 *decrease* of 7.9% in total radiation therapy entering-class enrollment. Coupled with a similarly broad confidence interval around the 2005 enrollment reported in last year's Snapshot, it is uncertain if the difference between last year's and this year's estimates of the 2005-to-2006 increase for radiation therapy programs isn't simply due to sampling variation. It *is* clear that growth in total enrollments in each of the three disciplines has been at a lower rate over the past three years than was the case in the 2001 to 2003 period.

Attrition Rates by Program Type and Educational Level

Attrition as a function of Educational Level

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Certificate only	183	10.4004	8.54915	.63197	9.1534	11.6473
Associate degree only	322	14.9803	10.05077	.56011	13.8784	16.0823
Bachelor's degree only	65	8.7451	8.63857	1.07148	6.6045	10.8856
Certificate and Associate degree	22	10.6500	7.68733	1.63894	7.2416	14.0584
Bachelor's degree combined with Certificate and/or Associate degree	29	8.5548	9.33052	1.73263	5.0057	12.1040
Total	621	12.5246	9.70648	.38951	11.7596	13.2895

Attrition as a function of Program Specialty

"Pure" Program Type	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Radiography	486	13.5313	9.47783	.42992	12.6865	14.3760
Radiation Therapy	64	12.0400	12.00179	1.50022	9.0420	15.0380
Nuclear Medicine	71	7.4366	8.23373	.97716	5.4877	9.3855
Other	3	5.0000	5.00000	2.88675	-7.4207	17.4207
Total	624	12.6438	9.80909	.39268	11.8727	13.4150

The mean attrition rate for programs providing an estimate of attrition was 12.6%. This rate differed significantly as a function of both program type and educational level of the program. In particular, associate-degree-only programs reported significantly higher attrition than the overall mean attrition rate for the remaining four educational levels ($F_{1,618}$ = 16.646, P < .001), which did not differ significantly among themselves. Also, nuclear medicine programs had a significantly lower attrition rate (7.4%) than did radiography (13.5%) and radiation therapy (12.0%) programs ($F_{1,616}$ = 35.153, P < .001), which did not differ significantly. The interaction between program discipline and program educational level was not statistically significant.

Perceived Variability in Attrition Rate

6. Has this attrition rate varied substantially over the past few years?

Responses to the above question were combined into a single variable assessing amount and direction of change in attrition rate, with a "No" response to question 6 coded as zero (no change either direction), except that answering question 6y overrode a "No" response to question 6. "Increased" was coded as +1; "decreased" was coded as -1; and "increased some years, decreased others" was coded as +.01.

6y. If "yes," how has the attrition rate varied?

Direction of change (if any)		Frequency	Valid Percent
	Decreased	62	9.7
	Stayed same	444	69.5
	Increased some years, decreased others	88	13.8
	Increased	45	7.0
	Total	639	100.0
	Missing[a]	9	
Total		648	

[a]Two of these respondents indicated that their attrition rates had varied, but didn't indicate how they had varied.

More than two-thirds of program directors reported that their attrition rates have held steady over the past few years. Among the 17% of programs that reported a consistent trend in attrition rates, 58% reported that attrition rates had declined over the past few years. This slight predominance of decreases over increases (mean on the -1 to +1 scale = -.025) was not statistically significant (even after application of the finite-population correction), nor did it differ significantly as a function of educational level, program discipline or their interaction.

7. About what percent of your program's graduates over the past five years have taken jobs in the U.S. (including U.S. territories and Puerto Rico)?

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
USA	592	97.5664	10.03598	.41248	96.7563	98.3765	.00	100.00
Canada	5	3.6000	4.15933	1.86011	-1.5645	8.7645	.00	10.00
Other[a]	1	95.0000	.	.	.	.	95.00	95.00
Total	598	96.7764	13.15906	.53811	95.7196	97.8333	.00	100.00

[a] This respondent indicated Puerto Rico as being the "Other" country. The Australian program director in the sample did not answer this question.

Note: Two U.S. programs reported that 0% of their graduates (of whom there were approximately 275 over the past five years) took jobs in the United States. An additional four U.S. programs reported that from 7% to 15% of their graduates (of whom

there were approximately 250 over the past five years) took U.S. jobs. It's possible that these six respondents misinterpreted the question as asking for the percentage of graduates taking jobs *outside* the U.S. Without these six outliers, the mean percentage of graduates of U.S. programs who take jobs in the U.S. is 98.48%.

Omitting the six outliers discussed above, a factorial ANOVA yielded a statistically significant difference in mean percentage of students entering the U.S. job market as a function of educational level (finite-population-corrected $F_{4,559} = 5.382$, $P < .001$), but a nonsignificant effect of program discipline and a nonsignificant interaction between discipline and educational level. (Omitting the Canadian programs yields an F for the educational-level effect of 5.388). In particular, associate-only programs had a significantly lower percent (98.0%) of graduates taking U.S. jobs than did the other four educational levels (99.0%,averaged together, finite-population-adjusted $F_{1,573} = 13.718$, $P < .001$). Those other four educational levels did not differ significantly among themselves.

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Radiography	457	98.0269	7.60972	.35597	97.3274	98.7265	.00	100.00
Radiation Therapy	62	94.4516	20.47764	2.60066	89.2513	99.6520	.00	100.00
Nuclear Medicine	70	95.7000	16.10774	1.92524	91.8592	99.5408	7.00	100.00
Total	589	97.3740	10.97373	.45216	96.4860	98.2621	.00	100.00

Radiation therapy and nuclear medicine programs had a significantly lower percent of entry into the U.S. job market (95%) than radiography programs. This can be attributed to a significantly higher percentage of those specialties' programs (6 of 68 = 9%) being located outside the U.S. than is true of radiography (10 of 497 = 2%).

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Certificate	175	98.0360	10.70236	.80902	96.4392	99.6328	.00	100.00
Associate Degree	300	97.9902	5.13602	.29653	97.4067	98.5738	50.00	100.00
Bachelor's Degree	64	92.8438	22.50377	2.81297	87.2225	98.4650	.00	100.00
Total	539	97.3940	10.66781	.45950	96.4914	98.2966	.00	100.00

ARRT vs. NMTCB Certifying Exams

8. If yours is a nuclear medicine program, approximately what percent of your program's graduates over the past two years have taken the ARRT certification exam in nuclear medicine technology vs. the NMTCB certification exam?

		Percent taking ARRT (N) only[a]	Percent taking NMTCB only[a]	Percent taking both exams[a]	Percent taking neither exam[a]
N	Valid	60	60	60	60
	Missing	588	588	588	588
Mean		3.5073	52.6609	42.9151	.9167
Median[b]		60	60	60	60
Mode		11.51083	39.85646	37.88541	4.16723
Std. Deviation		1.1000	63.5000	27.0000	.3448
Minimum		.00	.00	.00	.00
Maximum		80.00	100.00	100.00	25.00
Percent zeroes		3.5073	52.6609	42.9151	.9167

[a] Based on programs reporting nuclear medicine enrollments only.
[b]Calculated from grouped data.

NOTE: This question was apparently somewhat confusing for respondents, as there were 27 nuclear medicine technology program directors whose responses summed to more than 100% and another five whose responses summed to less than 100%. Many of these respondents appear to have missed the "only" qualifier in "ARRT exam only" and/or in "ASRT exam only" or to have interpreted "Both" as "at least one of the two exams." The final analysis was based on the 41 directors reporting only nuclear medicine technology enrollments whose responses summed to 100%, plus another 19 nuclear medicine program directors whose responses seemed interpretable as follows:

Reported Percentage					Percentages as Interpreted and Used in Above Table				Assumption(s) Employed in Interpreting Responses[a]
ASRT only	NMTCB only	Both exams	Neither exam		ASRT only	NMTCB only	Both exams	Neither exam	
6.00	35.00	60.00	Blank		5.94	34.65	59.41	.00	0
5.00	95.00	5.00	.00		.00	90.00	5.00	5.00	1
50.00	50.00	25.00	.00		25.00	25.00	25.00	25.00	1
20.00	100.00	20.00	.00		.00	80.00	20.00	.00	1
25.00	100.00	25.00	.00		.00	75.00	25.00	.00	1
33.00	100.00	33.00	.00		.00	67.00	33.00	.00	1
.	100.00	90.00	.00		.00	10.00	90.00	.00	1
50.00	100.00	50.00	.00		.00	50.00	50.00	.00	1
60.00	80.00	60.00	.00		.00	20.00	60.00	20.00	1
78.00	83.00	61.00	.00		17.00	22.00	61.00	.00	1
100.00	75.00	75.00	.00		25.00	.00	75.00	.00	1
80.00	100.00	80.00	.00		.00	20.00	80.00	.00	1
90.00	100.00	90.00	.00		.00	10.00	90.00	.00	1
100.00	100.00	100.00	.00		.00	.00	100.00	.00	1
90.00	87.50	100.00	.00		12.50	10.00	77.50	.00	2
.00	2.00	17.00	1.00		.00	10.00	85.00	5.00	3
--	100.00	15.00	--		.00	85.00	15.00	.00	4
--	100.00	15.00	--		.00	85.00	15.00	.00	4
50.00	100.00	--	--		.00	50.00	50.00	.00	1 and 4
50.00	100.00	--	--		.00	50.00	50.00	.00	1 and 4

[a] Assumption set 0: Failure to sum to 100% just arithmetic error; divide each by sum of responses.
Assumption set 1: "Only" responses are total taking exam; "Both" = percent taking both exams.
Assumption set 2: "Only" responses are total taking exam; "Both" = percent taking one or both exams.
Assumption 3: Responses are *number* of graduates taking exam, not percent.
Assumption 4: Missing responses omitted because respondent believed they should be obvious to researchers.

Finally, there were 12 response patterns for which no interpretation could be made; these were treated as missing data in the above analyses.

ASRT only	NMTCB only	Both exams	Neither exam
15.00	40.00	13.00	2.00
5.00	20.00	50.00	.
.	.	95.00	.
.	.	98.00	.
.00	100.00	8.00	.00
90.00	10.00	15.00	.
2.00	98.00	16.00	.
10.00	90.00	20.00	.
30.00	50.00	40.00	.00
30.00	100.00	20.00	.
8.00	100.00	66.00	.00
10.00	90.00	80.00	.

Near-term Changes

Capacity for Increase

2a. Is your program currently at full enrollment?

A significantly higher percentage (77%) of associate-degree programs than of certificate-only, baccalaureate-only and combined certificate/associate programs (54%) reported being at full enrollment ($t_{630} = 6.900$, $P < .001$). The relationship between likelihood of being at full enrollment and program type differed significantly after finite-population correction among the five educational levels ($F_{8,609} = 2.058$, $P < .05$) as follows:

Education - 5 levels	Only one program	N	Mean percent: "Yes, our program is currently at full enrollment."
Certificate only	Radiography	144	56%
	Radiation Therapy	19	26%
	Nuclear Medicine	22	55%
	Total	185	52%
Associate degree only	Radiography	295	78%
	Radiation Therapy	18	56%
	Nuclear Medicine	13	85%
	Total	326	77%
Bachelor's degree only	Radiography	26	62%
	Radiation Therapy	18	56%
	Nuclear Medicine	20	65%
	Total	64	61%
Certificate and/or Associate degree	Radiography	13	54%
	Radiation Therapy	4	75%
	Nuclear Medicine	6	33%
	Total	23	52%
Certificate and/or Associate degree and Bachelor's degree	Radiography	12	67%
	Radiation Therapy	3	33%
	Nuclear Medicine	11	45%
	Total	26	54%
Total	Radiography	490	69%
	Radiation Therapy	62	47%
	Nuclear Medicine	72	60%
	Total	624	66%

Overall, 66.5% of programs report being at full enrollment. However, a significantly higher percentage (77%) of associate-degree programs than of the other four educational levels (which did not differ significantly among themselves and had a combined 54.7% reporting full enrollment) report being at full enrollment ($t_{630} = 4.679$, $P < .001$).

Educational Level of Program	N	Proportion at Full Enrollment
Certificate only	187	.524
Assoc only	327	.768
Bachelor's only	68	.618
Certif and assoc	23	.522
Bach + (certif and/or assoc)	30	.567
Total	635	.661

Overall, radiography had a higher percentage of full-enrollment programs (70%) than did radiation therapy and nuclear medicine (54%), [$t_{632} = 5.141$, $P < .001$ after finite-population correction]. However, this difference was in part

an artifact because a much higher percentage of radiography programs (59.6%) than of radiation therapy and nuclear medicine technology programs (22.3%) offer only an associate degree. When controlling for educational level, the difference between radiography and the other two disciplines drops to 63.0% vs. 52.8% and is no longer statistically significant.

2b. [If not at full enrollment,] approximately how many additional students could be accommodated by your program?

Three of the program directors who answered "Yes" to question 2 (i.e., who indicated that their programs *are* at full enrollment) nevertheless reported that their programs could accommodate additional students – in one instance, 76 additional students, more than twice that program's current (full) enrollment. It is likely that these directors were reporting on future capacity for increased enrollment, should constraints such as budget, available clinical sites, etc. be lifted, rather than on the number of students that could have been admitted to their programs this year. The following table therefore omits those three reports in estimating total expansion capacity.

Only one modality	Mean	Std. Deviation	No. of Responses	Total no. of Programs in Population	Proportion of Programs Not at Full Enrollment	Estimated Total Expansion Capacity[a]
Radiography	7.065	9.6348	139	729	30.2%	1,558
Radiation Therapy	6.290	4.8111	31	122	51.5%	395
Nuclear Medicine	6.310	7.2610	29	132	39.7%	331
Total	6.830	8.7055	199	983		2,283

[a] (No. of programs in population) x (proportion not at full enrollment) x (mean no. of additional students)

Unused capacity did not differ significantly across program types (but is listed separately for each program type above to facilitate computation of total expansion capacity; the number of programs of each type in the population is known, but the population distribution of programs' educational levels is not known). Likewise, it did not differ significantly as a function of education level or modality x educational level interaction.

2c. If "yes," approximately how many qualified students did you turn away this fall?

There were 28 program directors who answered "No" to question 2 but indicated by responding to this question that their program had turned away qualified students in varying numbers. Verbatim comments from some of these respondents made it clear that they would have been at full enrollment had it not been for accepted applicants who declined the offer too close to the start of the semester to make it possible to admit any rejected candidates. These 28 responses therefore were included in the following analysis of excess demand.

Only one program	Mean	Std. Deviation	No. of Responses	Total no. of Programs in Population	Proportion of Programs at Full Enrollment	Estimated Excess Demand[a]	Ratio of Qualified Students Turned Away to Total Admitted
Radiography	56.77	56.135	328	729	69%	28,556	1.72
Radiation Therapy	16.24	13.339	25	122	47%	931	0.59
Nuclear Medicine	24.19	24.150	37	132	60%	1,916	1.08
Total	51.08	53.739	390	983		31,403	1.57

[a] (No. of programs in population) x (proportion at full enrollment) x (mean no. of qualified students turned away).

The factorial ANOVA of no. of qualified students turned away as a function of modality and educational level yielded statistically significant effects for type of program, finite-population correction ($F_{2,368} = 11.983$, $P < .001$) and for educational level ($F_{2,368} = 4.160$, $P < .05$), but not their interaction ($F_{4,368} = 2.510$, $P = .08$).

The mean number of qualified students turned away was significantly higher for radiography programs (56.7) than nuclear medicine and radiation therapy programs (21.0), [t_{387} = 4.973, P < .001]. Associate-level programs turned away significantly more qualified students (mean of 58.5 students) than did certificate-only and baccalaureate-only programs (combined mean = 31.0), [t_{384} = 4.855, P < .001]. However, combined certificate/associate programs turned away significantly more students (85.7) than did associate-only programs (finite-population-corrected t_{384} = 3.017, P = .003).

Radiography programs are, on average, larger than nuclear medicine and radiation therapy programs. However, the ratio between total number of qualified students turned away and total fall 2007 entering-class enrollments was substantially higher (1.7) for radiography programs than for radiation therapy (0.6) or nuclear medicine technology (1.1) programs.

3. Do you plan any changes related to enrollment?

			3. Do you plan any changes related to enrollment?			
			Plan to increase	Plan to decrease	Plan to remain the same	Total
Single discipline	Radiography	Count	54	33	408	495
		Percent	10.9%	6.7%	82.4%	100.0%
	Radiation Therapy	Count	12	6	47	65
		Percent	18.5%	9.2%	72.3%	100.0%
	Nuclear Medicine	Count	6	7	60	73
		Percent	8.2%	9.6%	82.2%	100.0%
Total		Count	72	46	515	633
		Percent	11.4%	7.3%	81.4%	100.0%

About 81% of the program directors in these disciplines plan to hold enrollment levels at about their current level. A lower percentage (72%) of radiation therapy program directors than of radiography and nuclear medicine programs (82%) plan to remain the same, finite-population-corrected (χ^2 (1) = 3.913, P < .05). Radiation therapy programs also are significantly more likely (18.5%) to report that they plan to increase enrollment than are the other two types of program (10.6%), finite-population-corrected χ^2 (1) = 8.162, P = .004. In terms of overall inclination to increase enrollment (scored as +1 for "Plan to increase," 0 for "Plan to remain the same" and -1 for "Plan to decrease"), only the main effect of educational level was statistically significant. In particular, baccalaureate-only programs were significantly more inclined to increase enrollments (mean = +.18) than were programs at the other four levels of education (combined mean = -.02, finite-population-corrected t_{628} = 3.979, P < .001). The other four educational levels did not differ significantly among themselves.

4. How viable is your program over the next few years?

Single Modality of the Program	Statistic	4. How viable is your program over the next few years?			
		Will definitely continue to operate	Possibly will be closing	Will be closing	Total
Radiography	Count	486	5	3	494
	Percent	98.4%	1.0%	.6%	100.0%
Radiation Therapy	Count	61	4	1	66
	Percent	92.4%	6.1%	1.5%	100.0%
Nuclear Medicine	Count	70	2	1	73
	Percent	95.9%	2.7%	1.4%	100.0%
Other	Count	3	0	0	3
	Percent	100.0%	.0%	.0%	100.0%
Total	Count	620	11	5	636
	Percent	97.5%	1.7%	.8%	100.0%

Approximately 97.5% of the program directors anticipate that their programs will definitely continue to operate, with 1.7% indicating the possibility of closing. Only 0.8% of all programs (three in radiography, one in radiation therapy and one in nuclear medicine) indicated they will be closing. Radiation therapy program directors were significantly

less likely (92%) to indicate that their programs would definitely continue to operate ($\chi^2(1)= 7.621$, $P < .005$) and significantly more likely (6%) than the other two types of program (1%) to indicate that their programs might be closing ($\chi^2(1)= 8.213$, $P < .005$).

Educational level for programs w/ only one level	Statistic	4. How viable is your program over the next few years?			Total
		Will definitely continue to operate	Possibly will be closing	Will be closing	
Certificate	Count	179	4	4	187
	Percent	95.7%	2.1%	2.1%	100.0%
Associate Degree	Count	322	4	0	326
	Percent	98.8%	1.2%	.0%	100.0%
Bachelor's Degree	Count	64	2	1	67
	Percent	95.5%	3.0%	1.5%	100.0%
Total	Count	565	10	5	580
	Percent	97.4%	1.7%	.9%	100.0%

There were no statistically significant differences, ($\chi^2(4) = 8.070$, P=.089) as a function of educational level.

4y. If your program is closing, how many more years will it continue to operate, including this academic year?

Combined programs	Mean	N	Std. Deviation
Radiography	1.33	6	.816
Radiation Therapy	3.00	3	2.000
Nuclear Medicine	1.33	3	1.528
Total	1.75	12	1.422

Among the 12 program directors who provided an estimate of the years of operation left for their programs, that estimate ranged from zero (those three program having already discontinued operation) to five years.

EDUCATIONAL ISSUE: RESOURCES FOR TEACHING DIGITAL IMAGING

Types of Imaging Systems in Use at Associated Clinical Sites

9. Please indicate what percent of your clinical sites have converted from film-screen imaging to digital-imaging systems.

Percent of clinical sites using:						
		Film-screen imaging	CR	DR	Filmless[b]	Other (Please specify)
N	Valid	565	565	565	581	565
	Missing	83	83	83	67	83
Mean		18.8	64.4	34.7	80.6	1.2
Median[a]		10.0	75.6	20.6	89.8	.0
Mode		.0	100.0	.0	100.0	.0
Std. Deviation		25.51	34.49	35.36	25.73	10.10
Minimum		.0	.0	.0	.0	.0
Maximum		100.0	100.0	100.0	100.0	100.0
Percentiles[a]	5	.1	.2	.0	12.5	.0
	95	82.1	99.9	99.8	99.9	.1
Percent zeroes		37.0	13.1	25.5	3.4	97.9
Percent hundred-percents		3.5	23.0	10.3	35.3	.5

[a] Calculated from grouped data.

[b] Percent filmless = 100 - % film-screen. However, if % film-screen left blank but a percentage entered for at least one of CR, DR, "Other," % filmless was calculated as %CR + %DR + %Other or 100.0%, whichever was smaller.

Responses to request to "Please specify" other image acquisition system by program directors who cited a nonzero percentage of sites using "Other" image acquisition systems:

Response	Frequency	Percent
Blank	3	25.0
Analog/ film-screen	1	8.3
C-Arm	1	8.3
C-arm procedures only	1	8.3
Combination of CR/DR	1	8.3
Digital fluoroscopy	1	8.3
Most of our simulators are not CT-based	1	8.3
Nuclear medicine has been using digital imaging for years and I don't use any of the above terms. 100% of our clinical sites have PACS systems.	1	8.3
PACS	1	8.3
Utilize a combination of CR and DR in their radiography rooms	1	8.3
Total	12	100.0

Responses to request to "Please specify" other image acquisition system by program directors who did not report any sites using "Other" image acquisition systems:

Response	Frequency	Percent
75% of this program's Nuclear Medicine affiliates are currently filmless departments. The physicians read from the computer solely.	1	2.0
100% - combination of CR and DR systems at each site. [No percents listed.]	1	2.0
6 of the 8 CR clinical sites are also DR sites. [Listed 20% screen, 80% CR, 60% DR, Other blank.]	1	2.0
66% of our clinical sites have both CR and DR equipment. [Listed 33% screen, 66% CR, 66% DR. Other blank]	1	2.0
A number of facilities have both CR/DR. [Listed 20% screen, 80% CR, 20% DR. Other blank.]	1	2.0
All digital imaging. [No percents listed.]	1	2.0
All have CR and 3 also have DR systems in certain areas like ER. [Listed 100%CR, 30%DR; other two blank.]	1	2.0
All major clinical sites have converted to digital, however, most have a mix of DR, CR and some have limited use of film-screen imaging. [100%CR; 100%DR; other two blank.]	1	2.0
All of the sites haves converted to CR. 2 have a couple of DR rooms. A couple of sites still have film-screen/processor as a backup, but not the main usage. [Listed 0%screen, 100%CR, other two %s blank.]	1	2.0
By the end of 2007, 80% will be CR; 20% film, but that is supposed to change in 2008. [Listed 40% screen, 60% CR.]	1	2.0
CT Scan, MR, Ultrasound. [Listed 40%screen, 60%DR, other two blank.]	1	2.0
Digital imaging-PACS [Didn't enter any percents.]	1	2.0
Don't know at this time (40 sites) [25% screen, other 3 percents blank]	1	2.0
Do not know what you are asking here! CT? MR? Densitometry? [40% screen, 60% CR, 40% DR, 0% Other]	1	2.0
Film is still used in surgery in all 3 sites. One site only has a DR chest unit. CR is predominate in all 3 sites. [100% CR, 100% DR; other two blank. Interpreted as 100% screen, 100% CR, 100% DR, 0% Other.]	1	2.0
I'm not sure what this question is asking. [No percents listed.]	1	2.0
I am unsure. I don't have time to calculate the percentages right now. Almost all of our affiliates are filmless. We are a nuclear medicine program. [No percents listed.]	1	2.0
I do not know because I teach radiation therapy and most are still using film. [No percents listed.]	1	2.0
I do not know what you mean by CR. About 50% of our clinical sites are now digital. [Listed 50% screen, 50% DR. Other two blank.]	1	2.0
I don't really understand the choices..... All of our clinical rotations are PACS. [Didn't list any percents.]	1	2.0
It is ridiculous that I have to teach my students film-screen when they will never see it. Get it out of the curriculum! We need to move to now! [Listed 0% screen, 100% CR, 100%DR.]	1	2.0
Major site has CR and DR. [Listed 90% screen, 90% CR, other two blank. Since don't know how many sites, couldn't infer % DR, didn't use in calculating relative %s.]	1	2.0

Mammography is film-screen. [Listed 0% screen, 100% CR, 100% DR. Reporting enrollments for radiography program.]	1	2.0
Most of our affiliates have converted to a combination of CR and DR. Approximately 90% of them. [Listed 10% screen, left other percents blank. Interpreted as 10%, 90%, 90%, 0%.]	1	2.0
Most of our sites have a combination of CR and DR. [Listed 10% screen, 90%CR, 90%DR.]	1	2.0
Most radiation therapy departments are digital or plan to go digital in the next few years. [Listed 50% screen; left other percents blank. Didn't use for relative %s.]	1	2.0
Most radiation therapy departments have converted to digital or plan to in the next few years. [Listed 50% screen, other 3 percents blank. Didn't use for relative %s.	1	2.0
Note that the percentages above for the DR also has CR available for students [Listed 14% film-screen, 56% CR,30% DR; Other blank.]	1	2.0
Of the 83%, this represents the percentage of sites that have both CR and DR. [Listed 17% screen, 83% each CR, DR.]	1	2.0
One facility is both CR, but has DR in one room. (25%). [Listed 100% CR, left other percents blank. Didn't use for relative %s.]	1	2.0
One of our CR sites has one room with DR- department is predominantly CR. [50% screen,50% CR,0% DR , blank]	1	2.0
One site has both CR and DR. [7% screen, 93% CR, 7% DR, blank other]	1	2.0
One site has both CR and DR. One more site is converting this year and will be both CR and DR. [12% film-screen, 88% CR, 12% DR, Other blank.]	1	2.0
One site still has film in conjunction to CR due to physician demand. [0% screen, 100% CR, 75% DR. Since don't know how many sites, didn't use for relative % or for % filmless.]	1	2.0
Our largest clinical site has both CR and DR (1/5 sites = 20%). [screen blank, 100%CR,20%DR]	1	2.0
Out of 6 cancer centers: 3 are using film-screen imaging and the other 3 have converted to electronic portal imaging (DR). [50% DR; other percents blank. Interpreted as 50% film-screen, 50% DR, and 0% other two.]	1	2.0
Reason for response above: Two of our clinical site have both CR and DR [0% film-screen, 100% CR, 40% DR, blank Other]	1	2.0
Since we are a hospital-based program, all of our students are able to rotate within the various radiology departments at our hospital. At present, the hospital has converted about 45% to CR/DR systems. [No percents listed.]	1	2.0
Some are using both CR and DR [25% film-screen, 50% CR, 25% DR, Other blank]	1	2.0
The above % equal more than 100 because some facilities have combinations of imaging systems (film-CR, CR-DR, etc). [23% film-screen, 62% CR, 23% DR.]	1	2.0
The simulator is still using film, 80-90% of the rest of the time digital imaging is used, either on board (kV) imaging or portal MV imaging with off line review (ARIA system). Very little hard copy film is used. [No percents entered. Not used for relative %s but interpreted as 15% filmless.]	1	2.0
This is more or less a guess as they are changing faster than we can keep up with what they are doing. [10% film-screen, 60% CR, 30%DR]	1	2.0
Two facilities have a combination of CR and DR [Listed 10% CR, 50% DR, other two blank.]	1	2.0
Two sites have digital fluoro. [Listed 25% film-screen, 75% CR, 50% DR, Other blank.]	1	2.0
Unsure of percentages. Most Ontario hospitals have at least CR and many (over 50%) are fully digital. [No percents listed.]	1	2.0
We actually have only one clinical site. The main department has both CR and DR. We have an on-campus clinic that our students rotate, which only has film-screen imaging. [No percents listed. Interpreted as 50% screen, 50% CR, 50% DR, 0% other]	1	2.0
We are having trouble finding places that are not CR/DR to demonstrate traditional film-screen imaging. It's abstract to them. [0% screen, 100% CR, .02% DR.]	1	2.0
We have not had film for about 7 years [no percents listed]	1	2.0
We have one location (5%) that will be converting to DR in the next 1-1 1/2 years. [Listed 50% screen, 50% CR, others blank.]	1	2.0
We have only one clinical site that supports a combination of CR and DR with about 95% CR and 5% DR [No percents listed; interpreted as 0% screen, 100%CR, 100%DR, 0% neither]	1	2.0
Total	50	100.0

Note: Square brackets enclose percents respondent cited in answering question 9.

The percentage of clinical sites employing the various image-acquisition systems was very different for the three disciplines.

Percent of clinical sites using:							
Only one program	Statistic		Film-screen imaging	CR	DR	"Other" imaging system	Filmless, incl. CR vs. DR breakdown not specified
Radiography	N	Valid	488	488	488	488	494
		Missing	8	8	8	8	2
	Mean		16.89	71.75	31.07	.43	82.46
	Median[a]		9.83	80.00	19.27	.00	89.98
	Mode		.0	100.0	.0	.0	100.0
	Std. Deviation		22.709	28.604	33.207	5.517	23.344
Radiation Therapy	N	Valid	31	31	31	31	34
		Missing	35	35	35	35	32
	Mean		34.39	5.58	59.65	2.42	61.44
	Median[a]		25.00	2.80	73.86	2.42	70.83
	Mode		.0	.0	75.0	.0	100.0
	Std. Deviation		34.579	11.066	35.599	13.470	32.823
Nuclear Medicine	N	Valid	35	35	35	35	42
		Missing	38	38	38	38	31
	Mean		26.29	14.40	61.60	11.14	79.02
	Median		4.50	1.67	85.00	11.25	99.05
	Mode		.0	.0	100.0	.0	100.0
	Std. Deviation		38.565	31.356	43.398	31.508	34.081

[a] Calculated from grouped data.

This question is most relevant to radiography programs. Of those responding, 17% of their associated clinical sites still employ film-screen systems while 82% are completely filmless, with a predominance of CR systems over DR systems. As expected, a majority of radiation therapy and nuclear medicine technology program directors either left this question blank or explicitly said that it was inapplicable to their programs. However, a sufficient number considered the question relevant to show that 61% of radiation therapy programs' associated clinical sites are filmless, with a predominance of DR over CR systems and about 34% still employing film-screen systems. Finally, about 26% of nuclear medicine programs' associated clinical sites still employ film-screen systems, while 79% are filmless and more than four times as many nuclear medicine technology clinical sites employ DR systems as use CR. (The difference between radiography and the other two disciplines with respect to each of percent film-screen, CR, DR, and filmless is statistically significant at the .001 level after application of the finite-population correction. Radiation therapy and nuclear medicine technology programs differ significantly at the .05 level in percent film-screen and at the .01 level in percent filmless.)

The only main effect of educational level that remained statistically significant after controlling for discipline of the program was a tendency for associate-degree programs to be less likely (64%) than certificate and bachelor programs (82%) to have gone filmless. This held for all three disciplines and led to a statistically significant main effect of educational level, ($F_{2,504}$ for this effect = 5.42, P = .005). There also was a statistically significant interaction between discipline and educational level of the program with respect to the percentage of clinical sites employing an "Other" imaging system: The only programs reporting that more than 1 percent of their clinical sites employ an "Other" system were associate-level radiation therapy programs (6.8%) and certificate-level nuclear medicine programs (26.4%), [$F_{4,504}$ for this interaction effect = 13.58, P < .001].

Please specify why [a question about clinical sites' imaging systems is] not applicable:

Response	Frequency	Percent
Blank	607	93.7
As a radiation therapy program these terms are not applicable.	1	.2
Define CR, DR, etc. About 50% of our clinical sites are now filmless - have PACs and physicians read from the computer.	1	.2
Employ both modalities	1	.2

	I couldn't answer for DR/CR as this is a Nuclear Medicine Program.	1	.2
	MR	1	.2
	N/A	1	.2
	Nuclear medicine or Nuclear medicine only or Nuclear medicine technology program.	5	.8
	Not sure %, most use digital, verification films	1	.2
	Nuc Med program (everything is digital)	1	.2
	Nuc Med students do not rotate through radiology; however 100% of nuclear medicine clinical sites have now converted to PACS.	1	.2
	Nuclear Medicine - 100% of our clinical sites have gone film-less but these are not exactly computerized radiography or digital radiography	1	.2
	Nuclear medicine 100% PACS	1	.2
	Nuclear medicine imaging doesn't use the imaging modalities used in radiography	1	.2
	Our Nuclear Medicine Sites have done without negative film for quite a while.	1	.2
	Radiation therapy or Radiation therapy program	8	1.2
	Radiation therapy using digital imaging	1	.2
	Related to the question below we are having a more difficult time giving students access to film in the clinical environment.	1	.2
	Since we are a hospital-based program, all of our students are able to rotate within the various radiology departments at our hospital. At present, the hospital has converted about 45% to CR/DR systems. [No percents listed.]	1	.2
	Some clinical sites use both film-screen and digital	1	.2
	The majority of our radiation therapy clinical sites have converted to the digital imaging format.	1	.2
	Therapy program	1	.2
	This doesn't apply to nuclear medicine. However, all of our affiliates are on PACS. None currently use film-based systems.	1	.2
	This is a radiography question rather than nuclear medicine.	1	.2
	This is only a nuclear medicine only program..	1	.2
	This question does not directly relate to nuclear medicine. All NMT clinical affiliates are either and/or have daily light system.	1	.2
	Unknown	1	.2
	We are a single site program in radiation therapy. We have all digital imaging systems in our center.	1	.2
	We have 10 clinical affiliates. All of them have begun the process of conversion, but none are completely converted except for one. Some are doing CR and some DR. We don't have the specifics on all of them at this time.	1	.2
	With therapy, some accelerators are capable of digital and others are not.	1	.2
	Total	648	100.0

Adequacy of Resource Materials for Instruction in Digital Imaging

10. Do you believe you have adequate resource materials on the topic of digital imaging to adequately prepare instruction?

		Frequency	Percent
	No	380	58.6
	Yes	228	35.2
	Total	608	93.8
	Not applicable	28	4.3
	Missing	12	1.9
Total		648	100.0

A little more than one-third of the program directors who answered this question felt that the resources available were adequate to prepare instruction on digital imaging. This percentage was much lower (33%) among radiography programs than among radiation therapy (52%) and nuclear medicine technology (60%) programs ($\chi^2(1) = 20.071$, $P < .001$). It also was lower (33%) among associate-degree program than among certificate (46%) and baccalaureate (42%) programs ($\chi^2(1) = 8.553$, $P < .01$).

10. If not, what resource materials do you find are lacking in this area?

	Frequency	Percent of Responses	Percent of Respondents
Textbooks	296	46.1%	76.3%
On-campus laboratory equipment	187	29.1%	48.2%
Access to clinical resources for simulation and training	124	19.3%	32.0%
Other	35	5.5%	9.0%
Total Responses	642	100.0%	129.7%
Number who listed one or more needs	388	59.9%	--
Missing	260	41.1%	--
Total Cases	648	100.0%	--

10. If "not applicable," please specify why not applicable:

	Frequency	Percent
BLANK	624	96.3
Have textbooks and access to clinical resources. Also, since film-screen technology is still in use in outpatient clinics and doctors' offices, we think retaining film-screen technology in the campus laboratory is beneficial to the students.	1	.2
I am not radiography	1	.2
MR	1	.2
My radiation therapy program only accepts radiographers. The digital or computerized imaging is expected to be covered in a student's respective radiograph program.	1	.2
Not able to assess. Unless the ASRT curriculum guide has been upgraded, have not seen minimum content specifications for digital course from anyone. We do teach the imaging aspects (LCD, TFT, flat panel, etc)	1	.2
Not required in curriculum	1	.2
Nuclear medicine program or Nuclear medicine or Nuclear medicine technology program	3	.5
Nuclear Medicine - 100% of our clinical sites have gone filmless but these are not exactly computerized radiography or digital radiography and the concerns of radiography are not relevant.	1	.2
Our program is closing in 2008 after 55 years of training technologists due to the JRCERT requirement for program directors to have a master's degree even though we received an eight year accreditation from them on our last site visit, have had 100% pass rate on the Registry exam, and 100% placement of graduates.	1	.2
Plenty of text book material	1	.2
Radiation therapy or Radiation therapy program	4	.6
Radiation Therapy digital imaging	1	.2
Radiation therapy films are not difficult to obtain	1	.2
Regarding question 11: We have a BAS completion degree. Many of those courses are offered online and should be eligible for category A credit.	1	.2
The DR is with CT sim and portal imaging.	1	.2
This is a nuclear medicine program, we have been digitally imaging and archiving for many, many years.	1	.2
This is only a nuclear medicine technology program	1	.2
We are building a new Allied Health Center that will have two CR rooms - 2009 opening date.	1	.2
We have a CR and film-screen energized lab on campus.	1	.2
Total	648	100.0

10. Please specify other resource materials lacking in this area:

	Frequency	Percent
BLANK	575	88.7
Video instruction, subject related CDs,	1	.2
A textbook is being released in October by Elsevier that will meet my needs for digital imaging.	1	.2
Accurate information - some authors contradict each other or lack sufficient information	1	.2
Although we have a CR system, it is old and outdated. We also don't have any DR	1	.2

	equipment. At the moment we get around that by teaching the theory, using the CR in lab and then the students work with both CR and DR when in clinical training.		
	Audio visual-- CD's, etc.	1	.2
	CD- ROMs, DVDs-any sort of supplemental information in addition to the textbooks	1	.2
	Current journal articles written by radiographers/educators.	1	.2
	Digital x-ray equipment in campus lab Not able to simulate or train on campus	1	.2
	Don't have an activated lab for experimentation and teaching	1	.2
	DVD, educational materials	1	.2
	Education for educators	1	.2
	Either textbooks or CD-ROMS or tutorials for students to utilize	1	.2
	Electronic resource material for instructors	1	.2
	Experts to consult (seminars, Websites, etc.) on advanced topics (sampling, quantization, compression, DQE) and standardization of terminology/definitions.	1	.2
	Faculty	1	.2
	Faculty development	1	.2
	Faculty education	1	.2
	Faculty expertise	1	.2
	Have recently purchased DR for on-campus simulation lab	1	.2
	I was able to attend the UNC Digital Radiography for Educators and sent my other full-time faculty as well. Textbooks just don't provide the resources. I've put CR in the capital budget for our lab but I'm not sure if or when we'll get it. I'm concerned about the maintenance required for them.	1	.2
	Instructional materials for students, and more learning opportunities for educators.	1	.2
	Instructor knowledge beyond what the textbooks and minimal hands-on experience provides.	1	.2
	Instructor resources	1	.2
	Instructor seminars and outside resources.	1	.2
	Instructor training and knowledge expectations for the students getting ready to complete ARRT exam.	1	.2
	Instructors need more education on this newer technology in order to teach it to students.	1	.2
	Instruction on teaching	1	.2
	It is not clear what the profession feels we need to know at entry level. Everyone is going off on what he/she "thinks" we need. The profession has not set any standards. Now every one of our clinical affiliations is digital. What are we supposed to make sure the student has knowledge of?	1	.2
	Lab experiments	1	.2
	Lab Manuals for energized lab	1	.2
	Lack of resources to hire additional instructors and secretarial help.	1	.2
	Lectures, workshops and seminars with QUALITY information and understandable dialogue. I do not have a Ph.D. in engineering, I need to be able to process the information, ask questions, and have resources. There is a lot of conflicting information out there you don't know if you are correct or not sometimes.	1	.2
	Local courses for instructors. One faculty attended the course at UNC Chapel Hill; rated it excellent.	1	.2
	Main program site is CR/DR	1	.2
	More PD for instructors	1	.2
	More texts are needed at a level of comprehension and for what is actually being done in clinic.	1	.2
	Need courses for instructor to increase knowledge and comfort level.	1	.2
	New textbooks would also be nice	1	.2
	No CR/DR in our x-ray room on campus	1	.2
	Not enough "simply explained" info for teachers to "teach" to RT students; you have to be a computer "geek" or IT specialist in order to interpret current available learning aides	1	.2
	NOTE: There is reasonably good material in some of the imaging texts (Carlton) and a new dedicated digital text is coming out this October.	1	.2
	Online material, CD's	1	.2
	Online materials	1	.2
	Our 18 clinical sites swiftly changed to CR/DR. We are now at a loss to teach film-screen and we are also challenged by having a nonenergized lab that is somewhat antiquated.	1	.2
	PowerPoint presentations, recording media etc	1	.2
	PowerPoint slides and other teaching aids	1	.2

	Practical experience of instructors with CR/DR; teaching resources	1	.2
	Proper guidance from ARRT/ASRT on the information required for ARRT testing vs. clinical applications.	1	.2
	QC equipment	1	.2
	Quality factors. How do we take what we know about film-screen and adapt it to image analysis in digital imaging.	1	.2
	Software simulation of CR or DR technique for procedures	1	.2
	Specifically in quality control of digital systems and artifacts.	1	.2
	Teaching aids, visuals, PP presentations other than those provided by vendor-specific companies. Need resources students can comprehend.	1	.2
	Teaching media	1	.2
	Teaching resources.	1	.2
	Technologists PROPERLY trained in digital and even CR. Thank goodness I have an amazing staff member who loves CR, DR, PACS, etc... because most information out there in the clinical sites is anecdotal at best and sometimes downright incorrect	1	.2
	Textbooks and Instructors are extremely difficult to find.	1	.2
	Textbooks have not kept up with the detail required for using the new curriculum on digital imaging. There is some info, but not a good comprehensive source. We are putting in a new lab and have asked for CR capabilities. Direct digital imaging equipment is everywhere for us to use for demos, but teaching the theory aspect is more difficult.	1	.2
	The biggest issue is that technology keeps changing and it can be difficult to keep up with the changes. Books can be outdated in a year or two.	1	.2
	The technology was in the hands of technologist prior to showing up in textbooks. Textbooks do not do a good job with practical theory.	1	.2
	There are not many dedicated digital imaging textbooks for technologists published.	1	.2
	There is no QA for determining a repeat analysis for overexposure. No easy way to track. Also there are too many unknowns regarding "S" numbers. If the film is not fully exposed, numbers are not reliable and there is no way to tell how much you need to increase/decrease techniques to solve the number issues. Application reps are now often not radiologic technologists so they just know the engineering aspects.	1	.2
	Treatment planning software	2	.3
	Videos, etc.	1	.2
	We could definitely use a good textbook on digital, but I have sent my instructor to a couple of courses on teaching digital, and she came back from the last one with a lot of hands-on information.	1	.2
	We currently use the Bushong textbook chapters on digital and find it detailed enough (along with some supplemental literature) to adequately educate the students. The cost of implementing and maintaining a digital system in our school lab is still prohibitive at this time.	1	.2
	We do NOT have on-campus equipment period	1	.2
	We have state-of-the-art FUJI DR, but older analog rooms. We are building a new state-of-the-art health sciences building, breaking ground in March 2008. Will have state-of-the-art facility on site in 2 years.	1	.2
	We need a CR/DR lab. We could increase enrollment if we had more clinical sites.	1	.2
	Web-CT materials, tutorials, quizzes	1	.2
	While I have many physicists available, they teach over the head of techs and students. We need more books specifically on digital imaging (the process of creating a digital image, storing and transferring).	1	.2
	Workshops to help those educators who are basically trained in film-screen and have no real clinical or didactic experience in CR/DR except for what they have read or discussed with other instructors.	1	.2
	Total	648	100.0

Category A Continuing Education Courses

11. Does your program offer courses (including Web-based courses) that are approved for Category A continuing education credit?

		Frequency	Percent
	No	478	73.8
	Yes	167	25.8
	Total	645	99.5
	Missing	3	.5
Total		648	100.0

11. If "no," is your program planning to offer courses approved for Category A or A+ continuing education credit?

		Frequency	Percent
	Yes	86	13.3
	No	375*	57.9
	Total	461	71.1
	Missing	187	28.9
Total		648	100.0

*Seven respondents who answered “no” to this question answered “yes” to their program offering courses that are approved for Category A continuing education credit.

To examine discipline and educational-level differences in responses to these two questions, a combined intention-to-offer-Category A-credit variable was constructed, with this variable set to 1 if the respondent answered “Yes” to question 11, 0 if the answer to question 11 was “No” and the answer to question 11 was “No” or missing, and .5 if the answer to question 11 was “No” and the answer to question 11 was “Yes.” The factorial ANOVA on this combined variable yielded statistically significant effects (after applying the finite-population correction) for program discipline and educational level, but not for their interaction, as shown by the following two tables:

Discipline * Intention to offer Cat A or A+ CE Crosstabulation

Discipline		Intention to offer Cat A or A+ CE			Total	Mean Intention to Offer[a]
		Don't and don't plan to	Don't offer, but planning to	Currently offer Cat A		
Radiography	Count	299	68	129	496	.3286
	Percent	60.3%	13.7%	26.0%	100.0%	
Radiation Therapy	Count	48	4	13	65	.2308
	Percent	73.8%	6.2%	20.0%	100.0%	
Nuclear Medicine	Count	41	12	20	73	.3562
	Percent	56.2%	16.4%	27.4%	100.0%	
Total	Count	388	84	162	634	.3218
	Percent	61.2%	13.2%	25.6%	100.0%	

[a] 1 = currently offer; 0.5 = don’t, but planning to; 0 = don’t and don’t plan to.

Radiation therapy programs are the most likely (74%) to neither offer nor plan to offer Category A or A+ credits, as compared to nuclear medicine and radiography programs (60%) [$\chi^2_1 = 11.032$, $P < .001$ after finite-population correction]. They also have a significantly lower mean intention to offer than do the other two types of program, finite-population-corrected $t_{631} = 2.809$, $P = .005$.

Education - 5 levels * Intention to offer Cat A or A+ CE Cross-tabulation

Educational Level of Program	Statistic	Intention to offer Cat A or A+ CE: Don't and don't plan to	Don't offer, but planning to	Currently offer Cat A	Total	Mean Intention to Offer[a]
Certificate only	Count	131	13	42	186	.2608
	Percent	70.4%	7.0%	22.6%	100.0%	
Associate degree only	Count	191	51	85	327	.3379
	Percent	58.4%	15.6%	26.0%	100.0%	
Bachelor's degree only	Count	34	8	24	66	.4242
	Percent	51.5%	12.1%	36.4%	100.0%	
Certificate and/or Associate degree	Count	13	2	8	23	.3913
	Percent	56.5%	8.7%	34.8%	100.0%	
Certificate and/or Associate degree and Bachelor's degree	Count	16	9	5	30	.3167
	Percent	53.3%	30.0%	16.7%	100.0%	
Total	Count	385	83	164	632	.3252
	Percent	60.9%	13.1%	25.9%	100.0%	

[a] 1 = currently offer; 0.5 = don't, but planning to; 0 = don't and don't plan to.

Certificate-only programs are significantly more likely (70%) than the other four educational levels (57%; no significant differences among those 4 levels) to neither offer nor plan to offer Category A credit. They also have a significantly lower mean intention to offer Category A credits (0.26 on the 0 to 1 scale) than do the other four levels (.352, $t_{627} = 3.504$, $P < .001$) after finite-population correction.

11. If "yes," who takes those courses? (Check all that apply.)

	Responses: N	Responses: Percent	Percent of Cases: N
Students enrolled full time in the program	74	30.3%	43.8%
Students enrolled in your institution's continuing education program	26	10.7%	15.4%
Other R.T.(s) seeking continuing education credit	144	59.0%	85.2%
Total	244	100.0%	144.4%

The percentage of programs offering Category A credit courses to these three groups differed significantly as a function of program discipline, but not as a function of educational level of the program:

Program type	N	Percent of Programs That Offer Courses Carrying Category A Continuing Education Credit to …: Students enrolled full-time in program	Students enrolled in institution's continuing ed program	Other R.T.s seeking continuing education credit	Only full-time students in program	Only those *not* enrolled FT in program
Radiography	131	37.4%	15.3%	90.8%	5.3%	62.6%
Radiation Therapy	13	69.2%	7.7%	61.5%	38.5%	30.8%
Nuclear Medicine	20	65.0%	15.0%	65.0%	25.0%	35.0%
Total	164	43.3%	14.6%	85.4%	10.4%	56.7%
Chi-square (1 *df*) for Radiography vs. Radiation Therapy, Nuclear Medicine		9.194 (20.790, $P < .001$ after fpc)	0.209	15.615, $P < .001$	17.674, $P < .001$	9.194 (20.790, $P < .001$ after fpc)

Among programs offering courses carrying Category A continuing education credits, radiography programs differed statistically significantly from radiation therapy and nuclear medicine programs (which did not differ significantly) in that radiography programs were less likely to offer courses carrying Category A credit to their own full-time students

(and thus more likely to offer such courses only to those outside their program), were less likely to offer Category A courses only to their own full-time students, and more likely to offer such courses to “other R.T.s seeking continuing education credit”. There were no differences among program types in the percent that offered Category A courses to students enrolled in their institutions’ continuing education programs.

IS THE GAP CLOSING?

To be more specific, if 2007 first-year enrollment figures are maintained, will the profession meet the need for additional R.T.s between 2004 and 2014 projected by the BLS? Our answer to this question assumes that each of the following factors remain constant for the three radiologic technology disciplines between now and the end of 2014:

- Total first-year enrollment rates in each discipline.
- Attrition rates, i.e., the percentage of first-year students who ultimately graduate from these programs.
- Pass rates, i.e., the percentage of graduates who pass an ARRT primary certification exam on the first attempt.
- Discipline retention profile, i.e., the ratio of number of R.T.s whose primary sphere of employment is within the discipline to the number of R.T.s who passed the certification exam one, two, …, ten years ago.
- For nuclear medicine, the percentage of program graduates who choose to take the ARRT (N) exam, the NMTCB exam, or both.

In addition, it is assumed that these estimates, which are based on currently available data, are accurate. These assumptions can be referred to collectively as "steady-state" assumptions. Using radiography as an example, some detail is shown below as to how the various statistics were estimated and then combined to predict the 2014 supply of radiographers. Briefer summaries of the calculations for the other two specialties follow. Where multiple estimates of the same statistic are available (e.g., enrollment figures for 2002 as reported directly in the 2002 *Snapshot* and retrospectively in the 2003 and 2004 *Snapshot*s), the simple average of the estimates is employed.

Radiography

BLS projects that 76,000 additional radiographers will be needed between 2004 and 2014. Given the estimate of 16,612 students entering radiography programs in 2007, together with respondents' estimated attrition rate of 13.5% and a 90.5% pass rate for the certification exam, this discipline would appear to be adding new radiographers to the profession at a rate of 13,045 per year.

However, not all new radiographers still will be practicing radiography in 2014. How many of a given year's new radiographer cohort remain in the profession for one, two, … ten years? The ARRT database provided information to determine the number of registered R.T.s who in early September 2007 listed radiography as their primary area of employment and who had been working in radiography for less than one year, one to three years, etc. For determining projections, the number of R.T.s who passed the radiography certification exam for the first time (a close equivalent to the number of R.T.s who graduated from a radiography program) each year from 1996 to 2006 was used, supplemented by the 13,045 passes in 2007 estimated from this year's Snapshot data. This information provides the following estimate of the overall retention profile for radiographers:

Year	No. of First-Time Certificants	No. in Radiography for X Years as of 9/2007	No.Reporting ___Years in Radiography as of 9/2007	Percent Retained
2007(est.)	13,045	.25(12,725) + .75(13,045) = 12,965	< 1 year: 7650	59%
2006	12,725	.75(12,725) = 9544		
2005	11,800	11,800	1-3 years: 19,875	19,875/31,876
2004	10,532	10,532		= 62%
2003	8530	8530	4-5 years: 9161	9161/15,751
2002	7221	7221		= 58%
1997-2001	7848, 7356, 6684, 6341, 6564	36,808	6-10 years: 15,632	= 45%

Similar retention profiles were computed based on demographic data supplied by ARRT in late August or early September of 2003 – 2006 and March 2002. Despite being based on somewhat different cohorts of radiographers (e.g., about one-third of the radiographers who fell into the 1-3 years category in September 2006 fell into the 4-5 years category in September 2007), the retention percentages were generally comparable to those given above.

Therefore, the six retention profiles[1] were averaged to increase the reliability of the retention-percentage estimates, as follows:

No. of Years in Radiography	Percent of New-Certificant Classes Still in Field After That Many Years
< 1 year	56%
1-3 years	70%
4-5 years	60%
6-10 years	40%

Assuming that this profile holds true for the radiography cohort of 2004 and subsequent cohorts, it can be expected that, on average, approximately 40% of radiographers who were first-time certificants between 2004 and 2008 would still be practicing radiography as their primary discipline in 2014; 60% of the classes of 2009 and 2010 would still be practicing radiography in 2014; about 71% of the classes of 2011, 2012, 2013 and 61% of the class of 2014 would be practicing at the end of 2014. ARRT's 2004-2006 Reports of Exams state that the class of 2004 consisted of 10,532 new certificants; the class of 2005, 11,800; the class of 2006, 12,725. Estimates are that the class of 2007 will include 13,045 new certificants (16,664 students who are estimated to have entered radiography programs in 2005, decreased by a 13.5% attrition rate and a 9.5% exam failure rate), while 2008 will see 13,205 new radiographers. Further, the new-certificant class of 2009 (and, under steady-state assumptions, each subsequent class) should consist of approximately 13,004 new radiographers. Combining these figures with the above retention profile leads to an estimate of 61,307 (the number of new radiographers certified in 2004 – 2008) x .40 + 26,008 x .60 + 39,013 x .70* + 13,004 x .56* = 74,726 additional radiographers by the end of 2014. However, this year's estimate shows that an average of 2.0% of new ARRT (R) certificants take jobs outside the U.S., so between 2004 and 2014 a total estimated 73,201 radiographers — about 3.7% short of the BLS-estimated need – will have been added to (and remain in) the U.S. labor pool of radiographers. Note that 11% of radiography program directors plan to increase their enrollments; 7% plan to decrease them.

Radiation Therapy

BLS projects that 7,000 radiation therapists will be needed between now and 2014. The ARRT 2004-2006 Reports of Exams state that the classes of 2004 - 2006 consisted of 813, 841 and 963 new certificants, respectively, and it is estimated that the class of 2007 will number 1,089 new certificants (1,393 students who are estimated to have entered radiation therapy programs in 2005, decreased by a 12.0% attrition rate and an 11.2% exam failure rate), while 2008 will have 1,102 new radiation therapists. Further, the new-certificant class of 2009 (and, under steady-state assumptions, each subsequent class) should consist of approximately 1,232 new therapists. Combining these figures with the retention profile estimated for radiation therapists leads to an estimate of 4,807 (the number of new radiation therapists certified in 2004 – 2008) x .93 + 2465 x 1.15 + 3697 x .99* + 1232 x .65 = 11,604 additional radiation therapists by the end of 2014. However, an average of 5.5% of new ARRT (T) certificants take jobs outside the United States. This means that between 2004 and 2014 a total of about 10,960 radiation therapists will have been added to (and remain in) the U.S. labor pool of radiation therapists, thereby exceeding the BLS-projected need in this modality by about 57%. Note that 18.5% of radiation therapy program directors plan to increase their enrollments – about twice the 9.2% who plan decreases.

The number of ARRT certificants whose primary sphere of employment in September 2007 is radiation therapy and who have been practicing in this discipline for 4 - 5 years is 15% greater than the number of radiation therapists who passed the radiation therapy certification exam in 2002 or 2003 (i.e., 4 - 5 years ago), so a multiplier of 1.15 was used in computing the number of 2009 and 2010 new (T) certificants who will be practicing at the end of 2014. This excess is probably due to repeat examinees and to migration into radiation therapy from other modalities (e.g., radiography).

[1] Since the "< 1 year" and "1-3 years" retention rates as calculated each year were based in part on Snapshot-based estimates of number of passes of the exam that year, those two rates were recalculated for 2002 through 2006 based on the subsequently known number of passes for each of those years, before being averaged with the estimated 2007 < 1 and 1-3 retention rates.

Nuclear Medicine Technology

BLS projects a need for 7,000 nuclear medicine technologists to meet increased demand and attrition between 2004 and 2014. The ARRT 2004-2006 Reports of Exams state that the classes of 2004-2006 consisted of 448, 531, and 590 new ARRT certificants, respectively. However, there were also 1062, 1244, and 1298 individuals who passed their initial NMTCB certification exam in 2004 - 2006 (personal communications from NMTCB, 3/04/06 and 2/16/07). Since many prospective nuclear medicine technologists take both certification exams, each year's new-certificant class numbers somewhere between the NMTCB number (since that's been the higher number since at least 1997) and the sum of the NMTCB and ARRT numbers.

Estimating the degree of overlap between ARRT and NMTCB registrants in any given year is difficult. The ratio between number of ARRT and number of NMTCB examinees has changed substantially over the years (dropping from .67 in 1997 to .61 in 1999 and then holding steady at around .40 from 2000 through 2005), suggesting that the degree of overlap has also varied over the years. However, this year and in 2006, the Snapshot asked nuclear medicine technology program directors to estimate the percentage of their graduates "over the past two years" who have taken the ARRT exam only, the NMTCB exam only, both, or neither. From these figures the percentage of nuclear medicine technology examinees who took both exams was estimated at 33.4% in 2005, 40.0% in 2006, and 46.6% in 2007. Applied to the known number of the two types of examinees who passed the exam in 2005 and 2006, this provides an estimate that 1,320 nuclear medicine technologists were newly certified in 2005 and 1,348 were certified in 2006. For 2007, 2008, and 2009 the number passing the ARRT and NMTCB exams is not yet known so only reported attrition rates and the 2006 pass rates can be applied to the 2005, 2006, and 2007 entering-class enrollments (estimated from the 2005 – 2007 Enrollment Snapshots). These calculations lead to an estimate of a 2007 new-certificant class size of 1,455, a 2008 new-certificant class numbering 1,594, and 1,479 newly certified nuclear medicine technologists in 2009. Under steady-state assumptions, that same number of 1,479 individuals should pass their nuclear medicine certification exam(s) for the first time in each of 2010 through 2014. That leaves the 2004 total number of new certificants unestimated. However, since the ratio of ARRT examinees to NMTCB examines in 2004 was almost identical to that same ratio in 2005, it seems reasonable to assume that the percentage of examinees who took both exams in 2004 was very close to the 2005 figure of 34.4%, leading to an estimated total of 1,124 new nuclear medicine certificants in 2004.

Before ARRT certificant and years-in-discipline figures can be used to estimate the retention profile for nuclear medicine technologists, the total number of new nuclear medicine certificants for each year from 1997 through 2003 must be estimated. (These estimates are available for 2004 forward.) It can be shown that the total number of certificants in a given year equals the sum of the ARRT and NMTCB numbers, divided by (1 + proportion of examinees who took both exams). A MIRODA match of the ARRT and NMTCB databases in 2000 showed at that time that the percentage of nuclear medicine technologists certified by both ARRT and NMTCB was about 55% -- considerably higher than the 34% to 46% observed from 2005 through 2007. Assuming (based on the observed pattern of the ARRT to NMTCB ratio) that the percentage of examinees taking both exams was 55% from 1997 through 1999 and was linearly related to the ARRT/NMTCB ratio from 2000 through 2004 enables an estimate of the total number of new nuclear medicine technologist certificants for every year from 1997 through 2007.

Combining these certificant numbers with current ARRT certificant and years-in-discipline information for nuclear medicine technologists provides an estimate of the number of ARRT certificants primarily employed in nuclear medicine technology for less than a year of about 35% of the number of first-time certificants in this cohort. The assumption also reveals that the number after 1-3 years is about 52% of the number in the first-time certificant classes for those years, that the number of ARRT-registered R.T.s who have practiced nuclear medicine for four to five years is about 61% of the number who took the primary exam and passed it for the first time four or five years earlier, and that ARRT registrants who have been in the discipline for six to 10 years would be, on average, 62% of first-time certificants in the corresponding five-year time slot. However, the ratio of total (ARRT and/or NMTCB) new certificants to ARRT certificants changed considerably over the time period. [That ratio can be shown to equal the ratio of (1 + #ARRT/#NMTCB) to (1 + proportion taking both exams).] Thus to get the best estimate of the percentage of new certificants (ARRT and/or NMTCB) in each cohort (those nuclear medicine technologists who entered the profession 6-10, 4-5, 1-3, or < 1 years ago) who remain in the profession today requires multiplying the above ARRT retention percentages by the average ratio of total certificants to ARRT-registered certificants that prevailed during that block of years. Doing so leads to estimated retention percentages for all registered nuclear medicine technologists of about 62% the first year, 94% years 1-3, 145% 4-5 years later, and 114% in the 6-10 years post-initial-exam time block.

Thus, steady-state assumptions produce an estimate that 16,930 additional ARRT- and/or NMTCB-registered nuclear medicine technologists would be practicing in the profession by the end of 2014. Since 95.6% of graduates of nuclear medicine technology programs take jobs in the U.S., this suggests that about 16,180 registered nuclear medicine technologists (about 8,781 of them ARRT-registered) will have been added to and retained in the U.S. labor pool between 2004 and 2014 – more than double the BLS-estimated need for additional nuclear medicine technologists.

Uncertainties in Projections

These projections are subject to a high degree of uncertainty. First, there is statistical uncertainty. The 95% confidence intervals (CIs) around the estimated total entering-class enrollment for 2007 in these three disciplines are ± 464 students for radiography, ± 275 for radiation therapy and ± 267 students for nuclear medicine technology. (The CIs around enrollment figures for 2004 - 2006 are narrower, since they are averages of estimates from more than one annual *Snapshot*.) There also is statistical uncertainty in the estimate of the attrition rate for each type of program.

Producing even more uncertainty are the possible systematic changes in enrollment rates and attrition rates (e.g., 11% of radiography program directors plan to increase their enrollments in the near future, potential variations in number of applicants due to changes in reimbursement rates for radiologic procedures, etc.). Moreover, the retention profiles (i.e., ratios between number currently practicing in a discipline and those who passed their initial certification exam in that discipline a certain number of years earlier) calculated each year are based on calculating backward from a single point in time (e.g., early September 2007) and might not be representative of what will happen to the 2004 to 2014 new-certificant cohorts.

Overall, however, our best current estimate is that radiation therapy is producing new practitioners at about 57% above the rate needed to meet the 2014 demand estimated by BLS, while nuclear medicine will more than double the estimated need and radiography is likely to come up somewhat short (by about 4%) of the projected demand unless enrollments and/or retention rates are changed.

APPENDIX:

QUESTIONNAIRE AND COVER LETTER

[ASRT logo]

September, 2007

Dear Program Director:

As director of an educational program in radiography, radiation therapy or nuclear medicine technology, you are both affected by and have a major influence on the supply of radiologic technologists in those professions. For you and your fellow program directors to make informed decisions about your program enrollment levels and for the profession to anticipate the effects of those decisions on the number of professionals who will be needed in coming years, it is necessary to have accurate estimates of educational program enrollments.

In each of the past six years at least 65 percent of program directors in radiography, nuclear medicine technology and radiation therapy participated in ASRT's enrollment surveys. This enabled us to provide the first hard evidence that the downturn in new enrollment had been reversed. It also has helped us to estimate whether current rates of enrollment, attrition and retention within the work force will enable each discipline to meet the need for additional technologists and therapists projected by the Bureau of Labor Statistics through 2012 and 2014. We now need to determine whether the upswing in enrollments is continuing or has leveled off, as appeared to be the case for radiography and radiation therapy the past two years. We also need to update our estimates of how each specialty is meeting the need for technologists.

I would appreciate your participating in the 2007 enrollment survey at your earliest convenience, so that ASRT can put together a quick, accurate snapshot of enrollment trends. You can do this by going to www.asrt.org/content/surveys/enr_snapshot_2007.html to complete the questionnaire online. Please use this online route if possible; this gets your feedback to us more quickly and minimizes administrative data entry errors. If, however, you would find a hardcopy questionnaire much more convenient, an e-mail note or phone call to Research Manager John Culbertson (800-444-2778, X-1297 or jculbertson@asrt.org) will get a printed questionnaire and a postage-paid reply envelope on their way to you.

We will summarize the data from programs in each discipline and the results will be made broadly available. Individual programs will not be identified.

We would, of course, be interested in additional comments you might wish to share about the trends and issues addressed by the questionnaire. However, we would prefer that you respond with the figures requested by the questionnaire as soon as possible and then send additional comments separately to John Culbertson by mail or e-mail at jculbertson@asrt.org.

Thank you very much for your help in gathering this vital information.

Sincerely,

Sal's signature

asrt
American Society of Radiologic Technologists
15000 Central Ave. SE, Albuquerque, NM 87123-3917 • 505-298-4500 • 800-444-2778 • Fax 505-298-5063 • www.asrt.org

RADIOGRAPHY, RADIATION THERAPY AND NUCLEAR MEDICINE ENROLLMENT SURVEY

FALL 2007

If possible, please respond via an electronic version of the questionnaire at
www.asrt.org/content/surveys/snapshot2007

Indicate your type of program.
- O Radiography
- O Radiation therapy
- O Nuclear medicine technology
- O Other (Please specify_____)

What is the educational level of your program?
- O Certificate
  - If yours is a certificate program, do you have an articulation agreement with a community college?
    - O Yes O No
- O Associate degree
- O Bachelor's degree
- O Other (Please specify_____)

In what country is your program located?
- O USA O Australia O Canada
- O Other (Please specify_____)

Please help us document overall trends in enrollment during the past three years.

Note: If yours is a multiple-discipline program, or includes multiple educational levels, please submit responses to questions 1 through 7 separately for each of the types and educational levels represented within your program. You may make copies of this form for this purpose. For a small number of subprograms, add lines to a single copy of the questionnaire.

1. How many students entered your program each of the following years? (A student is considered to have entered a program once he or she is admitted to that program. This may be after a year or more of general course work.)
   2005 ☐☐☐ 2006 ☐☐☐ 2007 ☐☐☐

2. Is your program currently at full enrollment?
   O Yes O No
   If "no," approximately how many additional students could be accommodated by your program? ☐☐☐
   If "yes," approximately how many qualified students did you turn away this fall? ☐☐☐

3. Do you plan any changes related to enrollment?
   - O Plan to increase
   - O Plan to decrease
   - O Plan to remain the same

[A few more questions are on the back of this page.]

4. How viable is your program over the next few years?
O Will definitely continue to operate
O Possibly will be closing
O Will be closing
If your program is closing, how many more years will it continue to operate, including this academic year? ☐☐

5. What was the average attrition rate for your program over the past few years (percentage of entering students who did not complete the program)?
Attrition rate ☐☐%

6. Has this attrition rate varied substantially over the past few years?
O Yes O No
If "yes," how has the attrition rate varied?
O Increased O Decreased O Increased some years, decreased others

7. Over the past five years, what percent of your program's graduates have taken jobs in the United States, including U.S. territories and Puerto Rico?

☐☐☐% **or** O Don't know

8. If yours is a nuclear medicine program, approximately what percent of your program's graduates over the past two years have taken the ARRT certification exam in nuclear medicine technology vs. the NMTCB certification exam?

ARRT exam only ☐☐☐% NMTCB exam only ☐☐☐% Both ☐☐☐% Neither ☐☐☐%

Next, please provide any feedback on the following three aspects of education in the radiologic sciences.

9. Please indicate what percent of your clinical sites have converted from film-screen imaging to digital-imaging systems.
Film-screen imaging ____% CR ___% DR ___% of this program's clinical sites
Other imaging system (Please specify_____) ___% of sites
O Not applicable. (Please explain why not applicable._____)

10. Do you believe you have sufficient resource materials on the topic of digital imaging to adequately prepare instruction?
O Yes O No
If not, what resource materials do you find are lacking in this area?
O Textbooks
O On-campus laboratory equipment
O Access to clinical resources for simulation and training
O Other (Please specify_____)
O Not applicable. (Please explain why not applicable._____)

11. Does your program offer courses (including Web-based courses) that are approved for Category A continuing education credit?
O Yes O No
O If so, who takes those courses? (Check all that apply.)
O Students enrolled full time in the program.
O Graduates of the program.
O Students enrolled in your institution's continuing education program.
O Other R.T.(s) seeking continuing education credit.
O If not, is your program planning to offer courses approved for Category A or A+ continuing education credit? (A+ credits are approved for the radiologist extender.)
O Yes O No

Thank you very much for your help. Please return the survey in the enclosed business-reply envelope to:

Richard Harris, Director of Research
ASRT
Research Department
P.O. Box 51060
Albuquerque, NM 87181-9980

Update to

ENROLLMENT SNAPSHOT OF RADIOGRAPHY, RADIATION THERAPY AND NUCLEAR MEDICINE PROGRAMS, FALL 2007: TECHNOLOGISTS ADDED 2006-2016

A Nationwide Survey of Radiology Department/Facility Managers and Directors
Conducted by
The American Society of Radiologic Technologists

Updated February 2008

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BACKGROUND AND OBJECTIVES

The seventh in a series of annual reports from the ASRT on class enrollments in educational programs for radiographers, radiation therapists and nuclear medicine technologists (www.asrt.org/media/pdf/research/Snapshot2007Report_Final.pdf) provided estimates of the number of technologists in each discipline that would be added to and retained in the U.S. work force between 2004 and 2014 if fall 2007 trends continued. After those analyses were completed, the Bureau of Labor Statistics (BLS) released projections for the number of technologists needed between 2006 and 2016 to meet increased demand and to replace technologists who leave the labor force during this time. This addendum provides supply-side projections for comparison with the most recent set of BLS demand-side projections.

HAS THE GAP CLOSED?

Updated to Relate to BLS Demand-Side Projections for 2006-2016

To be more specific, if 2007 first-year enrollment figures are maintained, will the profession meet the need for additional radiologic technologists between 2006 and 2016 projected by the BLS? The following projections for the 2006-2016 period were obtained employing data and methods that are detailed in the original *Enrollment Snapshot of Radiography, Radiation Therapy and Nuclear Medicine Programs, Fall 2007*, which estimated the number of technologists who would be added to and retained in the work force between 2004 and 2014.

Radiography

The BLS projects that 56,000 additional radiographers will be needed between 2006 and 2016. This is 20,000 fewer radiographers than its estimate for the 2004-2014 period. The ASRT estimates that, if fall 2007 enrollments, graduation rates and retention rates continue, 74,650 radiographers – 133% of the BLS-estimated need – will be added to and remain in the U.S. labor pool of radiographers between 2006 and 2016.

Radiation Therapy

The BLS projects that 6,000 additional radiation therapists will be needed between 2006 and 2016. This is 1,000 fewer radiation therapists than the need BLS projected for the 2004-2014 period. The ASRT estimates that, if current trends continue, –about 11,447 radiation therapists – 191% of the BLS-estimated need – will be added to and remain in the U.S. labor pool of radiation therapists between 2006 and 2016.

Nuclear Medicine Technology

The BLS projects a need for 6,000 nuclear medicine technologists to meet increased demand and attrition between 2006 and 2016. This is 1,000 fewer nuclear medicine technologists than the need BLS projected for the 2004-2014 period. As pointed out in the original *Enrollment Snapshot 2007* report, projecting nuclear medicine technologist supply is complicated by the fact that there are two routes to certification as a nuclear medicine technologist: the American Registry of Radiologic Technologists certification examination and the exam administered by the Nuclear Medicine Technologist Certification Board. Under the same assumptions that were used in the original report, we estimate that the profession will add and retain about 16,972 additional nuclear medicine technologists between 2006 and 2016

(9,227 of them ARRT-registered) – 183% more than the BLS-estimated need for additional nuclear medicine technologists.

Uncertainties in Projections

Readers should re-examine this section of the original report before making any decisions based on the estimates in the original report and in this update.

Overall, however, the best current estimate is that radiography programs are producing new practitioners substantially above the rate to meet the 2006-2016 demand estimated by BLS, while radiation therapy programs will almost double and nuclear medicine programs will almost triple the BLS-projected demand unless enrollments or retention rates within educational programs or within the discipline are decreased.