

Enrollment Snapshot Of Radiography, Radiation Therapy And Nuclear Medicine Programs, Fall 2003

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Background and Objectives

This is the third in a series of annual reports from the American Society of Radiologic Technologists (ASRT) on entering-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*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 American Registry of Radiologic Technologists (ARRT) to provide the first indications of whether current recruitment and retention rates were sufficient to meet Bureau of Labor Statistics (BLS) 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. Given the importance of anticipating trends in the supply of radiologic technologists (R.T.s) and the lag between R.T. recruitment/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 2003 Enrollment Snapshot’s primary objectives were 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 (PDs) 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 PDs to report their program’s attrition rate in recent years. Further, graduating from an ARRT-recognized educational program doesn’t guarantee entry into the U.S. radiologic technology labor pool, so PDs 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.

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

Methodology

In early September 2003, the ASRT mailed a two-page questionnaire to every radiography, radiation therapy and nuclear medicine program listed in the American Registry of Radiologic Technologists' *List of Education Programs*.³

The questionnaire asked PDs 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 PD 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/demand balance for radiologic technology disciplines. Unlike the 2002 *Snapshot*, this year's questionnaire asked the PD in which country his or her program is located and what percentage of recent (past five years) graduates have taken jobs in the United States.

As of October 15, 2003, 460 (72%) radiography programs, 60 (59%) radiation therapy programs, 66 (59%) nuclear medicine technology programs, and 3 programs whose directors didn't specify type of program had responded. The return rate – 584 of 851 questionnaires – represented an overall response rate of 69%.

Comparison of program size distribution (reported 2002 entering-class enrollments) with the corresponding distributions in the *Snapshot 2002* data revealed that none of the largest radiation therapy programs (those with 2002 entering-class enrollments of more than 25 students) were represented. E-mail messages were sent or phone calls made to every program listed in the *Health Professions Career and Education Directory*⁴ with a listed capacity of 25 or more students, requesting their 2001, 2002, and 2003 entering-class enrollment figures and estimated attrition rates. Further, since the *HPCED* lists only JRCERT-accredited programs, these PDs also were asked whether they knew of other equally large-enrollment radiation therapy programs. These efforts resulted in adding information on one large-enrollment radiation therapy program not included in the original returns.

Executive Summary

In early September 2003, 851 questionnaires were sent to every radiography, radiation therapy and nuclear medicine program listed by the ARRT. An electronic version of the questionnaire also was sent to 704 PDs for whom the ASRT had e-mail addresses. Seventy-one PDs chose to respond electronically. As of October 15, 2003, 460 (72%) radiography programs, 60 (59%) radiation therapy programs, 66 (59%) nuclear medicine technology programs and 3 programs of unspecified type had responded. The return rate of 584 of 851 questionnaires represented an overall response rate of 69%. A separate appeal (via e-mail and telephone) to directors of large-enrollment radiation therapy programs yielded enrollment and attrition-rate data for one additional radiation therapy program.

Entering-class radiography, radiation therapy and nuclear medicine enrollment increases noted in the 2001 and 2002 enrollment snapshot were repeated from 2002 to 2003. Information from PDs of more than two-thirds of all ARRT-listed educational programs in these specialties estimates fall 2003 ARRT-wide first-year enrollments at 14,965 radiography students, 1,274 radiation therapy students and 1,612 students in nuclear medicine technology. Factoring in reported attrition rates and certification examination pass rates, ASRT estimates that 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 U.S. Bureau of Labor Statistics (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.

Programs appear to be reaching their respective capacities. Overall, about three-fourths of PDs reported full enrollment in fall 2003 compared with about two-thirds of PDs who reported full enrollments in fall 2002 and one-half in fall 2001. Further, the rate at which PDs with programs at full enrollment reported turning away qualified students projects nationally to an unmet demand of about 26,700 students, while PDs whose programs are not at full enrollment reported unused capacity totaling only 1,100 students. Faced with this unmet demand, a little more than one-sixth of radiography PDs and about one-fourth of the participating radiation therapy and nuclear medicine PDs report they plan to increase enrollments.

When asked to rank four factors that limit enrollments, space emerged as the most important limiting factor, with funding and availability of faculty next most important, then equipment, followed by number and staffing levels of clinical sites. However, the number and staffing of clinical sites was not included as a choice on the response checklist, but was written in by a high percentage of respondents. Therefore, its importance as a limiting factor may have been understated.

When asked directly, 66% 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, with degree requirements and availability of interested applicants the next two most common, respectively. However, a significantly smaller percentage of nuclear medicine PDs

(7.7%) than of radiography and radiation therapy PDs (33.6%) felt that degree requirements contributed to their faculty-recruitment difficulties. As a result, “degree requirements” was the least frequently mentioned contributing factor among nuclear medicine PDs.

Detailed Results

Type of Program

Specialties

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Nuclear Medicine only	63	10.8	10.8	10.8
	Radiation Therapy	59	10.1	10.1	20.9
	Radiography only	452	77.3	77.7	98.6
	Radiography and Radiation Therapy	1	.2	.2	98.8
	Radiography & Nuc Med	1	.2	.2	99.0
	Radiography and Other	4	.7	.7	99.7
	Radiography, Rad Ther & Nuclear Medicine	1	.2	.2	99.9
	Radiog, Nuc Med, Other	1	.2	.2	100.0
	Total nonmissing	582	99.5	100.0	
Missing	.00	3	.5		
Total		585	100.0		

Other Type of Program, Specified

	Frequency	Percent
Blank	577	98.6
3 SEPARATE STREAMS	1	.2
ALSO MR & CT	1	.2
AND ULTRASOUND	1	.2
BS IS CT MR AND MAMMO	1	.2
CLINICAL SITE ONLY OF _____ PROGRAM	1	.2
DUAL CERTIFICATION RAD PLUS MR OR CT OPTIONS	1	.2
MR	1	.2
SONOGRAPHY	1	.2
Total	585	100.0

Educational Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Certificate	159	27.2	31.1	31.1
	Associate	259	44.3	50.6	81.6
	Bachelors	77	13.2	15.0	96.7
	Other	17	2.9	3.3	100.0
	Total	512	87.5	100.0	
Missing	-9.00	73	12.5		
Total		585	100.0		

Other Educational Level of Program, Specified

	Frequency	Percent
Blank	557	95.2
2 AND 2 AFFILIATION WITH BS PROGRAM	1	.2
2 YR DIPLOMA	1	.2
Additional diploma track starting this year	1	.2
AS DEGREE AND CERTIFICATE IN RADIOLOGY SCIENCE	1	.2
ASSOC OPTIONAL	2	.4
ASSOCIATE OF APPLIED SCIENCE	1	.2
CERT AFFILIATED AT COMMUNITY COLLEGE	1	.2
CERT IN MR & CT	1	.2
CERTIFICATE	1	.2
CERTIFICATE FIRST JUNIOR YR THEN SPECIALIZATION IN MR OR CT FOR BS SENIOR YR	1	.2
CERTIFICATE FOR THOSE WITH BS	1	.2
Certificate/assoc due to articulation with university	1	.2
DIPLOMA	6	1.0
Diploma d' etude collegial (DEC)	2	.4
HAVE ARTICULATION FOR BS IN RADIOGRAPHY WITH LOCAL UNIVERSITY	1	.2
HAVE BOTH	1	.2
JOINT PROGRAM WITH [a technical college]	1	.2
MASTER OF EDUCATION (HEALTH ED)	1	.2
May obtain associate through articulation agreement w/ local university.	1	.2
MBA AND HCM	1	.2
WE HAVE A BS AND CERTIFICATE TRACT	1	.2
Total	585	100.0

Program Specialty * In What Country is Program Located? Cross-tabulation

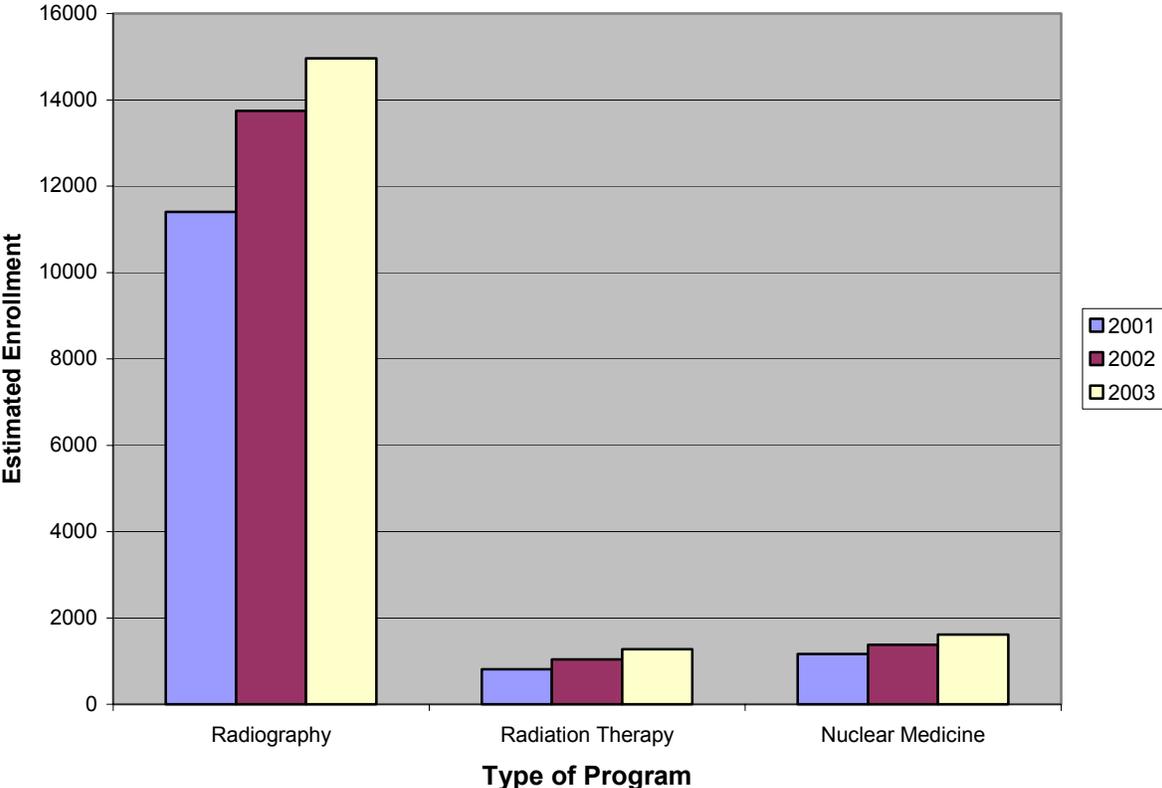
Specialty(ies)	In What Country is Program Located?			Total	
		U.S.	Canada		Other*
Nuclear Medicine Only	Count	60	1	1	62
	%	96.8%	1.6%	1.6%	100.0%
Radiation Therapy Only	Count	55	3	0	58
	%	94.8%	5.2%	.0%	100.0%
Radiography Only	Count	439	6	2	447
	%	98.2%	1.3%	.4%	100.0%
Radiography & Other Specialty(ies)	Count	6	2	0	8
	%	75.0%	25.0%	.0%	100
Total Nonmissing	560	560	12	3	575
	97.4%	97.4%	2.1%	.5%	100.0%

*All three "Other country" responses were 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.

Estimated Entering Class Enrollment All ARRT-listed Programs



Details of Enrollment Reports*

Type of Program	2001 Enrollment	2002 Enrollment	2003 Enrollment	Attrition rate (%)
Radiography				
N	432	443	448	439
Mean	19.33	21.79	23.42	21.56
Median	17.00	19.00	20.00	18.00
Mode	16	20	20	20
Std. Deviation	11.915	12.977	14.192	18.439
Minimum	0	4	0	0
Maximum	110	100	118	98
Sum	8351	9652	10492	9463
Radiation Therapy				
N	54	55	57	57
Mean	9.44	10.91	12.61	18.03
Median	7.50	9.00	10.00	9.00
Mode	7	7(a)	6(a)	0
Std. Deviation	7.299	8.414	10.053	25.237
Minimum	0	3	0	0
Maximum	50	62	66	100
Sum	510	600	719	1028
Nuclear Medicine				
N	55	61	63	63
Mean	11.51	13.25	14.52	7.12
Median	8.00	10.00	12.00	2.00
Mode	4(a)	4	7	0
Std. Deviation	10.107	11.012	12.173	12.954
Minimum	0	2	2	0
Maximum	47	50	60	88
Sum	633	808	915	448

(a) Multiple modes exist. The smallest value is shown.

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

The most crucial results from the previous table are:

Type of Program	Year	Total Reported Enrollment	Enrollment Data Return Rate*	Estimated Total, All Programs	Percent Increase
Radiography	2001	8351	440/639= 68.86%	11405	----
	2002	9652	451/639= 70.58%	13748	20.5%
	2003	10492	456/639= 71.36%	14965	8.9%
Radiation Therapy	2001	510	55/101= 54.46%	812	----
	2002	600	56/101= 55.45%	1036	27.6%
	2003	719	58/101= 57.43%	1274	23.0%
Nuclear Medicine	2001	633	56/111= 50.45%	1162	----
	2002	808	62/111= 55.86%	1378	18.6%
	2003	915	66/111= 59.46%	1612	17.0%

*Includes combination programs that contained this discipline (e.g., a program that contained both radiography and radiation therapy components). Does not include one radiation therapy program that was contacted via telephone follow-up. 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.

The radiography program return rate was significantly higher than for the other program areas ($\chi^2 = 12.15, 1 df, P < .001$), which did not differ significantly in this respect.

For the most part, reported 2001 and 2002 enrollments and the percentage increase from 2001 to 2002 are consistent with the findings from *Enrollment Snapshot 2002*. (The *Enrollment Snapshot 2002* estimated the following percentage increases in total enrollments from 2001 to 2002: 13.7% for radiography, 27.4% for radiation therapy and 29.0% for nuclear medicine technology. None of these figures differ significantly from the corresponding *Enrollment Snapshot 2003* estimates.

Enrollments by Educational Level

Differences in enrollment increases as a function of the program's educational level were examined for the three program types. There were no statistically significant effects of educational level among types of program.

Attrition Rates by Program Type and Educational Level

Differences in attrition rate as a function of the program type and its educational level also were analyzed. The reported attrition rate "over the past few years" was substantially and statistically lower for nuclear medicine programs (7.1%) than for either radiography programs (21.6%) or radiation therapy programs (18.3%). Furthermore, baccalaureate-level programs had a significantly lower reported mean attrition rate (8.4%) than either certificate-level programs (16.5%) or associate-level programs (24.4%). Associate-level programs had a significantly higher mean attrition rate than did certificate-level programs.

Perceived Variability in Attrition Rate

Question 6. Has your attrition rate varied substantially over the past few years? If “Yes,” how has the attrition rate varied during the past few years?

Program Type (combined) * 6y. If yes, how has the attrition rate varied?

		Hasn't Varied Substantially	Increased	Decreased	Increased Some Yrs, Decreased Others	Total
Radiography	Count	260	35	58	75	428
	%	60.7%	8.2%	13.6%	17.5%	100.0%
Radiation Therapy	Count	38	3	3	10	54
	%	70.4%	5.6%	5.6%	18.5%	100.0%
Nuclear Medicine	Count	52	5	5	1	63
	%	82.5%	7.9%	7.9%	1.6%	100.0%
Total	Count	350	43	66	86	545
	%	64.2%	7.9%	12.1%	15.8%	100.0%

None of the three program types reported a clear trend in attrition rate over the past few years. Furthermore, a chi-square analysis showed no statistically significant differences among program types.

Q7: About what percent of your program’s graduates over the past few years have taken jobs in the United States?

About what percent of program’s grads over past 5 years have taken U.S. jobs?

Program Type	Mean	N	Std. Deviation
Nuclear Medicine only	97.7458	59	12.0395
Radiation Therapy only	94.0727	55	21.61092
Radiography only	98.5295	427	9.5523
Radiography & other program(s)	100.0000	6	.00000
Total	97.7015	549	12.69592

Note: The two Puerto Rican PDs’ responses to this question averaged 12.5%. However, telephone and e-mail conversations with P.R. PDs suggested strongly that these were the percentages of program graduates who took jobs in the *continental* U.S., and that almost all other graduates took jobs in Puerto Rico – which, as indicated earlier, is a part of the U.S. labor pool to which BLS estimates apply. These two programs were thus omitted from the above calculations, which is equivalent to assuming that their U.S.-market percentages are not different from the average for the 50 states.

Overall U.S.-market % for U.S. programs was 99.4%; for Canadian programs, 4.3%.

Near-term Changes

Capacity for Increases

Question 2. Is your program currently at full enrollment?

Is Program Currently at Full Enrollment		Program type				Radiography Combined w/ Other Program(s)	Total
		Nuclear Medicine Only	Radiation Therapy Only	Radiography Only	Other		
Yes	Count	42	31	354	0	5	432
	%	66.7%	55.4%	78.8%	0.0%	71.4%	75.0%
No	Count	21	25	95	1	2	144
	%	33.3%	44.6%	21.2%	100.0%	28.6%	25.0%
Total	Count	63	56	449	1	7	576
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

An overall chi-square was performed and proved to be statistically significant. However, the chi-square analysis also was performed with each of the three main specialties (nuclear medicine, radiation therapy and radiography) to ensure valid significance. A statistically significant chi-square was obtained in this calculation as well ($\chi^2 = 17.46$ w 2 *df*, $P < .001$). Radiography program directors were more likely to report full enrollment (78.8%) than were directors of nuclear medicine (66.7%) or radiation therapy programs (55.4%). The overall number of 75% is a substantial increase over the approximately 67% rate reported in the 2002 enrollment snapshot ($\chi^2 = 8.53$ w 1 *df*, $P < .01$).

Question 2 (cont'd). If not at full enrollment, how many more students could be accommodated in your program?

Program Type (combined)	Mean	Std. Deviation	N	Estimated Total Expansion Capacity
Radiography	5.47	6.308	93	741 students
Radiation Therapy	4.44	5.124	25	200 students
Nuclear Medicine	2.65	2.925	20	180 students
Total	4.88	5.789	138	1,121 students

Unmet Student Demand

Question 2 (cont'd). If at full enrollment, how many qualified students did you turn away this fall?

Program Type (combined)	Mean	Std. Deviation	N	Estimated Total Unmet Enroll. Demand
Radiography	46.77	54.820	324	23,550 students
Radiation Therapy	13.55	23.281	33	758 students
Nuclear Medicine	32.08	49.014	39	2,375 students
Total	42.55	53.180	396	26,683 students

Plans for Change

Question 3. Do you plan any changes related to enrollment?

Program Type		Do you plan any changes related to enrollment?			Total
		Increase	Decrease	Remain same	
Radiography	Count	78	14	353	445
	%	17.5%	3.1%	79.3%	100.0%
RTT	Count	13	3	41	57
	%	22.8%	5.3%	71.9%	100.0%
Nuclear Medicine	Count	14	2	46	62
	%	22.6%	3.2%	74.2%	100.0%
Total	Count	105	19	440	564
	%	18.6%	3.4%	78.0%	100.0%

All three types of programs were more likely to remain the same in their enrollments rather than to increase them. Only small percentages are planning to decrease their enrollments.

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

Program Type		4. How viable is your program over the next few years?			Total
		Continue to operate	Possibly closing	Will be closing	
Radiography	Count	429	15	5	449
	%	95.5%	3.3%	1.1%	100.0%
RTT	Count	53	3	1	57
	%	93.0%	5.3%	1.8%	100.0%
Nuclear Medicine	Count	60	2	0	62
	%	96.8%	3.2%	.0%	100.0%
Total	Count	542	20	6	568
	%	95.4%	3.5%	1.1%	100.0%

There were no statistically significant differences among the disciplines in respect to program viability. Approximately 95.4% of the program directors anticipate that their programs will definitely continue to operate, with only 3.5% indicating the possibility of closing. Moreover, only 1% of all programs (5 radiography and 1 radiation therapy) indicated they will be closing.

Factors Limiting Enrollment

Question 8. Rank order the following factors with respect to how seriously they limit enrollments in your program. Leave the space blank if you don't believe the factor limits enrollments.

Factor	Radiography Programs			Radiation Therapy Prog			Nuclear Medicine Prog			Overall
	% Who Mentioned	Mean Rank If Ment'd	Mean Importance ^a	% Who Mentioned	Mean Rank If Ment'd	Mean Importance ^a	% Who Mentioned	Mean Rank If Ment'd	Mean Importance ^a	Mean Importance ^a
Funding	56.4	2.65	3.62	56.9	2.52	3.44	60.3	2.32	3.24	3.56
Space	73.2	1.88	2.64	58.6	2.26	3.27	65.1	2.46	3.18	2.77
Equipment	51.1	3.19	4.03	48.3	2.43	3.68	54.0	3.12	3.83	4.00
Number Qualified Applicants	46.9	3.80	4.44	46.9	2.91	3.74	55.6	3.80	4.21	4.35
Availability of faculty	64.8	2.58	3.35	58.6	2.47	3.40	63.5	2.38	3.19	3.33
Number, staffing of clinical sites ^b	27.2	1.67	4.52	10.3	1.33	5.04	15.9	1.6	4.95	4.65
Other	6.9	1.60	5.36	1.7	1.0	5.39	7.9	1.4	5.32	5.34

^aImportance score = rank assigned if mentioned (or average rank in case of ties), average of nonassigned ranks if not mentioned.

^bThis factor was not included in list of items to be ranked but was listed in the "other (please specify)" category by a substantial number of respondents.

Averaging across the three program types, program directors rate space as the most important limiting factor, funding and availability of faculty next most important, then equipment, followed by number of clinical sites. Results likely understate the importance of the number and staffing of clinical sites, since this was not a choice on the list of alternatives, but was extracted from among those who checked "Other (please specify)." The rank ordering of these six factors did not differ significantly among different program types or as a factor of program educational level. However, among radiation therapy PDs the percentage of directors of associate-level programs who mentioned number of qualified applicants as a barrier was lower (3/12 = 25%) than the percentage of certificate and baccalaureate PDs (26/38 = 68%) who considered this a limiting factor (chi-square = 7.06 w 1 *df*, *P* < .01).

8. Other limiting factor, specified

	Frequency	Percent
Blank	383	65.5
Statement that there are no problems with enrollment	3	.5
Number, staffing of clinical sites	138	23.6
High cost of tuition- private university	1	.2
staffing the 1:1 ratio	1	.2
# OF RADIOGRAPHERS REQUIRED	1	.2
# PTS FOR CLINICAL EXPERIENCE	2	.3
?????, UNKNOWN	2	.3
ACCREDITATION REQUIREMENTS, COSTS	4	
AFFILIATIONS WITH HOSPITALS - RADIOGRAPHER STAFFING	1	.2
CLINICAL EDUCATION SETTING	1	.2
COST/AVAILABILITY OF GRANTS AND SPONSORSHIPS	1	.2
Decrease in hospital work load	1	.2
Do too good a job to get the necessary help yet incompetent faculty get all the help.	1	.2
ENERGY - THIS JOB IS TOO DAMN HARD	1	.2
Enrollment is limited by on-site capacity of affiliating hosp's radiology dept and competition of other rt programs competing for the same slots at our affiliates	1	.2
FACULTY SALARIES ARE NOT COMPETITIVE IN COMPARISON TO RT FTES	1	.2
FUNDING REFERS TO STUDENT FINANCE NOT PROGRAM	1	.2
GEOGRAPHY ONLY LIMITING FACTOR OF AFFILIATE SITES	1	.2
I HAVE TOO MANY APPLICANTS	1	.2
IN OUR AREA OF THE U.S. THERE ARE ACTUALLY TOO MANY RTR PROGRAMS AND STUDENTS FOR THE AVAILABLE JOBS OR THERE WILL BE BY 2006	1	.2
INSTITUTIONAL POLITICS	1	.2
INTERESTED APPLICANTS. WE ARE NOT DOING A GOOD ENOUGH JOB OF ADVERTISING & MAKING THIS CAREER ONE THAT PEOPLE WANT TO COME INTO. ALSO A REMOTE (3 HRS BY CAR) DIDACTIC CENTER MEANS THAT STUDENTS WANT TO REMAIN IN CITY & NOT RELOCATE FOR CLINICAL	1	.2
JOB AVAILABILITY IN AREA - TIGHTENING INCREASED BY PROGRAMS CLOSE BY	1	.2
JRCERT COOPERATION	1	.2
JRCERT LIMITATION	1	.2
LACK OF JOBS IN CENTRAL ILL.	1	.2
LIMITED QUOTA SET BY THE NAVY	1	.2
LIMITS ON CLASS SIZE SET BY JRC BASED ON PT LOAD IN THE CLINICS	1	.2
MOST EXPENSIVE 4 YR PROGRAM IN THE US	1	.2
MY ONLY SERIOUS LIMITATION IS SPACE	1	.2
NA	2	.3
NEED OF ARRT SUPERVISOR TECHS VOLUME & VARIETY OF PROCEDURES/ARRT REQUIRED COMPETENCY	1	.2
Next to equipment (left blank): In lab or area hospitals?	1	.2
NO LIMITATIONS MORE QUALIFIED CANDIDATES THAN SEATS AVAILABLE FOR QUALITY EDUCATION	1	.2
NO OF STAFF TECHNOLOGIST AVAILABLE IN AREA	1	.2
NOT ENOUGH FACULTY TO INCREASE STUDENT NUMBERS	1	.2
Paperwork and cumbersome accreditation administration restricts expansion for lack of administrative support to carry this burden	1	.2
NUMBER OF PROCEDURES AVAILABLE	1	.2
NUMBER OF TECHS (1-1 RATIO)	1	.2

PROGRAM IS ATTACHED TO PRIVATE UNIV VERY EXPENSIVE COMPARED TO OTHERS LIKE IT	1	.2
Q8, next to "Other" (clinical sites): Most critical	1	.2
Q8 (space rated # 1, "other" checked); # of slots available at affiliating hospital.	1	.2
RTR to Student Ratio	1	.2
size of hospital - located in rural community	1	.2
STAFF TECH SHORTAGES	1	.2
STAFF TO STUDENT RATIO, AVAILABILITY OF PROCEDURES	1	.2
STAFFING	1	.2
STUDENT/PRECEPTOR RATIO IN CLINIC	1	.2
STUDENT/TECH RATIO, DOWNSIZING OF HOSPITAL EMPLOYEES	1	.2
THE ABOVE responses ARE FOR NEW STUDENTS ADMITTED 2002 TO 2003. Previous to 2002 # of qualified applicants would rank # 1. Also, we feel that as the economy improves and businesses start hiring that we will see a decrease in the # of qualified applicants. We had at least 20 qualified applicants for 2002 and 2003. This was not the norm for 1997-2001.	1	.2
WE ACCEPT BASED ON SUPPLY AND DEMAND IN OUR AREA	1	.2
WE COULD EXPAND OUR PROGRAM. WE HAVE INTERESTED SITES FOR EXPANSION AND INTERESTED STUDENTS HOWEVER a new AS program is opening in our state and the addition of their graduates to those our program graduates is likely to "flood" the market in our state. We will not expand for that reason,	1	.2
WE WON'T. THE MARKET	1	.2
YOU ARE ASSUMING THAT ENROLLMENT SHOULD INCREASE - ?? HAVE WHEN THE PHYSICIANS ??? OVER THE NEXT 2 YRS THE SHORTAGE WILL BE GONE	1	.2
Total	585	100.0

Faculty Issues

Recruiting Faculty

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

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	358	61.3	66.3	66.3
	No	182	31.2	33.7	100.0
	Total	540	92.5	100.0	
Missing	System	44	7.5		
Total		584	100.0		

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

Program Type		9. Do you find it difficult to recruit new faculty for your program?		Total
		Yes	No	
Radiography	Count	277	141	418
	%	66.3%	33.7%	100.0%
Radiation Ther	Count	39	10	49
	%	79.6%	20.4%	100.0%
Nuclear Med	Count	34	28	62
	%	54.8%	45.2%	100.0%
Total	Count	350	179	529
	%	66.2%	33.8%	100.0%

Across all three programs and all four education levels, about 66% of program directors surveyed answered yes to Question 9. Moreover, there were statistically significant differences between difficulties in recruiting new faculty across type of program. A higher proportion of radiation therapy program directors found it difficult to recruit new faculty (79.6%) than either radiography PDs (66.3%) or nuclear medicine PDs (54.8%) ($\chi^2 = 4.67$, 1 *df*, $P < .05$). However, there were no statistically significant differences as a function of program educational level.

Question 9 (cont'd). If “Yes,” what do you believe is the source of the difficulty?

Source of difficulty of recruiting faculty

Dichotomy Label	Count	Pct of Responses	Pct of Cases
Salary	197	35.4	52.3
Degree Requirements	165	29.7	43.8
Availability of Interested Applicants	145	26.1	38.5
Other	49	8.8	13.0
Total Responses	556	100.0	147.5
207 missing cases; 377 valid cases			

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.

The only substantial departure from this ranking as a function of program type or educational level was that a significantly smaller percentage of nuclear medicine PDs (7.7%) than of radiography and radiation therapy PDs (33.6%) felt that degree requirements contributed to their faculty-recruitment difficulties, with the result being that “degree requirements” was the least frequently mentioned contributing factor (not counting “other”) among nuclear medicine PDs .

90th. Other source of difficulty in recruiting faculty, specified.

	Frequency	Percent
Blank	494	84.4
Faculty recruitment not a problem	1	.2
College is only willing to offer part-time faculty positions and most work during the daytime hours. It would be easier to recruit if the position was permanent part-time with a set number of hours per week	1	.2
Full-time status & benefits	1	.2
MANY RADIOGRAPHERS SIMPLY DO NOT WANT TO TEACH.	1	.2
N/A; haven't had to recruit past 5 years (some said past 20 yrs)	11	
Qualified applicants with experience and a rural community	1	.2
Since we are hospital based and our instructors are exempt employees, they are not able to work on call or overtime in our facility.	1	.2
Unable to pay them a full-time salary.	1	.2
0 - master's prepared in their community college district; 2-3 bachelor's prepared.	1	.2
A CLINICAL INSTRUCTOR WOULDN'T BE DIFFICULT BUT A MASTER'S DEGREE PROGRAM DIRECTOR WOULD BE ALMOST IMPOSSIBLE	1	.2
ABILITY TO TEACH	1	.2

After 48 years of successfully graduating competent radiographers from our hospital-based radiography program, the JRCERT, in its lack of wisdom, has decided to eliminate all hospital-based programs by requiring a Master's Degree for all program directors. They were aware small hospital programs could not attract a Master's person therefore these programs would eliminate themselves.

This does not affect me personally as I am retiring in 2004 anyway; however our program will close at that time due to the JRCERT requirements. They should have required hospital-based program directors to have a B.S. and then college programs to have a Master's however this would not have accomplished their goal.

Ignorance is no excuse, however in spite of their myopic decision, our profession will survive.

ALL 3 FACTORS LISTED ABOVE	4	
Although we have not had to recruit any new faculty, I feel that recruitment would be difficult due to low salaries in our facility and educ'l requirements of faculty positions.	1	.2
AMOUNT OF WORK REQUIRED	1	.2
Availability of "qualified" applicants & training teachers in rad science	1	.2
AVAILABILITY OF QUALIFIED AFFILIATES	1	.2
AVAILABILITY OF QUALIFIED APPLICANTS	1	.2
Both Salary & degree requirements	1	.2
CANNOT HIRE MORE FACULTY	1	.2
college faculty contract	1	.2
COLLEGE ONLY WANTS TO HIRE ADJUNCTS	1	.2
COMBINATION OF SALARY AND AVAILABILITY OF INTERESTED AND QUALIFIED APPLICANTS	1	.2
COMPETITION WITH OTHER COLLEGE AND HOSPITAL PAY FOR NEW GRADS VS. TOP SALARY FOR SR TECHS	1	.2
CONVINCING THE COLLEGE WE NEED HELP PAYING A DECENT SALARY	1	.2
DEGREE REQ - MOST CLINICAL FACTOR; SALARY REQ - 2ND MOST CRITICAL FACTOR	1	.2
Do not know, as NO new faculty have been hired in many years.	1	.2
EDUCATION QUALIFICATIONS	1	.2
Faculty with published articles or research	1	.2
FOR CLINICAL COORDINATOR & PROGRAM DIRECTOR	1	.2
For example, I make less with a Master's Degree than I did as a tech.	1	.2
FUNDING -- Not allowed to hire more FACULTY	1	.2
FUNDING NOT AVAILABLE TO INCREASE TO NECESSARY LEVELS.		
REPLACEMENTS FOR A PART TIME LAB INSTRUCTOR NETTED GOOD RESULTS THIS PAST SUMMER	1	.2
FUNDING WILL NOT ALLOW FOR INCREASE IN NUMBER OF FACULTY	1	.2
GRADUATED IN DEC 02 WITH MASTERS - NO SALARY COMPENSATION REWARDED	1	.2
HELP!!	1	.2
I haven't had to "recruit" anyone recently but in my area the local tech college is having a very difficult time recruiting.	1	.2

I, _____, BA, RTLR, feel that the degree requirements are a necessary outcome for autonomy in our profession. However, most available candidates come from 2 yr certificate granting institutions. Some quite simply have no desire to continue to higher education. Therefore, most do not meet educ'l requirements. Now we are lucky with our articulation with _____ CC. Those potential students can choose an AS in Radiologic Science come to our program complete clinicals and ?? from this 2 yr program about 30 credit hours and earn their AS. This lights a fire in the student to aspire to higher levels of education and as a byproduct have in the work force a more "well-rounded" educated individual that can potentially fill vacancies, not only educational but managerial, etc.	1	.2
IF THIS WERE 2009 THE MASTERS REQUIREMENT OR JRCERT ACCREDITED PROGRAMS WOULD DEFINITELY BE A FACTOR. This degree requirement should be a HUGE concern to our profession, & this comment comes from a master's prepared PD!	1	.2
Individuals who meet the degree requirements can earn substantially more money in other positions.	1	.2
INDIVIDUALS WITH AN MBA ARE NOT GOING TO APPLY FOR A CERTIFICATE PROGRAM DIRECTOR PROGRAM	1	.2
INSTITUTIONAL DOWNSIZING	1	.2
IT'S A DIFFICULT JOB TO TEACH & ADMINISTRATION ONLY HAS SO MANY TEACHERS THEY WILL HIRE	1	.2
IT'S ONE THING TO HAVE HANDS-ON EXPERIENCE OR EVEN THE KNOWLEDGE BUT TO TEACH IT IS WHOLE OTHER STORY	1	.2
lack of health benefits for part-time faculty	1	.2
LACK OF INTERESTED & QUALIFIED APPLICANTS	1	.2
limited hours that they are allowed to work as adjunct faculty	1	.2
LIMITED QUALIFIED APPLICANTS TOO	1	.2
LOCATION	1	.2
LOCATIONS	1	.2
many in field don't think of this as a career option	1	.2
MASTERS DEGREE REQUIREMENTS narrow the candidate pool for program directors. There is not a wealth, by any means, of radiographers with graduate degrees.	1	.2
NEW FACULTY WILL BE A PROBLEM OVER THE NEXT 5-7 YEARS OR SO UNTIL WE DO A BETTER JOB OF PREPARING RECRUITS TO TAKE PLACES OF "WORN OUT" EDUCATORS. WE HAVE NOT BEEN PROACTIVE ENOUGH AS A PROFESSION IN GROWING REPLACEMENT FACULTY. NOW THAT RT SALARIES ARE HIGHER, IT IS EVEN MORE PROBLEMATIC FOR US. WE HAVE BEN PUSHING GRADS TO MOVE TOWARD HIGHER DEGREES IN ED TOO FEW BS, MS PROGRAMS IN ED THAT FALL OUTSIDE OF K-12 LEVEL PREP. IN ADDITION LOOK AT HOW WE WHINED AS A PROFESSION WHEN JRCERT IMPLEMENTED THE MS DEGREE REQUIREMENT FOR PROG. DIRETORS. WE WHINED IN THE EARLY 90S WHEN THE BS DEGREE WAS IMPLEMENTED AND EDUCATORS FOLDED UNDER THE PRESSURE AND TOOK A STEP BACKWARD, THEN IT WAS WITHDRAWN BECAUSE OF IT! IT IS OUR OWN FAULT WE ARE IN THIS SHAPE!	1	.2
NO MORE FTES	1	.2
Not now, but we will when degree requirements change.	1	.2
ONLY PART-TIME WORK AVAILABLE AT PRESENT	1	.2
OUR LOCATION VERY RURAL	1	.2
PROGRAM DIRECTOR REQUIREMENT OF A MS DEGREE W/O SALARY COMPENSATION IS A DRAWBACK	1	.2
Q9, arrow from "salary": Low pay.	1	.2
QUALIFIED AND EXPERIENCED IN TEACHING	1	.2
QUALITY OF APPLICANT	1	.2
Regarding question 9, we have not had to hire any new faculty in 8 years, and probably will not have to in the near future. I am concerned about the availability of interested applicants when it does become necessary to recruit new faculty due to the fact that we are located outstate, and not near any metro areas.	1	.2

SALARY	1	.2
Salary plus available hours generally not enough hours to satisfy most qualified applicants.	1	.2
SALARY TOO	1	.2
SALARY WILL NEVER BE HIGH ENOUGH TO HIRE A MASTERS - MY REPLACEMENT WOULD'VE BEEN A BS DEGREE PERSON, REFUSES TO PUT TIME & MONEY INTO MASTERS KNOWING COMPENSATION WILL NEVER BE APPROPRIATE	1	.2
SOME DIFFICULTY FINDING QUALIFIED FULL-TIME CLINICAL INSTRUCTORS AT OUR AFFILIATES	1	.2
THE BETTER EDUCATED ARE IN HIGH PAYING SPECIALTY AREA & NOT INTERESTED IN TEACHING - NEED TO INCREASE PAY BY 25% OR MORE	1	.2
The increased DEGREE REQUIREMENTS for faculty is driving quality candidates away.	1	.2
THE PROFESSION NEEDS TO PROMOTE BS AS ENTRY-LEVEL FOR RTS IN ORDER TO DEMONSTRATE THE IMPORTANCE OF CE NOT JUST BY "POINTS" FOR ARTICLES, etc.	1	.2
THESE COMMENTS REFER TO PART-TIME FACULTY	1	.2
THEY HAVE TO TAKE A HUGE CUT IN PAY	1	.2
THIS IS A NONLICENSURE STATE WE HAVE TROUBLE NOT HAVING ENOUGH ARRT TECHS TO SUPERVISE OUR STUDENTS THAT LIMITS HOW MANY STUDENTS WE ADMIT	1	.2
This program will be in serious trouble with faculty in 2009 due to new degree requirements.	1	.2
UNWILLING TO ASSIGN NEW POSITIONS/PAY	1	.2
WE ARE CURRENTLY AT FULL CAPACITY BUT ANTICIPATE A NEED W/IN THE NEXT YR & SALARY & DEGREE WILL BE AN ISSUE	1	.2
We filled one available faculty position. we had two applicants for the position	1	.2
WE HAVE BEEN STABLE FOR SOME TIME - I HAVE ALWAYS GROOMED PEOPLE TO BE READY TO TEACH BY GIVING THEM INSTRUCTION & OPPORTUNITY	1	.2
WE HAVEN'T HAD TO RECRUIT FACULTY BUT WILL BE FACED WITH TRYING TO FIND SOMEONE WITH A MASTERS DEGREE IN 2009. THE CURRENT PROGRAM DIRECTOR WILL NO LONGER BE ELIGIBLE. THIS MAY REQUIRE OUR PROGRAM TO BECOME AFFILIATED WITH LOCAL UNIVERSITY OR STATE	1	.2
We haven't had to recruit for 20 years!	1	.2
Yes, it is difficult to recruit new faculty as the pay rate for teaching is so low especially compared to what they can earn in the clinical aspect		
Total	585	100.0

Will the Gap Close?

To be more specific, if 2003 first-year enrollment figures are maintained, will the profession meet the need for additional R.T.s between 2000 and 2010 projected by the BLS? In answering this question, we assume that each of the following factors will remain constant for the three radiologic technology disciplines between now and the end of 2010:

- 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, ... eight years ago.

In addition, we assume that our 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, we show in some detail how the various statistics were estimated and then combined to predict the 2010 supply of radiographers. We then give briefer summaries of the calculations for the other two disciplines. 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 *Snapshot*), the simple average of the estimates is employed.

Radiography

The BLS projects that 75,000 additional radiographers will be needed between 2002 and 2010. Actual BLS projections represent the period between 2000 and 2010, but the number of applicants taking the primary certification exams declined late in 2001, so it is likely that the total need was not significantly reduced before 2002. Given the estimate of 14,965 students entering radiography programs in 2003, together with the PD-estimated attrition rate of 22% and an 88% pass rate for the certification exam, this discipline would appear to be adding new radiographers to the profession at a rate of 10,272 per year.

However, not all new radiographers still will be practicing radiography in 2010. Some will have moved into another specialty, while others may have switched to another health profession, left health care, or quit working altogether. How many of a given year’s new radiographer cohort remain in the profession for one, two, ... 10 years? An ARRT-supplied database provided the number of registered R.T.s who listed radiography as their primary area of employment in late March 2003 and who had been working in radiography for less than one year, one to three years, etc. We used 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 1992 to 2001.⁵ This information provides the following estimate of the overall retention profile for radiographers:

<u>Year</u>	<u>No. of First-time Certificants</u>	<u>No. in Radiography for X Years as of 3/2002</u>	<u>No. Reporting ___ Years in Radiography as of 3/2002</u>	<u>Percent Retained</u>
2001	7434	.75(7434) = 5576	< 1 year: 4390	79%

2000	7149	.25(7434) = 1858	1-3 years: 13,650	13650/14744
1999	7595	7149		= 82%

1998	8146	8146	4-5 years: 8876	8876/16837
1997	8691	8691		= 53%

1992-1996	36,883	48,710	6-10 years: 17,261	= 35%

A similar retention profile was computed using demographic data supplied by ARRT in late August 2003. Despite being based on somewhat different cohorts of radiographers (e.g., about one-third of the radiographers who fell into the one to three years category in March 2002 now fell into the for to five years category in August 2003), the retention percentages were generally comparable to those given above. We therefore averaged the two retention profiles to increase the reliability of the retention-percentage estimates, as follows:

<u># of Years in Radiography</u>	<u>Percent of New Certificants Still in Field After No. of Years</u>
< 1 year	69%
1-3 years	79%
4-5 years	56%
6-10 years	37%

Assuming that this profile holds true for the radiography cohort of 2002 and subsequent cohorts, we would expect that, on average, approximately 37% of radiographers who were first-time certificants between 2002 and 2004 would still be practicing radiography as their primary discipline in 2010; 56% of those in the classes of 2005 and 2006 would still be practicing radiography in 2010; about 79% in the classes of 2007, 2008, 2009 and 69% of the class of 2010 would be practicing at the end of 2010.

ARRT's 2002 *Report of Exams* shows the class of 2002 consisted of 7,188 new certificants, and we estimate that the class of 2003 will number 8,225 new certificants (12,298 students who entered radiography programs in 2001, decreased by a 22% attrition rate and a 12% exam failure rate), while 2004 will see 9,775 new radiographers. Further, the new-certificant class of 2005 (and, under steady-state assumptions, each subsequent class) should consist of approximately 10,272 new radiographers. Combining these figures with the above retention profile leads to an estimate that 25,188 (the number of new radiographers certified in 2002 to 2004) x .37 + 20,544 x .53 + 30,816 x .79 + 10,272 x .69 = 51,640 additional radiographers by the end of 2010. However, an average of 1.5% of new ARRT (R) certificants take jobs outside the United States, so we estimate that between 2002 and 2010 a total of about 50,866 radiographers – only about two-thirds of the BLS-estimated need – will have been added to (and remain in) the U.S. labor pool of radiographers. It should be noted that 17.5% of radiography program directors plan to increase their enrollments.

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Radiation Therapy

The BLS projects that 7,000 radiation therapists will be needed between now and 2010. According to ARRT's 2002 *Report of Exams*, the class of 2002 consisted of 561 new certificants. We estimate that the class of 2003 will number 638 new certificants (904 students who entered radiation therapy programs in 2001, decreased by an 18% attrition rate and a 14% exam failure rate), while 2004 will see 833 new radiation therapists. Further, the new-certificant class of 2005 and, under steady-state assumptions each subsequent class, should consist of approximately 898 new therapists. Combining these figures with the retention profile estimated for radiation therapists leads to an estimate of $2,032$ (the number of new radiation therapists certified in 2002 – 2004) $\times .73 + 1796 \times 1.22 + 2694 \times 1.15^* + 898 \times .96 = 7635$ additional RTTs by the end of 2010. However, an average of 5.9% of new ARRT (T) certificants take jobs outside the United States, so we estimate that between 2002 and 2010 a total of about 7,184 radiation therapists will have been added to (and remain in) the U.S. labor pool, thereby meeting the BLS-projected need in this modality. It should be noted that 22.8% of radiation therapy program directors plan to increase their enrollments.

*The number of ARRT certificants whose primary sphere of employment in February 2002 was radiation therapy and who have been practicing in this discipline for one to three years is 115% greater than the number of radiation therapists who passed the radiation therapy certification exam in 1999, 2000, or 2001 (i.e., one to three years ago). Therefore, the multiplier is 1.15 in computing the number of 2007, 2008, and 2009 new therapy certificants who will be practicing at the end of 2010. This excess probably is due to repeat examinees and migration into radiation therapy from other specialties (e.g., radiography).

Nuclear Medicine Technology

The BLS projects a need for 8,000 nuclear medicine technologists to meet increased demand and attrition between 2002 and 2010. We know from ARRT's 2002 Report of Exams that the class of 2002 consisted of 234 new ARRT certificants. However, there also were 722 individuals who passed their initial Nuclear Medicine Technology Certification Board (NMTCB) certification exam in 2002 (personal communication from NMTCB, 11/12/03). Since many prospective nuclear medicine technologists take both certification exams, the total 2002 new-certificant class is less than $722 + 234$ in number. To remain conservative, we adopted 722 for this report. Our best estimate of the total number of students entering nuclear medicine technology educational programs in 2001 is 1,180 (averaging the estimates obtained from the 2001, 2002, and 2003 *Enrollment Snapshots*). Nuclear medicine PDs estimate an attrition rate of about 11%, and the pass rate for the 2003 exam will probably be close to the 2002 rate of 90%. This means the new-certificant class of 2003 should consist of about 945 new nuclear medicine technologists. Similar calculations lead to an estimate of a 2004 new-certificant class of 1,134 and a 2005 new-certificant class numbering 1,291 new nuclear medicine technologists. Under steady-state assumptions that same number of 1,291 individuals should pass their nuclear medicine certification exam(s) for the first time in each year from 2006 through 2010.

From ARRT certificant and years-in-discipline information for nuclear medicine technologists, we estimate that the number of ARRT certificants primarily employed in nuclear medicine technology for less than one year is about 96% 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), that the number of ARRT-registered R.T.s who have practiced nuclear medicine for four to five years is about 106% of the number who took the primary exam and passed it for the first time four or five years earlier, and that those who have been in the discipline for six to 10 years would be, on average, 61% of first-time certificants in the corresponding five-year time slot. Thus, we expect under steady-state assumptions that about 11,004 additional ARRT-registered nuclear medicine technologists would be practicing in the profession by the end of 2010. Since 97.75% of graduates of nuclear medicine programs take jobs in the United States, this suggests that about 10,756 ARRT-registered nuclear medicine technologists will have been added to the U.S. labor pool between 2002 and 2010. 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. That figure may not hold up over the next seven years, but it seems likely that the profession will have added and retained at least 12,000 additional nuclear medicine technologists between 2002 and the end of 2010 -- 50% higher than the BLS-estimated need for additional NMTs.

Uncertainties in Projections

These projections are subject to a high degree of uncertainty. First is statistical uncertainty. The 95% confidence intervals (CIs) around the estimated total entering-class enrollment for 2003 in these three disciplines are ± 465 students for radiography, ± 178 for radiation therapy and ± 224 students for nuclear medicine technology. (The CIs around enrollment figures for 2000 to 2002 are narrower, since they average 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. For example, 17.5% of radiography PDs plan to increase their enrollments in the near future and potential variations in the number of applicants due to changes in reimbursement rates for radiologic procedures, etc. Moreover, retention profiles, or the ratios of those currently practicing in a discipline to those who passed their initial certification exam in the discipline a certain number of years earlier, are based on calculating backward from just two points in time (March 2002 and August 2003) and may not be representative of what will happen to the 2002 to 2010 new-certificant cohorts.

This enrollment snapshot is based on the supply side of the equation. We leave demand guesswork to the BLS, which will release revised projections for professional need through 2012 in February 2004. Undoubtedly, rapid changes in technology and health care economics impact supply and demand numbers. For example, though current figures show supply in nuclear medicine will exceed need for these technologists, current figures most likely have not taken into

account the rapid proliferation of PET/CT and the demand for technologists to fill these positions.

Based on the best and most current data available, however, we estimate that radiation therapy is producing new practitioners at or above the correct rate to meet the 2010 demand projected by BLS, while nuclear medicine will exceed the estimated need by 50% or more and radiography is likely to come up well short (by over 30%) of the projected demand unless enrollments and/or retention rates increase.

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Appendices

Appendix A: Questionnaire



Radiography, Radiation Therapy and Nuclear Medicine Enrollment Survey

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

Indicate your type of program.

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

What is the educational level of your program?

- Certificate
- Associate degree
- Bachelor's degree
- Other (Please specify _____)

In what country is your program located?

- USA
- Australia
- Canada
- Other (Please specify _____)

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

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 a program once he or she is admitted to that program; this may be after a year or more of general course work.)

2001 2002 2003

2. Is your program currently at full enrollment?

- Yes 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?

- Plan to increase
- Plan to decrease
- Plan to remain the same

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

- Will definitely continue to operate
- Possibly will be closing
- Will be closing
- If your program is closing, how many more years will it continue to operate, including this academic year?

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

Appendix B: Comments Written on Questionnaires or Sent Via E-mail

Supplementary comments written on questionnaire

	Frequency	Percent
Blank	507	86.7
Educational Level of Program		
Ed level (certif & assoc): Assoc degree optional.	1	.2
Ed level (checked "certif" and "bachelor's"): With affiliation to academic setting.	1	.2
Ed level (checked AS, Bach): Both.	1	.2
Ed level: Assoc of Applied Science: 30% gen ed, 70% Rad credit hrs, 84 total cr hrs.	1	.2
Ed level: Associate optional.	1	.2
Ed level: with educational affiliate (3+1)	1	.2
Educ level, next to bachelor's: Under development.	1	.2
Q1 (Entering-Class Enrollments)		
Q1: Program closed in 1996. Reopened with students in 2002.	1	.2
Q1 (11,12,12): 2001, 11 Assoc; 2002, 12 assoc & 10 certif; 2003, 12 assoc & 11 certif.	1	.2
Q1 (2003 entry only): This is the first year this program accepted students.	1	.2
Q1: Admit students every other year; odd years, nonradiographers, even years radiographers. 10 nonradiogr in 2001, 4 radiogr in 2002, 10 nonradiogr in 2003.	1	.2
Q1: Crossed out "freshman", replaced with "junior".	1	.2
Q2: Program at Full Enrollment?		
Q2 (# could be accommodated blank): We take 20. [2003 enrollment 18]	1	.2
Q2 (# turned away left blank): Not sure how to answer this. We don't actually turn students away. If they meet admission requ'ments they are put on a "waiting list" but are guaranteed to get in the program. Currently the list has 102 people on it. [2003 enrollment: 37]	1	.2
Q2 (# turned away): 40 (on waiting list)	1	.2
Q2 (full enrollment?): Yes for radiography, no for BS degree. (# turned away left blank): We have 35 students on waiting list for next year.	1	.2
Q2 (1 add'l could be accom'd): Due to dropout. Q2, beside (blank) "if yes": Interviewed 60, took 12.	1	.2
Q2 (1 more student could be accomodated): Student dropped -- we were at full enrollment.	1	.2
Q2 (10 more could be accom'd): As per allowance of 2 students per unit. Bottom of last pg: We probably could take in more students if we placed 2 per machine, added new sites, etc. However, in the past we found that increasing enrollments often resulted in graduating large classes after the "shortage" was over. We find that 15 students is a good number to keep the local market stable.	1	.2
Q2 (10 turned away): We purposely enroll less than what we can accommodate to keep the faculty to student ratio high.	1	.2
Q2 (15 turned away): However, they met minimum requirements -- we advise students to take more general education courses. Students chose to apply 2004.	1	.2
Q2 (15 turned away): Waiting list for next year.	1	.2
Q2 (150 turned away): 150 qualified students on the defer list. Our program admits students from a deferred enrollment list once they're qualified. This is a nonselective enrollment type of admission -- based on completion of program requirements.	1	.2
Q2 (4 more could be accommodated): First year full - 12. 2nd year - 8.	1	.2
Q2 (40 turned away): We do not "turn away" -- there is a waiting list to enter.	1	.2

Q2 (60 turned away): On wait list for 2004	1	.2
Q2 (8 add'l cld be accom'd): We are approved for 17, but our clinical sites are not able to accommodate that many at this time due to personnel shortages and high caseloads.	1	.2
Q2 (add'l accom'd blank): Waiting list up to 2007.	1	.2
Q2 (cld accom 10): Maybe, if decreased # of exams + faculty are a big problem.	1	.2
Q2 (could accom 6 add'l): If clinical sites were available & fully staffed.	1	.2
Q2 (could be accom'd left blank): Started at capacity and lost one. (0 turned away): Used waiting list.	1	.2
Q2 (full enrollm?): Yes and no. (9 add'l cld be accom'd): Varies per class. Current sophomore - full; can take 9 more freshmen. (6 turned away): transfers to the sophomore class.	1	.2
Q2 (full enrollment?): Rad ther, yes; NMT, no.	1	.2
Q2 (full, but # turned away blank): We had 60 applications submitted. How many were qualified?????	1	.2
Q2 (more than 50 turned away): Highest # of qualified applicants in history of program. See # 8.	1	.2
Q2 (not at full enrollment): "Attrition does not quite describe why my program is not full. In both 2001 and 2003 a student initially accepted a position in the program & then withdrew just before the program was to commence. Due to the late date of the withdrawal, it was not possible to fill the position, even though there were other qualified applicants who had been denied admission (several months previously)."	1	.2
Q2 (not full, but 0 more cld be accom'd): We are accredited for 14 students, but don't feel we can do 14 students justice. [2003 enrollment 12]	1	.2
Q2 (turned away left blank): N/A: We have ongoing wait list of 334 applicants	1	.2
Q2, how many turned away: Hard to say, as we did not continue to interview, although the # of applicants was approximately 2 x 2002 figures.	1	.2
Q2 [Canadian program]: Please note we had a lower intake this year because we changed our entrance requirements. The current requirements ask for 27 credit hours of post-secondary education. (see our website: _____.ca) We are moving towards a degree completion option program.		
Enrollment is "considered" full at _____ College for the following reason: The lack of RT's in the clinical education centers somewhat restricts the number of students assigned to each clinical center. The RT to student ratio must be 1:1. This has lowered the number of students assigned to each individual center and has forced the program to seek additional clinical education centers. The approved JRCERT number is not the enrollment number listed on the survey. Actual enrollment is well below JRCERT approved numbers due to the staffing situation mentioned.		
Q3: Plan, next few years, to increase, decrease, or stay same?		
Q3 (3 add'l): Our site. _____ sites have never had full enrollment.	1	.2
Q3 (increase): Attempting to be fully subscribed with 13 students.	1	.2
Q3 (plan remain same): This is due to accreditation guidelines.	1	.2
Q3 (Plan to remain same): Would like to increase by 3 or 4.	1	.2
Q3 (Plan to remain same): We have a capacity of 18 and have been "overloading" by a few each year.	1	.2
Q3 (remain same): 130 students per yr.	1	.2
. I answered that the program will remain the same at this time for enrollment. The only way to grow is to add clinical centers and our program will be looking to add more "outreach" clinical centers (centers more than 30 miles away).	1	.2

Q4: How viable is your program over the next few years?		
Q4 (how many more yrs?): Will be determined this December.	1	.2
Q4: Define next few years. We will probably be non-compliant with JRCERT in 2009 and lose accreditation.	1	.2
Q4 (possibly closing, how many yrs left blank): Don't know.	1	.2
Q4 (will be closing in 2 years): With Sept. 2004 class.	1	.2
Q4 (will be closing; when left blank): NA -- school is transitioning to a technical school in the area this fall.	1	.2
Q4 (yrs before closing): Until Master's degree requirement.	1	.2
Q5: Program's attrition rate, past 5 years		
Q5 (# qualified applicants ranked # 1): Quality was way up for 2003.	1	.2
Q5 (left blank): 2001-2002: 25%; 2002-2003: 9%.	1	.2
Q5 (left blank); 1 STUDENT IN CLASS ADMITTED IN 2001; 1 STUDENT IN CLASS ADMITTED IN 2002, BUT WAS REPLACED WITH AN ALTERNATE.	1	.2
Q5 (7% attrition): 5 in 2003 freshman to sophomore	1	.2
Q5 (attrition): Over 40% 1998-2002; 5% attrition of current 2nd year class.	1	.2
Q5 (12% attrition, next to "past few years"): How many?	1	.2
Q5 (53% attrition): 1999-2001.	1	.2
Q5 (attrition): .14 for 2003, .28 for 2002, and .28 for 2001.	1	.2
Q5: Approx. 20%-30 Q9, arrow from "salary": Low pay.	1	.2
Q5: Averaged over the last 3 yrs: 2001, 50%; 2002, 40%; 2003, 22%.	1	.2
Q5 (attrition): This is the average since 1998.	1	.2
Q5: 1 student (of 9)	1	.2
Q5: 14.63 over past 5 yrs (1999-2003).	1	.2
Q5: 2002, 38%; 2003, 19%.	1	.2
Q5 (5.6% attrition): Over 5 years.	1	.2
q5: 5 year avg.	1	.2
Q5: New program only 3 years of stats.	1	.2
Q5: New program. Figures not available. (Ditto, questions 6 and 7.)	1	.2
Q5: Over 5 years.	1	.2
q5: Over last 5 yrs	1	.2
Q5: Specified attrition rate was for past 5 years.	1	.2
Q6: How has attrition rate varied?		
Q6 (incr'd & decr'd): 12%, 36%, 0%, 17%, 20%.	1	.2
Q6: Underlined "substantially".	1	.2
Q6 (has varied): 67%, 31%, 60%.	1	.2
Q6 (attrition incr'd & decr'd): 5% current sophomore class, over 40% previous 5 years.	1	.2
Q6: SEE SUBMITTED CHART. [Didn't find.]	1	.2
Q7: What % of grads, past 5 years, took jobs in U.S.?		
Q7 (DK): New program as of 9/2002.	1	.2
Q7: n/a. Have not graduated a class yet.	1	.2
Q7 (100%): of those employed	1	.2
Q7 (100% U.S.): of students seeking employment	1	.2

Q7 (100% U.S.): of those seeking jobs in radiography -- a few have changed careers.	1	.2
Q7 (88% of grads took jobs in U.S.): Some went straight into advance modality programs. All have stayed in field in some modality.	1	.2
Q7 (Canadian program; left blank but wrote): 1 student = 14%.	1	.2
[Canadian program]: Our graduates have a difficult time to enter the U.S. employment market. The trade agreement does not include medical radiographers.	1	.2
Bottom of Last Page or Emailed, Not Clearly Related to a Particular Question		
Bottom of last pg: Could not get X marks into the spaces on the online version.	1	.2
Bottom last pg: the shortage of radiographers in the western __ area is decreasing somewhat. In 1999 we started w/ 9 students; in 2000 we started w/ 11 students. Enrollments and number of grads have increased 2001-2003 and will eventually fill open positions.	1	.2
Bottom of last page: I am starting a clinical education program. I will include academic if the person wants to teach in the classroom.	1	.2
Bottom of last page: This survey was addressed to our school [name thereof] but it had [PD of another program]'s name on it. We have a diploma program for radiation therapy so I filled it out. (_____, Program Director)	1	.2
Bottom of last pg: In our state the problem that programs are faced with is the inability to increase our enrollments due to a lack of clinical space. There are 17 programs in this state and all of the "hospitals" are currently being used by one or MORE of the programs. ("Dual affiliations" ... tend to split the maximum number betw programs and does not allow for an increase in total numbers.) This lack of clinical training space is the primary limiting factor in the attempt to increase enrollments. In my estimation the shortage will not be affected materially unless the bottleneck at the entry level is opened. It is nice to consider upward mobility career options (RA, etc.), but this only drains the pool and does not change the rate of refill. I have not had any trouble with recruitment in 32 years as a PD. Interest in the field is NOT a problem. We cannot accommodate any more first year students than we already do. Career ladder paths need to be created at the first year level to increase the number of graduates. Licensure in states without current restrictions will also add to the shortage. I would be happy to discuss this problem further. I can be reached at [phone #] or at [email address].	1	.2
Bottom of last pg: Program is new college base as of fall 2003.	1	.2
Bottom of last pg: The Masters degree that is being implemented by the JRCERT is forcing highly qualified program directors out of their current positions. This requirement is also steering tech away from education.	1	.2
Bottom of last pg: Could not get X marks into the spaces on the online version.	1	.2
I think I might have the wrong questionnaire.	1	.2
Last pg: This is a brand new program started June 23rd, 2003.	1	.2
N/A - waiting list maintained (54 on list). [2003 enrollment 18]	1	.2
The shortage does not seem as acute as it was -- We need to be projecting what the needs will be in 2 yrs when students graduate, not what is current.	1	.2
I have a few comments regarding the enrollment survey and the shortage of radiographers. We have increased the size of the program, particularly by adding a clinical site [a rural area] of Michigan as the shortage is seen to be quite severe up there. I am reluctant to increase the size too quickly, because of how fast the shortage turned around from the early to mid 90s.	1	.2
There is the perception that in much of Michigan, the shortage is not as acute as in other parts of the country because there are quite a few Radiography programs in Michigan.		

Just mailed the survey. I wanted to comment on the faculty shortage. A community college in our area has wanted to start a radiography program no matter where the job is, but especially in hospital-based programs.		
I will retire in 2008. No current RT at any of our clinical education sites or current Clinical Instructor/Coordinator wishes to pursue a Masters. Modalities and temps make more than we do. The money just isn't there compared to the amount of administrative duties and responsibilities. The past few years, I have discussed this with and Encouraged my students to replace me, but no one seems interested in pursuing a Masters when 1 more yr in a modality program will earn them more \$. That includes those students who already have a Bachelors.	1	.2
I look forward to the results of this survey.	1	.2
I have just completed the paper survey regarding RT school data and the shortage of technologists. An issue more important is the projected shortage of Program Directors and faculty that will occur as my age group begins to retire.		
The JRCERT requirement of a master's degree for program directors, regardless of the type of program, is going to result in myriad problems within a very short period of time. I will retire prior to the 2009 implementation date, after 40 years in my position, and I believe very strongly that my program will be closed at that time. Although Hospital administration values the on-going source of technologists the program provides annually and we have not had a staffing shortage as a result of our hospital based program, I do not think they will increase the pay scale for a new MS program director. However, I know that if I had an MBA, I would be applying for the hospital president's position, or at least some management job that would compensate me for that level of education.	1	.2
A BS degree makes sense for a certificate program, and perhaps an MS makes sense for a BS college program, but are there sufficient numbers of faculty with the required credentials to fill the void? What benefit is the MA in Theology, which I am near completing, to the education of my students?		
My faculty and I fought vehemently for a pay raise, when our most recent graduates were hired with a \$4.00/hr. pay raise, bringing them to 21.00/hr., full tuition reimbursement and a \$2000.00 hire on bonus. This brought the grads almost to the pay level of the instructors. We did get an increase for longevity, but not a dime as incentive to stay. One of the CIs threatened to quit teaching, resign and rehire as a new technologist. She would have earned more money than as an educator. I had recruited for one year to hire her last year.		
With nearly half of the present workforce being age 40+, it is going to be a bumpy road ahead. I sincerely hope there are qualified technologists available to take my radiographs as I transition to patient.		
Total	585	100.0