ENROLLMENT SNAPSHOT OF RADIOGRAPHY, RADIATION THERAPY AND NUCLEAR MEDICINE PROGRAMS

2004

A Nationwide Survey of Program Directors

Conducted by

The American Society of Radiologic Technologists.

Reported December 2004

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EXECUTIVE SUMMARY

In September 2004, 906 questionnaires were sent to every radiography, radiation therapy and nuclear medicine program listed by the American Registry of Radiologic Technologists. An electronic version of the questionnaire also was sent to 887 program directors for whom the American Society of Radiologic Technologists had e-mail addresses. The return rate of 619 of 906 questionnaires represented an overall response rate of 68%. Sixty-five program directors chose to respond by e-mail, 160 chose to respond online at the ASRT Web site, and the remaining 394 chose to mail their surveys to ASRT. As of Oct. 29, 2004, 471 of 684 (67%) radiography programs, 59 of 105 (53%) radiation therapy programs, 69 of 117 (57%) nuclear medicine technology programs, 9 mixed/other programs and 11 programs of unspecified type had responded.

Summary of Data:

Entering-class radiography, radiation therapy and nuclear medicine enrollment increases noted in the 2002 and 2003 enrollment snapshot were repeated from 2003 to 2004. Information from program directors of about two-thirds of ARRT-listed educational programs in these specialties estimates fall 2004 first-year enrollments at 15,683 radiography students, 1,513 radiation therapy students and 1,633 nuclear medicine technology students.

Overall, 77.5% of program directors reported full enrollment in fall 2004 compared to 75% of program directors who reported full enrollments in fall 2003, about 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 32,763 students, while programs not at full enrollment reported unused capacity totaling only 1,594 students. About 12.4% of radiography program directors, 8.6% of radiation therapy program directors and 17.6% of nuclear medicine program directors reported that they plan to increase enrollments.

When asked to rank six factors that limit enrollments, number and staffing levels of clinical sites emerged as the most important limiting factor, with space and availability of faculty next most important. Next followed funding, then equipment and qualified staff.

About 68% of the program directors indicated they had difficulty recruiting new faculty for their programs. Overall, salary was the most frequently cited obstacle to recruiting new faculty, followed by degree requirements and availability of interested applicants.

BACKGROUND AND OBJECTIVES

This is the fourth in a series of annual reports from ASRT on class enrollments in educational programs for radiographers, radiation therapists and nuclear medicine technologists.

The ASRT Enrollment Snapshot of Radiography, Radiation Therapy and Nuclear Medicine Programs, November 2001[a] provided the first empirical evidence that the downward trend in entering-class enrollments observed since 1994 had reversed. Snapshot 2002[b] 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[c] added a question as to the percentage of each program's graduates who enter the U.S. workforce. This 2003 iteration revealed further increases in entering enrollments and updated the projections of numbers of new R.T.s, radiation therapists, and nuclear medicine technologists that would be added through 2010. The conclusion was "if enrollments, attrition and other factors are held constant at fall 2003 levels, the profession will fall more than 30% short of meeting the need for additional radiographers between 2002 and 2010 projected by the BLS. On the other hand, current enrollments, attrition rates and retention rates appear adequate to meet the BLS-projected need for additional radiation therapists and to provide at least 150% of the BLS-projected need for additional 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 2004 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.

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. Finally, program directors were asked to share their perceptions of factors that impact enrollments and on the difficulty of recruiting new faculty for their programs.

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[a] American Society of Radiologic Technologists. Enrollment snapshot of radiography, radiation therapy and nuclear medicine programs, November 2001. Available at: www.radsciresearch.org. Accessed November 2004.
[b] American Society of Radiologic Technologists. Enrollment snapshot of radiography, radiation therapy and nuclear medicine programs, November 2002. Available at: www.radsciresearch.org. Accessed November 2004.
[c] American Society of Radiologic Technologists. Enrollment snapshot of radiography, radiation therapy and nuclear medicine programs, November 2003. Available at: http://www.asrt.org/content/RTs/SurveyResults/ProgramEnrollment/Enrollment_Survey.aspx. Accessed November 2004.

METHODOLOGY

In early Sept. 2004, the ASRT mailed a two-page questionnaire to every radiography, radiation therapy and nuclear medicine program listed in the ARRT's list of education programs.[a]

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, what the program director perceived to be the major factors limiting enrollment, whether hiring new faculty for their programs was difficult and, if so, what factors contributed to that difficulty. (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. Like the 2003 Snapshot, 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 of Oct. 22, 2004, 459 (67%) radiography programs, 57 (54%) radiation therapy programs, 67 (57%) nuclear medicine technology programs and 9 programs whose directors did not specify type of program had responded. The return rate – 600 of 906 questionnaires – represented an overall response rate of 66%. A preliminary report for presentation at RSNA was based on those returns. This final report includes 19 additional returns received through Nov. 5, 2004, leading to final return-rate figures of 69% from radiography programs, 56% from radiation therapy programs, 59% from nuclear medicine programs, and 68% overall.

[a] American Registry of Radiologic Technologists. ARRT-recognized educational programs. Available at: http://www.asrt.org/content/RTs/SurveyResults/ProgramEnrollment/Enrollment_Survey.aspx. Accessed November 2004.

DETAILED RESULTS

Source of Data

	Frequency	Percent	Valid Percent	Cumulative Percent
Hardcopy	394	63.7	63.7	63.7
Online	160	25.8	25.8	89.5
E-mail	65	10.5	10.5	100.0
Total	619	100.0	100.0	

Type of Programs

	Frequency	Percent	Valid Percent	Cumulative Percent
Radiography	471	76.1	77.5	77.5
Nuclear Medicine	69	11.1	11.3	88.8
Radiation Therapy	59	9.5	9.7	98.5
Radiography & Other	6	1.0	1.0	99.5
Other	2	.3	.3	99.8
Radiography & Radiation Therapy	1	.2	.2	100.0
Missing	11	1.8		
Total	619	100.0	100.0	

Other Programs

	Frequency	Percent
Other	609	98.4
Ultrasound/Sonography Management	3	.5
Mammography	2	.3
AAS and BS -- have opportunities for Sonography students	1	.2
We will be starting Nuclear Medicine soon if all goes well.	1	.2
24 months	1	.2
Radiography 1 to 7	1	.2
Ultrasound	1	.2
Total	619	100.0

Educational Levels

	Frequency	Percent	Valid Percent	Cumulative Percent
Certificate only	149	24.1	31.2	31.2
Associate degree only	230	37.2	48.1	79.3
Bachelor's degree only	46	7.4	9.6	88.9
Certificate & Associate degree	19	3.1	4.0	92.9
Certificate & Bachelor's degree	17	2.7	3.6	96.5
Associate degree & Bachelor's degree	12	1.9	2.5	98.8
Certificate, Associate degree, & Bachelor's degree	1	.2	.2	99.1
Certificate & Other	2	.3	.4	99.5
Other	2	.3	.4	100.0
Missing	141	22.8		
Total	619	100.0	100.0	

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

	Code	Count	Percent of Responses	Percent of Cases
Certificate	1	188	35.5	39.3
Associate Degree	2	262	49.4	54.8
Bachelor's Degree	3	76	14.3	15.9
Other	4	4	.8	.8
Total		530	100.0	110.9

Other Educational Level of Program

Specification of Other Educational Level	Frequency	Percent
Blank	603	97.4
A.A.S.	2	.3
Students graduate with a B.S. degree	1	.2
At a community & technical college	1	.2
affiliate universities, the [university] at	1	.2
DEC in collegial studies	1	.2
Post baccalaureate certificate	1	.2
BS is a completion program. All students come in to the AAS program. If they want a BS degree they can get it done in about 3 semesters after they complete the AAS degree.	1	.2
Affiliated with [university] also, those	1	.2
In affiliation with community college so graduates also receive AS Degree in Radiography	1	.2
12 month certificate	1	.2
We are a certificate program however 99% of our students come from 2 year programs	1	.2
B.S. option thru affiliation	1	.2
Have both college credit certificate and associate of science degrees	1	.2
BS degree in Nuc Med.	1	.2
24 month associate in science	1	.2
Total	619	100.0

Relationship Between Specialty and Educational Level of Program

		Radiography	Radiation Therapy	Nuclear Medicine	Radiography & Other	Other	Total
Certificate only	Count	112	14	18	1	2	147
	%	31.6%	28.6%	33.3%	16.7%	100.0%	31.6%
Associates Degree only	Count	207	11	8	1	0	227
	%	58.5%	22.4%	14.8%	16.7%	.0%	48.8%
Bachelor's Degree only	Count	13	15	15	1	0	44
	%	3.7%	30.6%	27.8%	16.7%	.0%	9.5%
Certificate and Associates	Count	11	4	4	0	0	19
	%	3.1%	8.2%	7.4%	.0%	.0%	4.1%
Certificate and Bachelor's	Count	4	3	8	1	0	16
	%	1.1%	6.1%	14.8%	16.7%	.0%	3.4%
Associates and Bachelor's	Count	7	2	1	2	0	12
	%	2.0%	4.1%	1.9%	33.3%	.0%	2.6%
Total	Count	354	49	54	6	2	465
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

There are two few other-specialty and combined-specialty programs to meaningfully compare their educational levels with those of the single-specialty programs. Restricting our attention to the pure programs, the overall chi-square for the differences among them in educational level is highly significant, $\chi^2(10) = 114.69$, $P < .001$. In particular, radiography programs are more likely (58.5%) than radiation therapy and nuclear medicine programs (18.4%) to offer only a certificate, $\chi^2(1) = 51.14$, $P < .001$. Conversely, they are less likely (3.7% vs. 29.1%) to confer only a Bachelor's degree [$\chi^2(1) = 60.65$, $p < .001$] or both a Bachelor's degree and a certificate or an associate degree [3.1% vs. 13.6%, $\chi^2(1) = 16.96$, $P < .001$].

Country in Which Program is Located

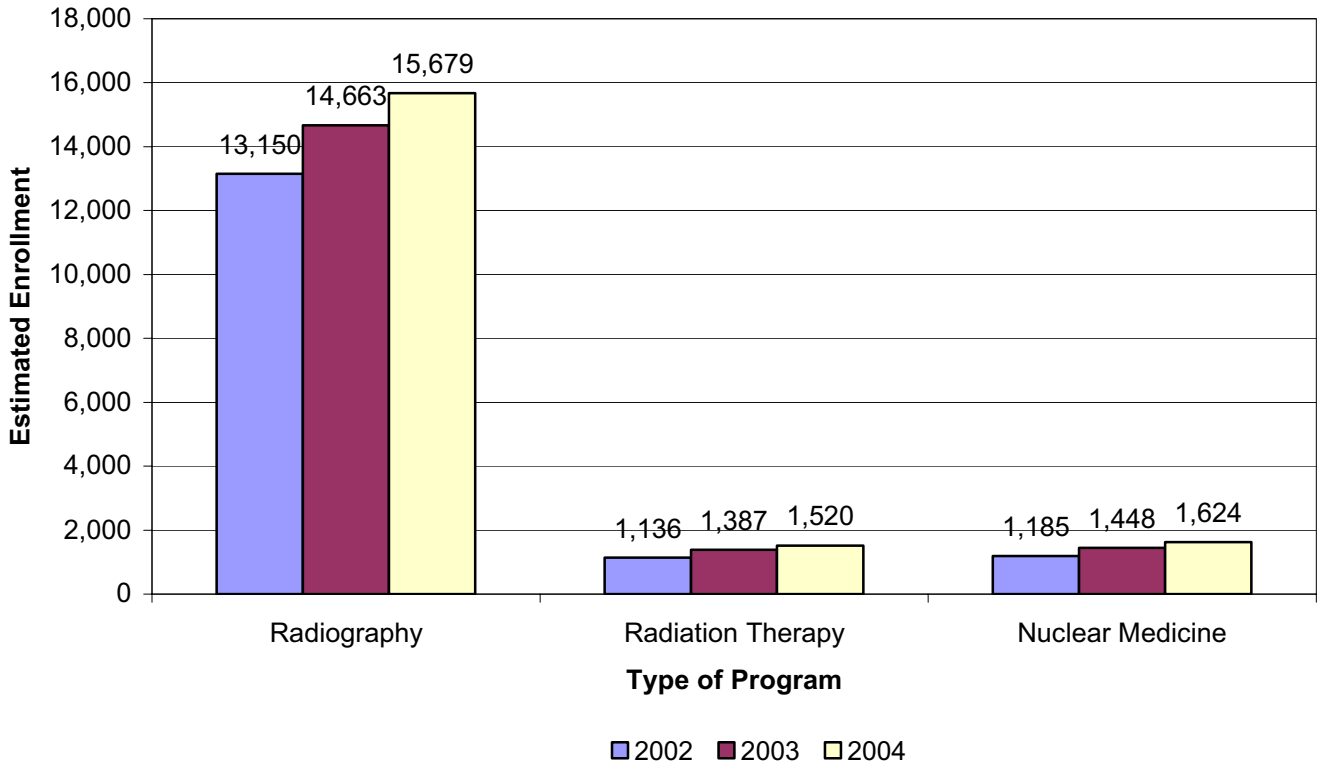
With only two reporting programs located outside the United States (a Canadian radiation therapy program offering a DEC in collegial studies and a certificate program in nuclear medicine located in an unspecified “Other” country), no statistically meaningful comparisons could be made with respect to program specialty and program educational level.

		U.S.	Canada	Other	Total
Radiography	Count	453	0	1	454
	%	99.8%	.0%	.2%	100.0%
Radiation Therapy	Count	55	1	0	56
	%	98.2%	1.8%	.0%	100.0%
Nuclear Medicine	Count	65	0	1	66
	%	98.5%	.0%	1.5%	100.0%
Radiography and Radiation Therapy	Count	1	0	0	1
	%	100.0%	.0%	.0%	100.0%
Radiography and Other	Count	6	0	0	6
	%	100.0%	.0%	.0%	100.0%
Other*	Count	2	0	0	2
	%	100.0%	.0%	.0%	100.0%
Total	Count	582	1	2	585
	%	99.5%	.2%	.3%	100.0%

* One of the “Other country” responses was specified as Puerto Rico, which is included in BLS analyses as part of the U.S. labor market.

ENROLLMENT TRENDS

All three types of radiologic technology programs experienced increased entering-class sizes during the past two years:



1. What were your freshman enrollment figures for 2002, 2003 and 2004?
5. What was the attrition rate for your program over the past few years?

			Freshman enrollment 2002	Freshman enrollment 2003	Freshman enrollment 2004	Attrition Rate
Radiography	N		455	469	470	462
	Mean		20.66	22.87	22.93	20.538
	Median[a]		18.15	19.55	20.09	15.914
	Mode		20	16	14	20.0
	Std. Deviation		13.492	14.494	13.460	19.3027
	Sum		9399	10726	10776	9488.6
	Percentiles	5[b]	5.07	7.36	7.43	.594
		25	11.79	14.12	14.24	9.250
		75	26.45	28.81	28.50	25.344
		95	43.29	48.44	47.80	72.250
Radiation Therapy	N		57	59	58	58
	Mean		11.91	13.75	14.41	11.897
	Median[a]		9.57	12.00	12.43	9.583
	Mode		8	7[c]	9	.0
	Std. Deviation		10.052	10.367	10.337	12.1275
	Sum		679	811	836	690.0
	Percentiles	5[b]	1.59	3.76	4.40	.1208
		25	7.18	7.46	8.50	1.500
		75	13.70	16.36	17.75	17.667
		95	30.80	37.47	31.40	35.733
Nuclear Medicine	N		66	69	68	65
	Mean		11.62	13.23	13.96	9.835
	Median[a]		9.57	10.00	10.44	6.167
	Mode		7[c]	8	10	.0
	Std. Deviation		9.295	10.810	12.204	11.8361
	Sum		767	913	949	639.3
	Percentiles	5[b]	1.20	2.97	3.60	.0706
		25	6.55	7.04	7.67	.396
		75	13.50	15.38	15.50	14.250
		95	32.00	43.30	42.80	33.375

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.) None of the effects involving the interaction of modality and educational level was statistically significant, so their effects were examined separately.

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

Averaged across disciplines and educational levels, mean entering-class size increased nearly linearly from 2002 (19.1 students per program) to 2004 (21.15 students per program): the linear trend accounted for 94% of the variation among the three annual means and yielded an $F(1,427) = 39.68$, $P < .001$. However, this trend differed significantly among programs at different educational levels, $F(4,427) = 3.39$, $P = .01$:

Educational Level of Program	Mean Number of Students in Entering Class			Increase = 2004 - 2002
	2002	2003	2004	
Certificate	12.74	13.93	14.15	1.41
Associate	24.70	26.92	26.50	1.80
Bachelor's	12.21	13.72	14.86	2.65
Certificate & Associates	14.24	16.24	18.35	4.11
Bachelor's & Associates or Certificate	20.21	23.12	25.62	5.41

The single-level programs showed significantly smaller increases in entering class size than did the multiple educational level programs, $F(1,452) = 13.82$, $P < .001$.

The analysis also showed that, within and averaging across year, radiography programs tend to have larger entering-class sizes than do nuclear medicine and radiation therapy programs and that associate-only and bachelor's-associate or bachelor's-certificate programs tend to enroll more students than do the other three educational levels.

Crucial Results from Previous Table and Graph:

	Year	Total Reported Enrollment	Received*	Sent	Return Rate*	Estimated Total, All Programs	Percent Change
Radiography	2002	9,128	455	684	65.52%	13,035	---
	2003	10,349	469	684	68.57%	14,614	12.12%
	2004	10,361	470	684	68.71%	15,683	7.31%
Radiation Therapy	2002	646	57	105	54.29%	1,132	---
	2003	769	59	105	56.19%	1,388	22.68%
	2004	796	58	105	55.23%	1,513	9.01%
Nuclear Medicine	2002	729	66	117	56.41%	1,209	---
	2003	874	69	117	58.97%	1,469	21.52%
	2004	916	68	117	58.11%	1,633	11.17%

Radiography's 67% return rate was significantly higher than the 56% return rate for the other two types of program, $\chi^2(1) = 9.245$, $P < .01$. The return rates for radiation therapy and nuclear medicine did not differ significantly.

* 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 programs that returned questionnaires but did not provide enrollment data for that year.

Attrition Rates by Program Type and Educational Level

5. What was the attrition rate for your program over the past few years?

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Certificate only	146	16.589	18.7030	1.5479	13.530	19.648
Associate Degree only	224	22.044	17.8170	1.1904	19.698	24.390
Bachelor's Degree only	45	10.533	15.6519	2.3332	5.831	15.236
Certificate and Associates	18	13.222	11.0377	2.6016	7.733	18.711
Certificate or Associates & Bachelor's	30	9.900	16.4639	3.0059	3.752	16.048
Total	463	18.075	18.0825	.8404	16.424	19.727

The mean attrition rate, for programs providing an estimate of that rate, was 18.1%. This rate did not differ significantly among the three program types, but differed significantly as a function of educational level of the program, $F(4,458) = 7.12$, $P < .001$. In particular, certificate-only and Associate-only programs reported significantly higher attrition rates than did bachelor's-only, certificate-associate, or programs offering a bachelor's along with either a certificate, an associate degree, or both; $F(1,458) = 13.92$, $P < .001$.

Perceived Variability in Attrition Rate

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

			Increased	Decreased	Increased some years, decreased others	Total
	Radiography	Count	19	52	72	143
		%	13.3%	36.4%	50.3%	100.0%
	Radiation Therapy	Count	6	1	6	13
		%	46.2%	7.7%	46.2%	100.0%
	Nuclear Medicine	Count	3	3	4	10
		%	30.0%	30.0%	40.0%	100.0%
Total		Count	28	56	82	166
		%	16.9%	33.7%	49.4%	100.0%

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

A two-way ANOVA of mean differences on this combined variable yielded no statistically significant effects of program specialty, program educational level, or their interaction. However, treating the combined variable as a nominal variable yielded the following statistically significant difference among the three disciplines:

Perceived variability in attrition rate	Statistic	Program Type (not including combined programs)			Total
		Radiography	Radiation Therapy	Nuclear Medicine	
Decreased	Count	49	1	3	53
	%	11.3%	1.7%	4.8%	9.6%
Stayed same	Count	294	45	52	391
	%	67.9%	77.6%	83.9%	70.7%
Up and down	Count	72	6	4	82
	%	16.6%	10.3%	6.5%	14.8%
Increased	Count	18	6	3	27
	%	4.2%	10.3%	4.8%	4.9%
Total	Count	433	58	62	553
	%	100.0%	100.0%	100.0%	100.0%

The overall $\chi^2(6) = 17.62$, $P < .01$. In particular, radiography programs are significantly more likely than the other two types of program to report that their attrition rates have declined in recent years [$\chi^2(1) = 6.91$, $P < .01$] but are also more likely to report that their attrition rate has bounced up and down [$\chi^2(1) = 5.12$, $P < .05$]. Directors of radiation therapy programs are significantly more likely than other program directors to report an increase in attrition rates [$\chi^2(1) = 4.16$, $P < .05$], while nuclear medicine program directors were significantly more likely than program directors of radiography or radiation therapy programs to report that their attrition rates have held steady [$\chi^2(1) = 5.84$, $P < .05$]. However, more than two-thirds of the directors of each of the three types of program reported that their attrition rates have held steady.

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
Radiography	442	99.20	2.442
Radiation Therapy	56	97.21	13.267
Nuclear Medicine	66	98.35	11.951
Radiography & Other	7	98.57	3.780
Other	2	100.00	.000

The two non-U.S.-based (one Canadian, one unspecified) programs reported placing 4% and 100% of their graduates in the U.S. job market. The Puerto Rico-based program to which the respondent checked, "Other country" places 90% of its graduates in the U.S. job market. Analyzing responses from the programs that specified a U.S. location yielded statistically significant differences among educational levels and a significant interaction between educational level and program discipline. However, both effects were entirely due to one associate-level nuclear medicine program reporting that only 3% of its graduates entered the U.S. job market. This lowered the mean percentage for associate-level nuclear medicine programs to 87.9%. The other eight programs in that category all reported 100% U.S. job market entry. Omitting the outlying response (which was submitted online and may have resulted from keyboard error) results in no statistically significant differences as a function of program specialty, program educational level, or their interaction and an overall percentage of graduates entering the U.S. market (among U.S.-based programs) of 99.3%. Similarly, there were no statistically significant effects of program specialty, educational level, or their interaction on the percentage of programs reporting 100% U.S. job market entry (which was 86.8% of the programs).

Near-term Changes

Capacity for Increase

2a. Is your program currently at full enrollment?

		Radiography	Radiation Therapy	Nuclear Medicine	Total
yes	Count	367	41	53	461
	%	78.3%	69.5%	79.1%	77.5%
no	Count	102	18	14	134
	%	21.7%	30.5%	20.9%	22.5%
Total	Count	469	59	67	595
	%	100.0%	100.0%	100.0%	100.0%

The percentage of programs at full enrollment did not differ significantly as a function of program specialty, educational level of program, or their interaction.

2b. Approximately how many additional students could be accommodated by your program?

	Mean	Std. Deviation	N	Estimated Total Expansion Capacity
Radiography	7.45	9.520	100	1,106
Radiation Therapy	12.50	30.779	16	400
Nuclear Medicine	3.58	2.539	12	88
Total	7.72	13.698	128	1,594

Even though the mean number of additional students that could be accommodated by radiation therapy programs was considerably larger in our sample than were the means for the other two program specialties, the small number of programs at less than full capacity and the high variability from program to program within each specialty led to statistically nonsignificant effects of program specialty, educational level or their interaction. (The mean for radiation therapy programs was greatly affected by a respondent reporting its program could accommodate 127 additional therapy students; that program's reported 2003 and 2004 entering-class enrollments were 19 and 17 respectively. The second-highest reported expansion capacity for a radiation therapy program was 16 students.)

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

	Mean	Std. Deviation	N	Estimated Total Expansion Capacity
Radiography	55.14	65.400	296	29,531
Radiation Therapy	13.35	15.091	37	974
Nuclear Medicine	24.40	26.627	40	2,258
Total	47.70	60.894	373	32,763

The mean number of qualified students turned away was significantly higher for radiography programs than for the other two specialties, [$F(1, 283) = 12.32$, $P < .001$], but did not differ significantly across educational levels.

However, radiography programs are, on average, larger than nuclear medicine and radiation therapy programs. To test whether this accounted for the larger mean number of students turned away from radiography programs, the ratio between number of qualified students turned away and fall 2004 entering-class enrollments was calculated, leading once again to a statistically significant main effect of program specialty, $F(2,281) = 5.21$, $P < .01$. However, both radiography and nuclear medicine programs had a significantly higher ratio of turned away students to accepted students (2.45 and 2.16, respectively) than did radiation therapy programs (.92), $F(2=1,281) = 7.85$, $P < .01$.

3. Do you plan any changes related to enrollment?

		Increase	Decrease	Remain the same	Total
Radiography	Count	58	20	390	468
	%	12.4%	4.3%	83.3%	100.0%
Radiation Therapy	Count	5	4	49	58
	%	8.6%	6.9%	84.5%	100.0%
Nuclear Medicine	Count	12	2	54	68
	%	17.6%	2.9%	79.4%	100.0%
Total	Count	75	26	493	594
	%	12.6%	4.4%	83.0%	100.0%

There were no statistically significant differences among the three primary disciplines, across educational levels, or as a function of their interaction in respect to net intention to increase enrollments (scores as -1 for “Decrease,” 0 for “Remain the same,” and +1 for “Increase”). Nor were there any significant differences with respect to the percentage of programs planning to increase or decrease enrollments.

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	459	2	4	465
	%	98.7%	.4%	.9%	100.0%
Radiation Therapy	Count	58	1	0	59
	%	98.3%	1.7%	.0%	100.0%
Nuclear Medicine	Count	67	1	0	68
	%	98.5%	1.5%	.0%	100.0%
Total	Count	584	4	4	592
	%	98.6%	.7%	.7%	100.0%

There were no statistically significant differences among the three primary disciplines in respect to program viability, ($\chi^2 = 3.052$, 4 *df*, $P=.549$). Fisher’s exact test on the difference between the .9% of radiography programs that will be closing as compared to the zero percent of radiation therapy or nuclear medicine programs planning to close also was statistically nonsignificant, 2-tailed $P = .580$. Approximately 98.6% of the program directors anticipate that their programs will definitely continue to operate, with only 0.7% indicating the possibility of closing. Moreover, only 0.7% of all programs (all four in radiography) indicated they will be closing.

FACULTY ISSUES

8a. Rank order the following factors with respect to how seriously they limit enrollments in your program.

	Radiography Programs			Radiation Therapy Programs			Nuclear Medicine Programs			Overall
Factor	% That Mentioned	Mean Rank if Mentioned	Mean Importance[a]	% That Mentioned	Mean Rank if Mentioned	Mean Importance[a]	% That Mentioned	Mean Rank if Mentioned	Mean Importance[a]	Mean Importance[a]
Funding	.5541	3.12	3.9766	.6441	2.97	3.7203	.6232	2.84	3.6304	3.9115
Space	.6667	2.49	3.3174	.6780	3.43	3.9153	.6377	2.82	3.6087	3.4098
Equipment	.4756	3.83	4.5011	.5763	3.53	4.1780	.5362	4.08	4.5507	4.4750
Number Qualified Applicants	.4268	4.22	4.8238	.4915	4.41	4.8475	.5362	4.27	4.7029	4.8122
Availability of faculty	.6624	2.68	3.4586	.6271	2.22	3.2881	.7681	2.58	3.0942	3.3998
Number, staffing of clinical sites	.8195	1.67	2.2834	.8644	2.31	2.6441	.8116	1.84	2.4130	2.3339
Other	.0722	2.54	5.6062	.1186	3.57	5.6780	.0435	2.33	5.8551	5.6419

[a] Importance score = rank assigned if mentioned (or average rank in case of ties), average of nonassigned ranks if not mentioned.

Averaging across the three program types, program directors rate number and staffing of clinical sites as the most important limiting factor; space, availability of faculty, and funding the next most important; equipment, followed by number of qualified applicants and "Other" as the least important factors.

Two-way ANOVAs on the three dependent variables (barrier mentioned or not, rank if mentioned, and importance score) showed no statistically significant differences across program specialties but did reveal significant differences as a function of educational level, as follows:

	Certificate Programs			Associate-degree Programs			Bachelor's Programs			Certificate and Associate Programs			Bachelor's/Certificate, Bachelor's/Associates Programs		
Factor	% Who Mentioned	Mean Rank if Mentioned	Mean Importance[a]	% Who Mentioned	Mean Rank if Mentioned	Mean Importance[a]	% Who Mentioned	Mean Rank if Mentioned	Mean Importance[a]	% Who Mentioned	Mean Rank if Mentioned	Mean Importance[a]	% Who Mentioned	Mean Rank if Mentioned	Mean Importance[a]
Funding	54.4	4.23	4.11	58.9	3.49	3.89	61.4	3.44	3.90	36.8	2.00	3.97	66.7	2.89	3.37
Space	74.1	2.40	2.79	65.2	3.13	3.52	59.1	3.94	4.11	47.4	3.75	3.68	60.0	3.22	3.60
Equipment	47.6	3.94	4.36	50.4	4.36	4.54	59.1	4.19	4.16	36.8	4.25	4.42	53.3	4.00	4.42
Number Qualified Applicants	46.3	4.65	4.64	38.8	5.30	5.11	68.2	4.81	4.26	21.1	4.25	4.92	43.3	6.11	5.33
Availability of faculty	63.3	3.40	3.62	70.1	3.09	3.41	63.6	1.88	3.16	68.4	2.00	2.84	66.7	2.67	3.40
Number, staffing of clinical sites	70.7	2.60	2.95	89.3	1.62	1.89	79.5	2.12	1.67	78.9	4.75	3.74	86.7	2.67	2.22
Other	7.5	1.82	5.57	7.6	2.59	5.64	11.4	4.60	5.81	10.5	1.00	5.10	6.7	4.50	5.80

Barriers showing statistically significant differences across the five educational levels in either percent mentioning, importance rating or both after Bonferroni adjustment for the number of dependent variables (i.e., for which the *P* value was .05/8 = .006 or lower) were space, number of qualified applicants, and number and staffing of clinical sites. In particular, space was rated as significantly less important by bachelor's-only programs than programs at other educational levels [$F(1,459) = 7.27$, $P = .007$]. Number of qualified applicants was mentioned as a barrier by a higher percentage of bachelor's only programs and was rated as more important [$F(1,459) = 7.27$, $P = .007$ and 7.96, $P = .001$, respectively]. Number and staffing of clinical sites was mentioned as a barrier by a lower percentage of certificate-only programs than it was by programs at other educational levels [$F(1,459) = 8.34$, $P = .004$]. Number and staffing of clinical sites was rated as less important by certificate-only and certificate-and-associate programs [$F(1,459) = 19.23$, $P < .001$].

[a] Importance score = rank assigned if mentioned (or average rank in case of ties), average of nonassigned ranks if not mentioned.

8b. Other limiting factors:

	Frequency	Percent
Blank	572	92.4
2 OTHER PROGRAMS WITHIN 100 MILES FROM OUR PROGRAM	1	.2
ARE LIMITING ENROLLMENT TO ADDRESS RAPIDLY INCREASING NUMBERS OF PROGRAMS AND GRADS OUR FIELD WILL OVERSHOOT SOON	1	.2
AS OF RIGHT NOW WE HAVE TOO MANY APPLICANTS	1	.2
AVAILABILITY OF SOME EXAMS	1	.2
[state] has a restriction against two schools sharing the same clinical affiliation - this greatly inhibits growth for one school as the other school is less than amenable to accepting a new program for various reasons. [state] will not lift restriction.	1	.2
Clinical affiliates have been the only barrier we have faced over past 3 years.	1	.2
Competition with other programs.	1	.2
Enrollment is strong. None of he factors listed above have affected enrollment yet.	1	.2
Few jobs in the area	1	.2
Fighting against other colleges/programs for spots in hospitals we have been affiliated with for 20+ years. This has hurt our program significantly and needs to be addressed by the JRC and ASRT.	1	.2
Finding full-time faculty has been extremely difficult due to the staff salaries of NMTs in the clinical setting versus the faculty salary scale in higher education.	1	.2
First, we don't want to overload the job market.	1	.2
HIGH TUITION RATES	1	.2
I could take more students if they were qualified. I don't fill my spots if I don't have quality students. Numbers of enrolled indicate the number enrolled at this time (some have failed and joined later classes - so the numbers get confusing).	1	.2
I DO NOT WANT TO FLOOD THE JOB MARKET	1	.2
In [state], we are simply running out of clinical sites. Many sites are used by more than one program.	1	.2
IN THE [state] AREA AND THE NUMBER OF RADIATION THERAPY PROGRAMS IN THE DOWNSTATE AREA, IT IS HARD TO OBTAIN QUALIFIED CLINICAL AFFILIATES WITH ALL THE PROPER EQUIPMENT NECESSARY FOR THE STUDENTS.	1	.2
Job market	1	.2
Job market is decreasing and programs opening in [city] area increasing.	1	.2
JOB OPPORTUNITIES	2	.3
Job opportunities to graduate numbers	1	.2
Jobs have really dried up in our area of central [state]. There are not enough jobs for next May's grads at this point. We definitely will not be increasing enrollment.	1	.2
LABORATORY SPACE	1	.2
LACK OF CAREER LADDER LIMITED SCOPE PROGRAMS TO FILL slots lost through attrition.	1	.2
Lack of clinical sites limits us the most with other R.T. programs in the metro area	1	.2
LOCAL NEED I WILL NOT SATURATE THE MARKET LIKE 1995	1	.2
Loss of educational validity (classes and labs too large to provide high quality instruction)	1	.2
Master's degree requirement	1	.2
Micromanagement, fee charges, and requirements of the JRCERT. They say they are but are not true outcomes based assessment.	1	.2
MINDSET ADMINISTRATION	1	.2
My program is housed within a state-funded academic medical center. While we have a cutting edge, innovative, highly visible, and well-respected NMT educational program, the funding crisis in state education has placed priority for funding of this…	1	.2

NONLICENSURE STATE X-RAY TECHS ARE USED AS THERAPIST at a reduced salary. Clinical sites don't want to train.	1	.2
Not flooding market -- need jobs	1	.2
SHARING CLINICAL SITES WITH OTHER NON-JRCERT ACCREDITED PROGRAMS NECESSITATES REDUCING ENROLLMENT REMAIN IN COMPLIANCE WITH JRCERT STANDARDS	1	.2
STUDENT FUNDING RESOURCES	1	.2
Supply of radiographers in this area is adequate. Most grads wish to stay in area.	1	.2
Technologists are being put into new imaging modalities. General radiographers off of the floor. For every FTE that leaves general radiography, we lose a clinical slot to train a technologist. This is creating a "bottleneck" that is causing the shortage.	1	.2
THERE ARE NO PROBLEMS WITH THE OTHER CATEGORIES	1	.2
This question does not work for us... we just expanded from 25 to 50 and I would refuse to expand any more PERIOD.	1	.2
TOO MANY RADIOGRAPHY PROGRAMS IN METRO AREA NOT Enough jobs for grads.	1	.2
We are a hospital based program and I have to limit the number of students because of the tech ratio.	1	.2
WE ARE A SMALL HOSPITAL BASED PROGRAM 6 STUDENTS ARE adequate for the size of our radiology dept.	1	.2
We do not turn students away, but create waiting lists for all qualified students.	1	.2
WE LIMIT ENROLLMENT BECAUSE WE LIKE THE SHORTAGE. There are too many programs now -- glut of techs in 05-08. Here we go again!	1	.2
We really have no limits as to enrollment. We set our own limits based on what we anticipate the community needs.	1	.2
WHAT ARE THE NEEDS RELATIVE TO EMPLOYMENT	1	.2
Total	619	100.0

9. Do you find it difficult to recruit new faculty for your program?

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	402	64.9	67.4	67.4
No	194	31.3	32.6	100.0
Missing	23	3.7		
Total	619	100.0	100.0	

Faculty Recruitment Difficulty as a Function of Program Type

		Yes	No	Total
Radiography	Count	304	151	455
	%	66.8%	33.2%	100.0%
Radiation Therapy	Count	47	10	57
	%	82.5%	17.5%	100.0%
Nuclear Medicine	Count	44	22	66
	%	66.7%	33.3%	100.0%
Total	Count	395	183	578
	%	68.3%	31.7%	100.0%

Across all three programs and all four education levels, about 68% of program directors surveyed answered "yes" to question 9. A higher proportion of radiation therapy program directors found it difficult to recruit new faculty (82.5%) than either radiography program directors (66.8%) or nuclear medicine program directors (66.7%), although these results were not significant (χ^2 = 5.825, 2 *df*, *P*=.054). Nor was perceived difficulty affected significantly by educational level of the program or by the interaction between educational level and modality.

	Code	Count	Percent of Responses	Percent of Cases
Salary	1	240	40.4	58.1
Degree requirements	2	162	27.3	39.2
Availability of interested applicants	3	121	20.4	29.3
Other	4	71	12.0	17.2
Total	594	100.0	143.8	

Source of Difficulty Broken Down by Program Type*

	Radiography		Radiation Therapy		Nuclear Medicine	
	Total	Percent	Total	Percent	Total	Percent
Salary	169	54.0%	36	75.0%	30	66.7%
Degree Requirements	135	43.1%	14	29.2%	9	20.0%
Availability of Interested Applicants	100	31.9%	9	18.8%	10	22.2%
Other	57	18.2%	5	10.4%	8	17.8%

Salary was the most frequently cited obstacle to recruiting new faculty, with degree requirements and availability of interested applicants the next two most common, respectively. While salary was mentioned by a majority of the directors of each program specialty, it was mentioned significantly less often by radiography program directors (54%) than by directors of programs in the other two specialties (71%), χ^2 (1) = 9.84, *P* < .01. There were no statistically significant differences in the frequency with which the various reasons were cited as a function of educational level of the program or of the interaction between educational level and specialty.

* These figures do not include programs that were a combination of one or more programs.

Other sources of difficulty in recruiting faculty:

	Frequency	Percent
Blank	545	88.0
[Believe the "17" in Q8 was the # of clinical sites available to the program.]	1	.2
Adjunct faculty need degrees, but don't want to work only part time with no benefits. Salary at the college lags behind. All three answers for us....salary, degree required (small effect) and available part-time workers.	1	.2
Administration not believing extra personnel is needed.	1	.2
All 3 of the above contribute equally.	1	.2
ALL OF THE ABOVE	2	.3
All of the above are factors in recruiting new faculty	1	.2
ALL OF THE ABOVE FACTORS	1	.2
ALL of the above!	1	.2
All of the above! (but salary #1, deg #2)	1	.2
Also degree requirements	1	.2
AVAILABILITY OF BACHELOR'S AND MASTERS PREPARED INDIVIDUALS is MAJOR problem in rural areas.	1	.2
BENEFITS	1	.2
Both equally	1	.2
Both salary and degree requirements are barriers	1	.2
Budget restraints.	1	.2
College degree	1	.2
COMBINATION DEGREE REQUIREMENTS LIMITED AVAILABILITY BASED ON SALARY OFFERED.	1	.2
combination of above 3	1	.2
degree requirements and availability of interested applicants	1	.2
Degree requirements would also be a major factor, almost equal to salary.	1	.2
Don't know -- Faculty is stable (No problems at last opening.)	1	.2
Educator's pay seems to be substantially lower than some of the modalities. This is especially evident with the amount of work and time required for the position and the pay scales given to educators.	1	.2
Educators are not valued.	1	.2
Experience as an instructor in a JRCERT accredited program.	1	.2
FEW BS AND MS WITH EXPERIENCE IN TEACHING	1	.2
Geographic location	1	.2
Have not gotten approval for new positions.	1	.2
HAVE NOT HAD TO RECRUIT BUT DEGREE REQUIREMENTS MAY BECOME A FACTOR IN 2009	1	.2
Have not needed to recruit new FT faculty in the past few years, but I believe that the degree requirements and low salaries will have tremendous impact on recruiting program officials in the very near future.	1	.2
Higher education salary scale cannot compete with the clinical pay scale for NMTs.	1	.2
I agree with the degree requirements; unfortunately this is not an emphasis in general radiography.	1	.2
I believe both degrees and salary are equal. In fact one drives the other.	1	.2

I believe that salary, degree requirement and availability of interested applicants equally play a role in recruiting new faculty.	1	.2
I have not had to recruit faculty yet. Ask me next year when one member retires.	1	.2
I haven't had to in a long time; I think it will be difficult if we expand.	1	.2
I plan to begin a clinical Instructor's program in Jan. 2005.	1	.2
I WOULD LIKE TO SEE BETTER QUALIFIED APPLICANTS.	1	.2
I would like to see better qualified applicants.	1	.2
I would think all could be a factor; it is dependant upon the location of the program.	1	.2
IF WE NEEDED TO REPLACE STAFF IT WOULD BE VERY DIFFICULT TO FIND REPLACEMENTS DUE TO SALARY. THANKFULLY OUR FACULTY IS DEDICATED AND STATIONARY AT PRESENT.	1	.2
Lithe difference in pay is significant. program directors work too hard and get the blame for graduate numbers. Some programs graduate numbers not quality clinicians. Would like to comment more.	1	.2
JRC is requiring advanced degrees for faculty and directors, it may be virtually impossible for colleges and or hospital-based programs to hire faculty/directors due to market value of technologist versus educational salaries.	1	.2
JRCERT new standards of Master's for program director and B.S. for clinical coordinator has made it hard to find qualified applicants for the program faculty.	1	.2
Lack of full-time benefits	1	.2
LACK OF FULL TIME BENEFITS	1	.2
Limit on the funding of the position for instructors.	1	.2
Location of the program -- rural [state]	1	.2
need minimum of MS but prefer PhD.	1	.2
NO EXPERIENCED APPLICANTS MEETING DEGREE REQUIREMENTS. Example: Our clinical coordinator meets degree requirements, but has extreme weakness in classroom.	1	.2
No funds available at this moment for an additional faculty member.	1	.2
No openings for 13 years.	1	.2
No turnover in full-time faculty for over 20 years; haven't had a problem with R.T.s wanting to come on board as adjunct faculty; in our area, part-time faculty make more than staff techs per hour.	1	.2
PART-TIME AVAILABLE ONLY	1	.2
Q5 (85%): 1999-2003	1	.2
Salary also plays a role	1	.2
Salary and qualified applicants with degrees beyond 2 years of education.	1	.2
Salary causes about the same difficulty as degree requirements.	1	.2
Salary, advanced degree and the small amount of individuals interested in teaching is the difficulty for us.	1	.2
Teaching is difficult and has not been competitive with clinical employment.	1	.2
TEACHING IS DIFFICULT AND HAS NOT BEEN COMPETITIVE WITH CLINICAL EMPLOYMENT.	1	.2
Though salaries are low, we are fortunate to have great support of our program.	1	.2
TIME	1	.2

Time [P overbar] registration	1	.2
Time demands of teaching	1	.2
TOO FEW EDUCATORS	1	.2
We are currently in need of a program director and clinical coordinator. Very few responses to our ads from qualified individuals.	1	.2
We cannot compete with the current salary and with the entry level where it is currently, individuals do not have the necessary degree requirements. Where is the incentive for them to pursue advanced degrees!!!	1	.2
We cannot compete with the current salary and with the entry level where it is currently, individuals do not have the necessary degree requirements. Where is the incentive for them to pursue advanced degrees!!! Need it make the entry level a BS degree!	1	.2
We chose a limited class enrollment this year due to staff changes.	1	.2
WE HAVE BEEN EXTREMELY LUCKY TO HAVE GREAT FACULTY THAT HAVE BEEN WITH US FOR THE PAST SEVERAL YEARS.	1	.2
We haven't had to hire faculty in 3-4 years.	1	.2
willingness to teach only part-time	1	.2
X-ray limited to hiring status part-time vs. full-time.	1	.2
Total	619	100.0

WILL THE GAP CLOSE?

To be more specific, if 2004 first-year enrollment figures are maintained, will the profession meet the need for additional R.T.s between 2002 and 2012 projected by the BLS? Answering this question assumes that each of the following factors will remain constant for the three radiologic technology disciplines between now and the end of 2012:

- 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 to 10 years ago.

In addition, this report assumes that the estimates, which are based on currently available data, are accurate. These assumptions can be referred to collectively as "steady-state" assumptions. The radiography example below shows in some detail how the various statistics were estimated and then combined to predict the 2012 supply of radiographers. Briefer summaries of calculations for the other two disciplines follow. Where multiple estimates of the same statistic are available (i.e., enrollment figures for 2002 as reported directly in the 2002 Snapshot and retrospectively in the 2003 and 2004 Snapshots), the simple average of the estimates is employed.

Radiography

The BLS projects that 72,000 additional radiographers will be needed between 2002 and 2012. Given the estimate of 15,683 students entering radiography programs in 2004, together with the program director-estimated attrition rate of 22% and an 88.6% pass rate for the certification exam, this discipline would appear to be adding new radiographers to the profession at a rate of 10,838 per year.

However, not all new radiographers will still be practicing radiography in 2012. How many of a given year's new radiographer cohort remain in the profession for one to ten years? An ARRT-supplied helped determine the number of registered R.T.s who, in early Sept. 2004, 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. 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) was profiled each year from 1992 to 2003.[1] This information provides the following estimate of the overall retention profile for radiographers:

[1] American Registry of Radiologic Technologists. 2001, 2002, 2003 annual reports of examinations. Available at: www.arrt.org/website/newsite/Psychometrics/AnnualReportofExams.pdf. Accessed November 2004.

Year	Number of First-time Certificants	Number in Radiography for X Years	Number Years in Radiography as of Sept. 2004	Percent Retained
2004(est)	9590	.333(8530) + .667(9590) = 9237	< 1 year: 5655	61%
2003	8530	.667(8530) = 5687	1 to 3 years: 14,207	14207/19472 = 73%
2002	7221	7221		
2001	6564	6564		
2000	6341	6341	4 to 5 years: 8166 = 63%	8166/13025
1999	6684	6684		
1994- 1998	42,614	42,614	6 to 10 years: 16,953	= 40%

A similar retention profile was computed based on demographic data supplied by ARRT in late August 2003 and a third, based on a March 2002 download. Despite being based on somewhat different cohorts of radiographers – about one-third of the radiographers who fell into the 1 to 3 years category in March 2002 fell into the 4 to 5 years category in August 2003 – the retention percentages were generally comparable to those given above. We therefore averaged the three retention profiles to increase the reliability of the retention-percentage estimates, as follows:

# of Years in Radiography	Percent of New-Certificant Classes Still in Field After That Many Years
< 1 year	67%
1 to 3 years	77%
4 to 5 years	58%
6 to 10 years	38%

Assuming that this profile holds true for the radiography cohort of 2004 and subsequent cohorts, one would expect that, on average, approximately 38% of radiographers who were first-time certificants between 2002 and 2006 would still be practicing radiography as their primary discipline in 2012; 58% of the classes of 2007 and 2008 would still be practicing radiography in 2012; about 77% of the classes of 2009, 2010, 2011 and 67% of the class of 2012 would be practicing at the end of 2012.

ARRT's 2002 Report of Exams shows that the class of 2002 consisted of 7,221 new certificants; the class of 2003, 8,530; and the class of 2004 should include 9,564 new certificants (13,839 students who entered radiography programs in 2002, decreased by a 22% attrition rate and an 11.4% exam failure rate). In 2005, about 10,221 new radiographers should enter the market. Further, the new-certificant class of 2006 (and, under steady-state assumptions, each subsequent class) should consist of approximately 10,838 new radiographers. Combining these figures with the above retention profile leads to an estimate that 46,374 (the number of new radiographers certified in 2002 to 2006) x .38 + 21,676 x .58 + 32,514 x .77 + 10,838 x .67 = 62,492 additional radiographers by the end of 2012. However, an average of 1.2% of new ARRT radiography-certified technologists take jobs outside the United States (averaging the Snapshot 2003 and Snapshot 2004 estimates of that percent), so between 2002 and 2012 a total of about 61,742 radiographers — about 14% short of the BLS-estimated need – will add to (and remain in) the U.S. labor pool of radiographers. Of additional note is that 12.6% of radiography program directors plan to increase their enrollments.

Radiation Therapy

The BLS projects that 7,000 radiation therapists will be needed between now and 2012. ARRT's 2003 Report of Exams shows that the class of 2002 consisted of 562 new certificants, and that the class of 2003 numbered 679 new certificants. 2004 will see an estimated 838 new radiation therapists (1,165 students who entered radiation therapy programs in 2002, decreased by a 12.03% attrition rate and an 18.2% exam failure rate). Given the estimate of 1,331 students entering radiation therapy programs in 2003, together with the program director-estimated attrition rate of 12.03% and an 18.2% exam failure rate for the certification exam, this discipline would appear to be adding 958 new radiation therapists for 2005. Further, the new-certificant class of 2006 (and, under steady-state assumptions, each subsequent

class) should consist of approximately 1,089 new therapists. Combining these figures with the retention profile estimated for radiation therapists leads to an estimate of 4,131 (the number of new radiation therapists certified in 2002 to 2006) x .763 + 2,178 x 1.23 + 3,267 x 1.12* + 1,089 x .91 = 10,475 additional radiation therapists by the end of 2012. However, an average of 3.6% of new ARRT therapist certificants take jobs outside the U.S., so between 2002 and 2012, a total of about 10,098 radiation therapists may be added to (and remain in) the U.S. labor pool of radiation therapists, thereby exceeding the BLS-projected need in this modality by about 44%. About 8.6% of radiation therapy program directors plan to increase their enrollments, while 6.9% plan to decrease them.

Note: The number of ARRT certificants whose primary sphere of employment in Sept. 2004 is listed as radiation therapy and who have been practicing in this discipline for four to five years is 123% greater than the number of radiation therapists who passed the radiation therapy certification exam in 1999 or 2000 (i.e., 4 to 5 years ago), impacting the calculations for new radiation therapists who will be practicing in 2007 through 2010. This excess is probably due to repeat examinees and to migration into radiation therapy from other specialties (i.e., radiography) without benefit of ARRT certification in radiation therapy.

Nuclear Medicine Technology

The BLS projects a need for 7,000 nuclear medicine technologists to meet increased demand and attrition between 2002 and 2012. ARRT's 2003 Report of Exams showed that the class of 2002 consisted of 233 new ARRT certificants. However, there were also 722 individuals who passed their initial NMTCB certification exam in 2002 (personal communication from Nuclear Medicine Technology Certification Board, Nov. 12, 2003). Since many prospective nuclear medicine technologists take both certification exams, the total 2002 new-certificant class is less than 722 + 234 in number. Starting with 722 provided a conservative estimate. On that same basis (including personal communication, NMTCB, Oct. 25, 2004), the certificant class of 2003 consisted of 893 ARRT first-time examinees and a possibly overlapping 360 ARRT first-time examinees, leading to a conservative estimate of 893 in the 2003 new-certificant class. The best estimate of the total number of students entering nuclear medicine technology educational programs in 2002 is 1,339 (averaging the estimates obtained from the 2002, 2003, and 2004 Enrollment Snapshots). Nuclear medicine technology program directors estimate an attrition rate of about 8%, and the pass rate for the 2004 exam will probably be close to the 2003 rate of 88%, so the new-certificant class of 2004 should consist of about 1,084 new nuclear medicine technologists. Similar calculations lead to an estimate of a 2005 new-certificant class of 1,239 and a 2006 new-certificant class numbering 1,315 new nuclear medicine graduates.

Under steady-state assumptions, the 1,315 individuals should pass their nuclear medicine certification exam(s) for the first time in each year from 2006 through 2012. ARRT certificant and years-in-discipline information for nuclear medicine technologists, show that the number of ARRT certificants primarily employed in nuclear medicine technology for less than one year is about 105% of the number of first-time certificants in this cohort, that the number after one to three years is about 149% of the number in the first-time certificant classes for those years (presumably due to repeat examinees and migration from other disciplines). The number of ARRT-registered R.T.s who have practiced nuclear medicine for four to five years is about 118% of the number who took the primary exam and passed it for the first time four or five years earlier, and those who have been in the specialty for six to 10 years would be, on average, 65% of first-time certificants in the corresponding five-year time slot. Thus, under steady-state assumptions, about 11,004 additional ARRT-registered nuclear medicine technologists would be practicing in the profession by the end of 2012. Since 98% of graduates of nuclear medicine program graduates take jobs in the United States, this suggests that about 13,927 ARRT-registered nuclear medicine technologists will add to the U.S. labor pool between 2002 and 2012. However, a MIRODA-sponsored match of the NMTCB and ARRT databases conducted about three years ago found that 58% of NMTCB registrants also are registered with ARRT. This implies that the total number of certified nuclear medicine technologists at that time was more than 50% greater than the number of ARRT-registered nuclear medicine technologists, so it seems likely that the profession will add and retain almost 21,000 additional nuclear medicine technologists between 2002 and the end of 2012 – nearly triple 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 2004 in these three disciplines are ±502 students for radiography, ±292 for radiation therapy and ±265 students for nuclear medicine technology. (The CIs around enrollment figures for 2002 to 2003 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., 12.5% 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, each retention profile (i.e., the 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) are based on calculating backward from a single point in time (March 2002, end of Aug. 2003, or beginning of Sept. 2004) and might not be representative of what will happen to the 2002 to 2012 new-certificant cohorts.

Overall, however, 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.

APPENDIX A

QUESTIONNAIRE

asrt
American Society of
Radiologic Technologists

September 13, 2004

Dear Program Director:

As director of an educational program in radiography, radiation therapy or nuclear medicine, you are both affected by and have a major influence over the supply of radiologic technologists in those professions. For you and your fellow program directors to make informed decisions about enrollment levels in your program 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 the most accurate possible estimates of R.T. educational-program enrollments.

In each of the past three years, at least two-thirds of all program directors 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 has also enabled 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 the Bureau of Labor Statistics projects by 2012. We now need to determine whether the upswing in enrollments has continued or has leveled off and how each specialty is doing in meeting the need for its technologists. This issue will be discussed at several upcoming meetings such as the Radiological Society of North America meeting that begins at the end of November.

I would appreciate your help in completing and returning the enclosed, two-page questionnaire at your earliest convenience, so that ASRT can put together a quick, accurate snapshot of enrollment trends. 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 these issues or the factors driving recent trends in your program's enrollment figures. 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 Richard Harris by mail or e-mail rharris@asrt.org.

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

Sincerely,

Sal Martino

Sal Martino, Ed.D.
Executive Vice President and Chief Academic Officer

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

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Radiography, Radiation Therapy and Nuclear Medicine Enrollment Survey
Fall 2004

If you would prefer to respond via an electronic version of the questionnaire, e-mail your request to jculbertson@asrt.org.

Indicate your type of program.

- O Radiography
- O Radiation therapy
- O Nuclear medicine
- O Other (Please specify _____)

What is the educational level of your program?

- O Certificate
- 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-modality program, or includes multiple education levels, please submit responses to questions 1 through 7 below separately for each of the types and educational levels represented within your program. You may make copies of this form for this purpose or, for a small number of sub-programs, add lines to a single copy of the questionnaire.

1. What were your freshman enrollment figures for the following years, i.e., how many students entered your program each year? (A student is considered to have entered the program once he or she is admitted to that program; this may be after a year or more of general course work.)

   2002 ☐☐☐ 2003 ☐☐☐ 2004 ☐☐☐

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

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 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. 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)?

   ☐☐☐% or O Don't know

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

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Next, please provide any feedback on the following two issues related to education in the radiologic sciences.

8. Rank order the following factors with respect to how seriously they limit enrollment in your program. Write a "1" beside the most limiting factor, "2" beside the second most serious limitation, etc. Leave the space blank if you don't believe the factor limits enrollments.

☐ Funding ☐ Space ☐ Equipment ☐ Number of qualified applicants ☐ Availability of faculty

☐ Number and/or staffing of clinical sites available to your program

☐ Other (Please specify _____)

9. Do you find it difficult to recruit new faculty for your program?

O Yes O No

If "yes," what do you believe is the source of the difficulty?

O Salary O Degree requirements O Availability of interested applicants

O Other (Please specify _____)

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

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

APPENDIX B

COMMENTS WRITTEN ON QUESTIONNAIRES OR SENT VIA E-MAIL

Via E-mail

“One comment I have about the survey is that according to JRCERT our program is not at full enrollment, however we feel it is based on volume of procedures and staff availability to supervise students at our various clinical education sites. We currently have 11 hospitals and 2 clinics. I have noticed the trend of programs to increase student capacity and have been concerned that with the competency based system, programs are passing students through clinical experiences with fewer required exams to be performed by the student. (We have noticed this with other programs claiming competence of graduates.) We do not feel that a student is competent just because they completed a procedure on a good patient one time for the instructor. Can they do it again at a later date with a patient who is not a text book case? We do require more of our students and as a result dropped our enrollment number by two this last year and will probably drop another position next year to ensure that graduates are truly competent and capable. Flooding the market with graduates just to supply numbers will not solve the problems we have in technology today when we are expecting more complex skills plus critical thinking abilities as part of the job market. Also, in our area that we are supplying with graduates we have noticed a leveling off of vacant positions. There seems to be a reluctance of graduates to go to other areas of the country for employment.”

“What limits my enrollment now is job availability. There are not many jobs left in [state] except in the very rural areas and most students, unless they are from this area, do not want to move to such a remote town. Therefore, I do not want to graduate students who do not want to leave [state] but must if they want to find a job!

“In order to fill the jobs in rural areas, I am currently attempting a distance education with another facility. We picked a student who wants to become a radiation therapist, who already lives in the area and has ties there. This will hopefully prevent this person from leaving after they finish the program. This individual cannot leave and come to school here in [city] for a year so – distance education on a shoestring. I am hopefully addressing this problem in the state because there is no licensure for RTTs and I am fearful that unqualified individuals will be running linear accelerators!

“The other factor which limits the number of students is program faculty. Since I am a hospital-based program I am the only faculty member who teaches in the program. All of the other faculty have clinical jobs and they teach basically in between their clinical duties. Therapy is so labor intensive and these people demand high salaries so we cannot hire faculty just to teach in the program.

“Thank you for your time.”

“And please do not forget that there are still hospital-based programs out there and many of the surveys, recommendations and suggestions do not address my reality!”

Written on Questionnaire

	Frequency	Percent
Blank	577	93.2
1. This program takes new students every other year. 2. This program hasn't recruited new staff for over 25 years.	1	.2
Accented and put stars around "degree requirements" in Q9.	1	.2
End of questionnaire: Our faculty searches have been limited by a combination of degree requirements and salary. Those, in our area, who hold the necessary degree for program director are usually dept. managers who are paid about $20,000/yr more than the salary they	1	.2
Q1: Junior = 1st year in our "professional" discipline-specific program.	1	.2
Q1: Of the 15, 8 sonogr, 7 management	1	.2
Q2 (students turned away): 80 in 2003, 40 in 2002. Q5 (19% attrition):avg 3 years. Q6 (variation in attrn rate): 32% 2004, 6% 2003, 19% 2002	1	.2
Q2(not at full enrmnt): Lost 2nd year students.	1	.2

Q2: Underlined "qualified". Q4: Underlined "definitely". Q6(No): Not "substantially".	1	.2
Q3 (Plan to incr enrmnt): Possible affiliation with college.	1	.2
Q3 (plan to remain same): "Or slightly decrease".	3	.5
Q3(Plan to increase): If more clinical sites are added.	1	.2
Q3(Plan to remain same): May increase by not more than 5.	1	.2
Q3(Plan to remain same): we overloaded for 2 years and now have "maxed out" clinic sites.	1	.2
Q5-7: NA; Program started in 2003.	1	.2
Q5 (84% attrition): Past 5 yrs.	1	.2
Q5 (attrition rate 11%): for current class. Q7 (DK): No graduates yet.	1	.2
Q6 (blank): New program; no history.	1	.2
Q6 (No): "0-18%".	1	.2
Q7 (blank): New program -- no graduates yet -- 2005.	1	.2
Q8 ("Clinical site" # 1 and only): Only limitation.	1	.2
Q9 (blank): Have not needed to recruit new faculty.	1	.2
Q9 (Checked 1-3): All of these!	1	.2
Q9 (No): I have been with this program since 1980. We recruited the clinical coordinator from within the facility -- very easy to do. However, if either one of us retired (quit), then I believe it would be very difficult to recruit for a new program director due to degree requirements. However, I fully support the Master Degree level requirement for the Program Director position.	1	.2
Q9 (No): Note all faculty are employees of the hospital; we do not recruit for faculty.	1	.2
Q9 (No): this answer is misleading since we have not attempted to recruit new faculty.	1	.2
Q9 (yes): We have been trying to fill a full-time faculty position for the past three years!	1	.2
Q9,deg reqmnts: At the university level, higher educ'n is required and I fully support this! However, finding college educated & degreed faculty is difficult.	1	.2
Q9: All 3.	1	.2
Q9: deg #1, salary #2	1	.2
Q9: I had one opening this past year and only one interested applicant!! [Also ranked Sal,deg,applics 1st,2nd,3rd.)	1	.2
Q9: Salary #1, applic #2, deg #3	1	.2
Q9:Put a ++ by "Availability of interested applicants"	1	.2
Qns2&3: We are at full enrollment because we decreased enrollment due to job shortage. I think that your survey should include questions related to job market. Thanks. ___, Program Chair.	1	.2
Qs 2002,2003,5-7,9: NA -- new program.	1	.2
Qs5-7: N/A -- new program	1	.2
Qs5-7: N/A -- program started 2003	1	.2
Qs5-7: New program began fall 2003	1	.2
Qs5-7: No graduates at this time.	1	.2
Ranked Q9 deg, applic, sal	1	.2
This program will close effective November 2004.	1	.2
Total	619	100.0