

Enrollment Snapshot Of Radiography, Radiation Therapy And Nuclear Medicine Programs, September 2002

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Table of Contents

Background and Objectives	3
Methodology	4
Executive Summary	5
Detailed Results	
Enrollment Trends	7
Near-term Changes	11
Faculty Issues.....	15
New Kinds of Programs.....	19
Will the Gap Close?.....	21
References	24
Appendices	
Appendix A: Questionnaire	25
Appendix B: Comments Written on Questionnaires or Sent Via E-mail	27

Background and Objectives

This is the second 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 been reversed. Given the importance of anticipating trends in the supply of radiologic technologists (R.T.s) and given the lag between R.T. recruitment and education and students sitting for certification exams, the ASRT is attempting to capture an annual “snapshot” of the earliest stage of the recruitment process by surveying directors of educational programs.

The primary objective of the 2002 Enrollment Snapshot 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 (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.

PDs were surveyed about the future of their programs, including plans for increasing or decreasing enrollments and whether there was a possibility that the program might close within the next few years. Finally, PDs were asked to share their perceptions of factors that have an impact on enrollments, and about their knowledge of and interest in the R.T. aide and radiologist assistant (R.A.) curricula being developed by ASRT.

Methodology

In mid-September 2002, 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*.²

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 enrollments and the PD's knowledge of and interest in programs to educate R.T. aides and radiologist assistants. (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 2001 snapshot, this year's questionnaire asked the PD whether his or her program was at the associate, baccalaureate or master's level.

As of October 24, 2002, responses were received from 428 (68%) radiography programs, 60 (58%) nuclear medicine technology programs, 56 (59%) radiation therapy programs and 20 programs whose directors didn't specify type of program or who considered the program to be "none of the above." The return rate of 544 of 830 questionnaires represented an overall response rate of 66%.

Executive Summary

In mid-September 2002, 830 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 253 PDs for whom the ASRT had e-mail addresses; 123 PDs chose to respond by that method. As of October 24, 2002, responses were received from 428 (68%) radiography programs, 60 (58%) nuclear medicine technology programs, 56 (59%) radiation therapy programs, and 20 programs whose directors didn't specify the type of program or who considered the program to be "none of the above." The return rate of 544 questionnaires represented an overall response rate of 66%.

Entering-class radiography, radiation therapy and nuclear medicine enrollment increases that were noted in the 2001 enrollment snapshot were repeated from 2001 to 2002. Based on information provided by PDs of two thirds of all ARRT-listed educational programs in these three areas, fall 2002 nationwide first-year enrollments are estimated at 14,734 radiography students, 1,326 radiation therapy students and 1,454 students in nuclear medicine technology. Factoring in reported attrition rates and certification examination pass rates, ASRT estimates that if enrollments, attrition rates and other factors are held constant at fall 2002 levels, the profession would fall about 30% short of meeting the need for additional radiographers between now and 2010 projected by the U.S. Bureau of Labor Statistics (BLS). On the other hand, current enrollments, attrition rates, and retention rates appear to be adequate to meet the BLS-projected need for radiation therapists and nuclear medicine technologists by the beginning of 2010 or earlier.

Programs appear to be reaching their respective capacities. Overall, about two-thirds of PDs reported being at full enrollment in fall 2002 compared with about half of PDs who reported full enrollments 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 15,600 students, while PDs whose programs are not at full enrollment reported unused capacity totaling only 2,200 students. Faced with this unmet demand, a little more than a quarter of radiography and radiation therapy program directors and exactly half of the participating nuclear medicine PDs report that they plan to increase enrollments.

When asked to rank four factors that limit enrollments, space emerged as the most important limiting factor for radiography program directors, while funding, space and number of qualified applicants were of about equal importance to radiation therapy and nuclear medicine program directors. Faculty availability was the fourth factor PDs were asked to rank. When asked directly, 62% of the program directors indicated that they had difficulty recruiting new faculty for their programs. Overall, salary was the most frequently cited impediment to recruiting new faculty, with degree requirements and availability of interested applicants the next most common. However, exactly half of the radiography PDs who reported difficulty in recruiting new faculty listed degree requirements as one of the difficulties compared with only 19% of radiation therapy and nuclear medicine technology PDs.

In the “other” category, about a quarter of radiography and radiation therapy program directors mentioned the number and/or staffing of clinical sites as a major impediment to increasing their enrollments.

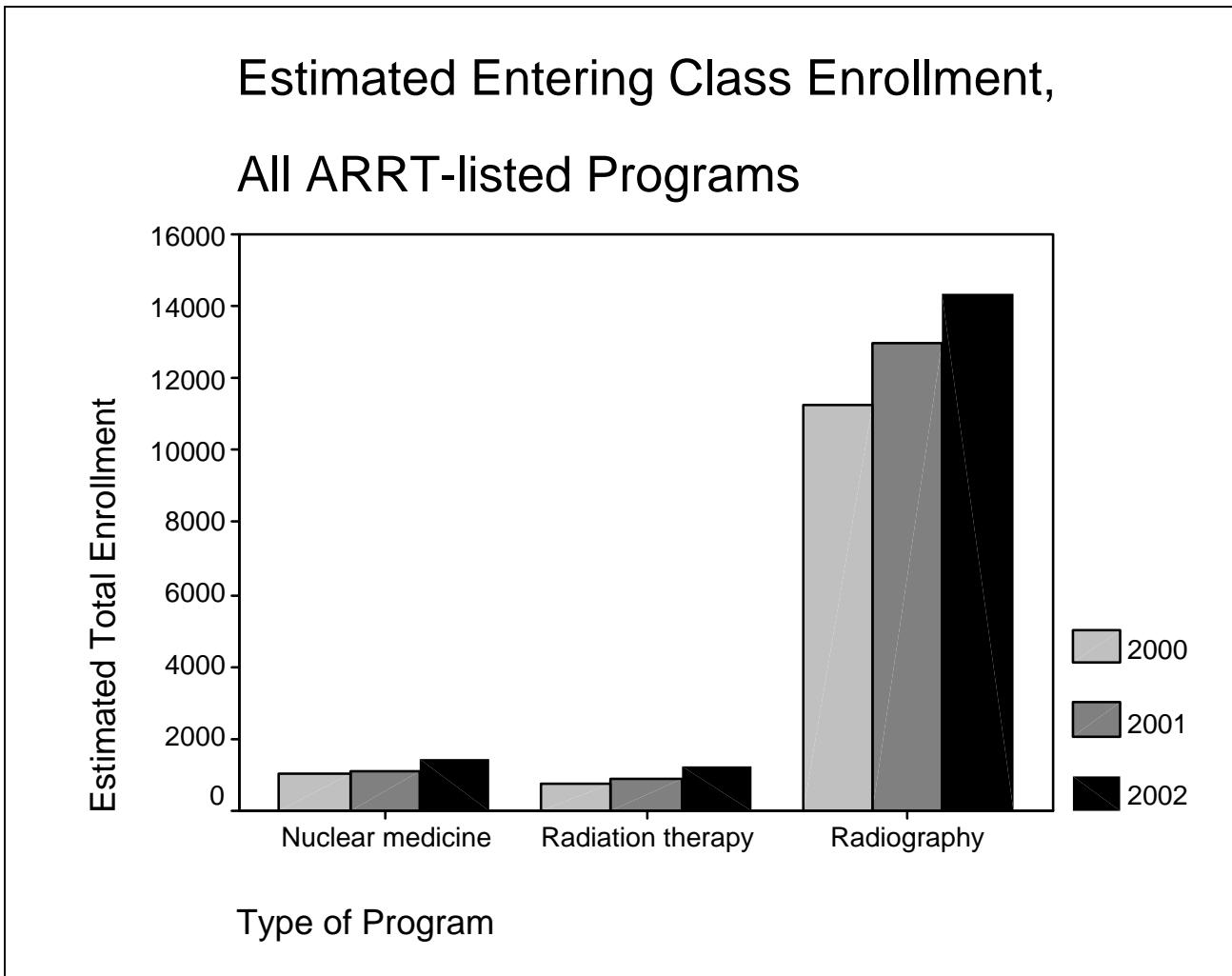
Opportunities for professional development do not appear to be a problem for the programs surveyed. More than 90% of the PDs reported that they and their faculty are able to take advantage of opportunities for professional development, though this percentage is somewhat lower (83%) for certificate and baccalaureate programs than for associate and multiple-level programs (97%).

Sixty-two (11.5%) PDs surveyed reported having a program to educate R.T. aides. On the opposite end of the career ladder, about a quarter of the program directors expressed an interest in developing a program for radiologist assistants. Interest in the R.A. was higher (45%) among baccalaureate programs and lower (8%) among radiation therapy program directors.

Detailed Results

Enrollment Trends

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



Details of Enrollment Reports*

Type of Program		2000 Enrollment	2001 Enrollment	2002 Enrollment	Attrition rate (percent)
Radiography	Mean	18.56	20.54	23.35	23.64
	N	412	418	418	411
	Std. Deviation	22.45	24.02	25.30	16.87
	Median	15.0	16.5	18.5	20.3
	Minimum	0	0	0	0
	Maximum	375	400	410	97
	Sum	7,467	8,586	9,760	---
Radiation Therapy	Mean	8.13	10.96	13.96	11.10
	N	52	52	52	48
	Std.Deviation	6.50	9.22	13.89	11.38
	Median	6.5	8.1	8.00	6.2
	Minimum	0	0	1	0
	Maximum	25	50	88	39
	Sum	423	570	726	---
Nuclear Medicine	Mean	9.00	10.84	13.98	7.95
	N	52	56	56	56
	Std. Deviation	9.55	8.36	10.22	8.74
	Median	7.0	8.0	10.50	5.1
	Minimum	0	0	0	0
	Maximum	62	40	50	35
	Sum	468	607	783	---

*These figures do not include 17 programs of unspecified program type, 7 that were a combination of radiography and one or more other programs and 2 that were listed as "none of the above."

The most crucial results from the previous table are:

Type of Program	Year	Total Reported Enrollment	Return Rate *	Estimated Total, All Programs	% Increase
Radiography	2000	7,322	418/631 = 66.2%	11,711	---
	2001	8,536	423/631 = 67.0%		10.7%
	2002	9,498	426/631 = 67.5%		13.7%
Radiation Therapy	2000	386	56/95 = 58.9%	772	---
	2001	514	56/95 = 58.9%		34.9%
	2002	647	56/95 = 59.9%		27.4%
Nuclear Medicine	2000	504	54/104 = 51.9%	936	---
	2001	578	57/104 = 54.8%		20.4%
	2002	742	58/104 = 55.8%		29.0%

*Includes combination programs that contained this discipline (eg, a program that contained both radiography and radiation therapy components). However, other statistics were based only on programs for that specific discipline.

The radiography program return rate was significantly higher than for the other radiologic technology areas ($\chi^2 = 6.09$, 1 df, $p < .05$), which did not differ significantly in this respect.

For the most part, reported 2000 and 2001 enrollments and the percentage increase from 2000 to 2001 are consistent with the findings from *Enrollment Snapshot 2001*. (The *Enrollment Snapshot 2001* estimated the following percentage increases in total enrollments from 2000 to 2001: 12.3% for radiography, 22.3% for radiation therapy and 29.1% for nuclear medicine technology. None of these figures differ statistically significantly from the corresponding *Enrollment Snapshot 2002* 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. (These significance tests were carried out using the sign of the increase times the square root of its absolute value as the dependent variable, so as to minimize the effects of a few outlier scores of 100% or higher.) The only statistically significant effect of educational level occurred among radiography programs: Certificate and associate-level radiography programs reported, on average, substantially lower percentage increases from 2001 to 2002 (12.6% for the 117 certificate-level programs; 15.6% for the 63 associate-level programs) than did baccalaureate (52.5%, N = 11 programs) and multiple-level (47.8%, N = 14) radiography programs, $F(3,412) = 3.32$, $p = .02$.

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. (Significance tests used the square root of attrition rate as the dependent variable to correct for the strongly positively skewed distribution of attrition rate.) The reported attrition rate “over the past few years” was substantially and statistically significantly higher for radiography programs (23.7%) than for radiation therapy programs (11.4%), which were in turn significantly higher than for nuclear medicine technology programs (7.7%). Associate-degree programs had a significantly higher mean attrition rate (25.9%) than did programs at the other three levels (combined mean = 16.7%).

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 * How has attrition rate varied past few yrs?

Program type		How has attrition rate varied past few yrs?				Total
		Hasn't varied substantially	Increased	Decreased	Incr'd some yrs, decr'd others	
Radiography	Count	226	50	51	79	406
	%	55.7%	12.3%	12.6%	19.5%	100.0%
Radiation therapy	Count	34	1	4	9	48
	%	70.8%	2.1%	8.3%	18.8%	100.0%
Nuclear medicine	Count	49	2	1	3	55
	%	89.1%	3.6%	1.8%	5.5%	100.0%
Total	Count	309	53	56	91	509
	%	60.7%	10.4%	11.0%	17.9%	100.0%

None of the three programs report a clear trend in attrition rate over the past few years. While radiography programs were more likely (44%) than radiation therapy or nuclear medicine technology programs (81% combined) to report that the attrition rate had varied substantially, 28% of PDs reporting said that the rate has increased over the past few years; 28% that it has decreased; and 44% that the attrition rate has increased some years but decreased other years.

Near-term Changes

Capacity for Increases

Question 2. Is your program currently at full enrollment?

Is program at full enrollment?	Program type					Total	
	Radiography	Radiation therapy	Nuclear medicine	Other	Radiography combined w other program(s)		
Yes Count	286	26	36	1	7	356	
%	69.1%	52.0%	64.3%	50.0%	77.8%	67.0%	
No Count	128	24	20	1	2	175	
%	30.9%	48.0%	35.7%	50.0%	22.2%	33.0%	
Total Count	414	50	56	2	9	531	
%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Radiation therapy PDs were less likely to report being at full enrollment (52.0%) than were directors of radiography and nuclear medicine technology programs (68.5%). The overall number (two-thirds) of programs at full capacity is a substantial increase over the approximately 50% rate reported in last year's enrollment snapshot.

Full-enrollment rates did not differ reliably as a function of the educational level of the program.

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

Program Type	Mean	Std. Dev.	N	Estimated Expansion Capacity	Total
Radiography	8.650	12.099	123	1,688 students	
Radiation therapy	5.714	6.627	21	261 students	
Nuclear medicine	6.700	4.219	20	251 students	
For entire sample	8.037	10.873	164	2,200 students	

Differences among the program types were not statistically significant, nor was mean number of additional students that could be accommodated per program significantly affected by educational level of the program.

Unmet Student Demand

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

<u>Program Type</u>	<u>Mean</u>	<u>Std. Dev.</u>	<u>Estimated Total</u>		
			<u>N</u>	<u>Unmet</u>	<u>Enroll.</u>
Radiography	31.579	35.104	59	13,766	
Radiation therapy	9.083	16.197	24	449	
Nuclear medicine	19.724	29.408	29	1,381	
For entire sample	28.747	34.112	312	15,596	

Plans for Change

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

		Do you plan any changes related to enrollment?			Total
		Plan to increase	Plan to decrease	Plan to remain the same	
Radiography	Count	117	6	289	412
	%	28.4%	1.5%	70.1%	100.0%
Radiation therapy	Count	13	2	34	49
	%	26.5%	4.1%	69.4%	100.0%
Nuclear medicine technology	Count	28		28	56
	%	50.0%		50.0%	100.0%
Total	Count	158	8	351	517
	%	30.6%	1.5%	67.9%	100.0%

Nuclear medicine technology programs were exactly evenly split between remaining the same and planning to increase their enrollments, with no programs planning to decrease. Radiography and radiation therapy programs, on the other hand, were less than half as likely to plan increases as they were to remain at the same level of enrollment, with only a small percentage planning to decrease enrollments.

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

Program type		How viable is your program over next few years?			Total
		Will definitely continue to operate	Possibility of closing	Will be closing	
Radiograph	Count	400	13	3	416
	%	96.2%	3.1%	.7%	100.0%
Radiation therapy	Count	49	1		50
	%	98.0%	2.0%		100.0%
Nuclear medicine	Count	54	2		56
	%	96.4%	3.6%		100.0%
	Count	503	16	3	522
	%	96.4%	3.1%	.6%	100.0%

There were no large or statistically significant differences among the disciplines in this respect: More than 96% of the PDs anticipated that their programs definitely will continue to operate, with only about 3% indicating a possibility of closing and only 3 programs (all radiography) reporting that they will be closing (or in one case, already have closed).

Factors Limiting Enrollment

Question 7. 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.

	Radiography Programs			RTT Programs			Nuclear Med Programs		
Factor	% Who Men- tion ed	Mean Rank If Ment' d	Mean Impor tance ^a	%Who Ment' d	Mean Rank If Ment' d	Mean Impor tance ^a	%Who Ment'd	Mean Rank If Ment'd	Mean Impo rtan ce ^a
Funding	51.7	2.82	3.58	70.0	2.46	3.00	64.3	2.08	2.89
Space	73.2	1.92	2.52	70.0	2.57	3.11	66.1	2.62	3.15
Equipment	51.2	3.07	3.71	62.0	2.94	3.49	62.5	3.46	3.74
Number Qualified Applicants	52.2	2.93	3.66	66.0	2.64	3.26	71.4	2.68	3.16
Availability of faculty	51.9	2.59	3.48	56.0	2.57	3.45	51.8	2.67	3.56
Number, staffing of clinical sites ^b	27.0	2.06	4.21	22.0	2.64	4.61	14.3	2.25	4.73
Other	9.1	1.46	4.73	2.0	1.0	5.08	8.9	1.3	4.87

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

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

Radiography PDs, on average, considered space as the most important factor limiting enrollments, while funding was most important for nuclear medicine programs. Radiation therapy PDs saw those two factors plus the number of qualified applicants as about equally important. PDs were not asked to rank order availability and staffing of clinical sites, but around a quarter of the radiography and radiation therapy PDs and about one-seventh of the nuclear medicine technology PDs cited it as an "other" limiting factor.

Faculty Issues

Recruiting Faculty

Question 8. Do you find it difficult to recruit new faculty for your program?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	329	59.4	61.8	61.8
	No	203	36.6	38.2	100.0
	Total	532	96.0	100.0	
Missing	-9	12	2.2		
	System	10	1.8		
	Total	22	4.0		
	Total	554	100.0		

Across all three program types and all four educational levels, about 62% of PDs surveyed answered affirmatively to Question 8. There were no statistically significant differences in this response rate as a function of program type, educational level of program or their interaction.

Question 8 (cont'd). If "Yes," what do you believe is the source of the difficulty?

Category label	Count	Pct of Responses	Pct of Cases
Salary	210	38.3	63.3
Degree requirements	144	26.3	43.4
Availability of interested applicants	149	27.2	44.9
Other	45	8.2	13.6
	-----	-----	-----
Total responses	548	100.0	165.1

221 missing cases; 332 valid cases

Overall, salary was the most frequently cited impediment to recruiting new faculty, with degree requirements and availability of interested applicants the next most common. However, exactly half of the radiography PDs who reported difficulty in recruiting new faculty cited degree requirements as one of the difficulties, as compared with only 19% of radiation therapy and nuclear medicine technology PDs.

Professional Development for Faculty

Question 11. Are you and your faculty able to take advantage of professional development opportunities? If "Yes", [in what areas]?

11. Are you & your faculty able take adv of prof'l devel'mt opport's?	Educational Level of Program					Total	
	Certif	Assoc	Bach	Multiple levels	Other	single level	
Yes	Count	113	206	36	36	2	393
	%	81.9%	97.2%	87.8%	94.7%	100.0%	91.2%
No	Count	25	6	5	2		38
	%	18.1%	2.8%	12.2%	5.3%		8.8%
Total	Count	138	212	41	38	2	431
		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

More than 90% of PDs surveyed reported that they and their faculty are able to take advantage of professional development opportunities. As expected, that percentage is lowest (82%) in certificate programs. Somewhat surprisingly, it is highest (97%) in associate degree programs. The difference between certificate and bachelor's programs in this respect is not statistically significant, but their combined percentage of 83% is significantly lower than the combined percentage (97%) for associate and multiple-level programs, while those two program levels do not differ significantly in this respect.

Areas in wh prof dev avail to faculty

Category label	Count	Pct of Responses	Pct of Cases
Instructional technology	408	35.2	90.1
Assessment techniques and strategy	345	29.8	76.2
Instructional design	315	27.2	69.5
Other	90	7.8	19.9
-----	-----	-----	-----
Total responses	1158	100.0	255.6

100 missing cases; 453 valid cases

There were no substantial or statistically significant differences in professional development areas available to faculty among program types or program levels.

Question 11 (cont'd). Other professional development opportunities specified by respondents:

	Frequency
Blank	470
? PROGRAM ? FEES TO YOUR SALARY	1
ADDITIONAL MODALITY TRAINING/EDUCATION	1
All, anything, whatever is needed, etc.	7
All faculty attend [RTC] and the state conference.	1
ANNUAL STATE AND NATIONAL CONVENTIONS	1
Anything related, in the area, etc.	4
ASTRO ATTENDANCE	1
AVAILABLE COLLEGE HAS PROFESSIONAL DEVELOPMENT COURSES FOR CREDIT THROUGH WEST TEXAS A&M UNIVERSITY. COURSES COUNT TOWARDS MASTERS OR DOCTORATE DEGREES	1
BASED ON FACULTY INTEREST	1
BUDGET CUTS HAVE SEVERLY LIMITED THE OPPORTUNITIES. IF THEY ARE NOT FREE OR VERY INEXPENSIVE, NO FUNDING IS PROVIDED	1
Campus wide staff development training available to all instructors	1
COLLEGE & GRADUATE COURSES CONFERENCES	1
Conferences and seminars	1
CONT ED FOR FACULTY AND STAFF	1
Cont ed on current and emerging imaging technologies. It is up to us to find them.	1
CONTINUING ED OPPORTUNITIES AND ASRT CONFERENCES	1
EDUCATIONAL ADVANCEMENT (MASTERS)	1
Educational seminars	4
FACULTY DEVELOPMENT ON CAMPUS	1
FINISHING A PHD IN HEALTH EDUCATION	1
FORMAL EDUCATION IS AVAILABLE IN ALMOST ANY FORM	1
General lecture	1
GENERAL TOPICS	1
IMAGING TECHNOLOGIES	1
Leadership & Managerial workshops	2
LOCAL SOCIETY MEETINGS	1
MANY WORKSHOP/SEMINARS ON CAMPUS	1
MASTERS LEVEL STUDIES/ATTEND CONFERENCES	1
meetings, seminars, etc.	1
MODALITIES IN RADIOLOGIC TECHNOLOGY (CT, MRI)	1
Mostly CE available through ASRT membership and State Convention lectures	1
MY INSTITUTION IS VERY SUPPORTIVE OF ANY WORTHWHILE EDUCATIONAL PROFESSIONAL DEVELOPMENT OPPORTUNITIES	1
Opportunity to go to RSNA & learn about new equipment, get tuition reimbursement for college courses	1
Outcome based educational track	1
PROFESSION SPECIFIC INFO - THE NEW PROCEDURES EQUIPMENT	1
RADIOPHARMACEUTICALS ETC	1
Professional	1
PROFESSIONAL INSERVICES PD CI WORKSHOPS ETC	1
Professional meetings	1
Professional meetings, grant funded programs, such as Focus on the Workplace, Title III & V	1
PROFESSIONAL/TECHNICAL CE	1
Pursuing Phd	1
RADIOGRAPHY CE COURSES	1
RADIOLOGY; HEALTH RELATED ISSUES	1
REAL TIME VIDEO CONFERENCE INSTRUCTION	1
REIMBURSEMENT FOR OUTSIDE LEARNING	1
RSNA & SNM	1
RT CONTINUING EDUCATION	1

SEMINARS - TSRT - ASRT	1
Sometimes	1
STATE & NATIONAL EDUCATIONAL MEETINGS	1
STATE & NATIONAL PROF SOCIETY MEETINGS	1
State meetings, conferences	2
STUDENT SUCCESS	1
TEACHING TECHNIQUES DIVERSITY & MANY OTHER TOPICS	1
TEAM BUILDING BUDGET MANAGEMENT	1
The university has an office for PD plus faculty are given travel money to attend meetings	1
THERE IS LITTLE EDUCATION AIMED AT THE EDUCATOR AVAILABLE. THE STATE OF IA DOESN'T RECOGNIZE MANY THAT ARE	1
THROUGH OUR PROFESSIONAL DEVELOPMENT ASSOC	1
TIME IS LIMITING FACTOR ESPECIALLY IN PURSUING ADVANCED DEGREES	1
UNCLEAR ON #11 IF OFFERED AT OUR INSTITUTION WE WOULD BE ABLE TO TAKE ADVANTAGE. WE ARE ABLE TO ATTEND CONFERENCE	1
Unsure what you are asking. Faculty may attend educational seminars and pursue educ'l opp' although they are not always offered at this hospital.	1
VARIED QUITE FLEXIBLE	1
Various Staff development mini-courses are offered throughout the semester ie, computer related topics, students learning styles, etc.	1
WE ARE ABLE TO CUSTOMIZE PROFESSIONAL DEVELOPMENT OPPORTUNITIES TO MEET OUR NEEDS	1
Workshops & conferences (ASRT)(AHRA)(AERS)(OSRT)(CSRT) etc.	1
WSRT, ASRT, COLLEGE COURSES	1
Total	553

New Kinds of Programs

Educating R.T. Aides

Question 9 asked whether the PD's institution or any of its affiliates have educational programs for R.T. aides. If so, permission was requested to contact the PD for further information on this program. If not, the PD was asked if he or she knew of any other program that educates R.T. aides.

9. Does your institutn have training prog for RT aides?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	62	11.2	11.5	11.5
	No	478	86.4	88.5	100.0
	Total	540	97.6	100.0	
Missing	-9	6	1.1		
	System	7	1.3		
	Total	13	2.4		
Total		553	100.0		

Of the programs surveyed, 11.5% reported having a program to educate RT aides. This percentage did not differ significantly across program types or educational levels. Thirty-three of the 62 PDs provided contact information (phone number, postal and/or e-mail address, and/or name) for their program. Another 15 PDs reported that, while their own institution did not have an R.T. aide educational program, they knew of other institutions that did; one of these PDs provided contact information for that program.

Developing Radiologist Assistant Programs

Question 10 asked whether the PD's institution was interested in developing a program to educate radiologist assistants. If yes, we asked permission to contact the PD to discuss this possibility. Interest in developing an R.A. program differed significantly across program types and educational levels, though these two factors did not interact significantly.

10. Interested in dev'ng prog to train radiol assts (RAs)?	Educational Level of Program				Total	
	Certif	Assoc	Bach	Multiple levels		
Yes	Count	25	56	17	6	104
	%	17.2%	26.4%	41.5%	15.4%	23.8%
No	Count	120	156	24	33	333
	%	82.8%	73.6%	58.5%	84.6%	63.2%
Total	Count	145	212	41	39	437
	%	100.0%	100.0%	100.0%	100.0%	100.0%

Not surprisingly, interest in the R.A. program increased as the educational level of the program increased, while PDs of multiple-level programs were least interested in this new program.

10. Interested in dev'ng prog to train radiologist assts (RAs)?	Program type			Total	
	Radiography	Radiation therapy	Nuclear medicine		
Yes	Count	107	4	11	122
	%	25.6%	8.0%	19.6%	23.3%
No	Count	311	46	45	402
	%				
Total	Count	418	50	56	524
	%	100.0%	100.0%	100.0%	100.0%

Note: The above two tables treat no response as equivalent to a "No" response.

Directors of radiation therapy programs were least likely to be interested in developing an R.A. program. Of the 136 PDs who expressed an interest in the R.A. program, 129 provided contact information.

Will the Gap Close?

To be more specific, if 2002 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 in 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.

Radiography

BLS projects that 75,000 additional radiographers will be needed between now and 2010. (The BLS projections were actually for the period between 2000 and 2010, but because the number of applicants taking the primary certification exams declined until the latter part of 2001, it is likely that the total need was not significantly reduced before 2002.) Given the enrollment snapshot's estimate of 14,734 students entering radiography programs in 2002, together with the PD-estimated attrition rate of 24% and an 88% pass rate for the certification exam, this discipline would appear to be adding 9,854 new radiographers to the profession each year.

However, not all new radiographers still will be practicing radiography in 2010. How many of a given year's new radiographer cohort remain in the profession for one, two, ... ten years? We used an ARRT-supplied database to determine the number of registered R.T.s who in late March 2002 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. We took 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 2001.³ This information gives us the following estimate of the overall retention profile for radiographers:

<u>Year</u>	# of First-Time Certificants	# in Radiography for X Years as of 3/2002	# Reporting ___ Years in Radiography as of 3/2002	Percent Retained
2001	7434	.75(7434) = 5576	< 1 year: 4390	79%
		.25(7434) = 1858		
2000	7149	7149	1-3 years: 13,650	13650/14744
1999	7595	5696		= 82%
1998	8146	8146	4-5 years: 8876	8876/16563
1997	8691	8691		= 53%
1992-				
1996	36,883	48,710	6-10 years: 17,261	= 35%

Assuming that this profile holds true for the radiography cohort of 2002 and subsequent cohorts, we would expect that, on average, approximately 35% of radiographers who were first-time examinees between 2002 and 2004 would still be practicing radiography as their primary discipline in 2010; 53% of the classes of 2005 and 2006 would still be practicing radiography in 2010; and about 80% of the classes of 2007, 2008, 2009 and 2010 would be practicing at the end of 2010. Assuming that each of those classes consists of 9,854 new certificants, we can expect under steady-state assumptions a total of $5.31(9854) = 52,325$ additional radiographers by the end of 2010 — only about two-thirds of the BLS-estimated need. Note that more than a quarter of radiography program directors plan to increase their enrollments.

Nuclear Medicine Technology

BLS projects a need for 8,000 nuclear medicine technologists to meet increased demand and attrition between now and 2010. Our best estimate of the total number of students entering nuclear medicine technology educational programs in 2002 is 1,454. PDs estimate an attrition rate of about 8%, and we can expect under steady-state assumptions that 1,338 graduates will be eligible to take the Registry exam each year, with 1,217 passing it the first time. From ARRT certificant and years-in-discipline information for nuclear medicine technologists, we estimate that the number of R.T.s primarily employed in nuclear medicine technology for three years or less is about 150% of the number of first-time certificants in this cohort (presumably due to repeat examinees and migration from other disciplines), that the number of R.T.s who have practiced nuclear medicine for four to five years is about 107% 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, 58% of first-time certificants in the corresponding five-year time slot. Thus, we expect under steady-state assumptions that $9.88(1217) = 12,023$ nuclear medicine technologists would be practicing in the profession by the end of 2010 and that the discipline would have fulfilled the BLS-projected need for 8,000 new nuclear medicine technologists by the beginning of 2009.

Radiation Therapy

BLS projects that 7,000 radiation therapists will be needed between now and 2010. The results of the 2002 enrollment snapshot lead to an estimate of 1,326 first-year students enrolled in

radiation therapy programs. Given an estimated attrition rate of 11%, we calculate that 1,180 radiation therapists will become eligible to take the certification exam each year, and $.84(1180) = 991$ will pass it. Although this is slightly more than half of the present shortage of therapists (a recent American Society for Therapeutic Radiology and Oncology survey estimated a shortfall of 1,648 radiation therapists), the estimated retention profile suggests that the radiation therapy discipline will meet the BLS-estimated demand by the beginning of 2010.

Uncertainties in Projections

These projections are subject to a high degree of uncertainty. First, there is statistical uncertainty. The 95% confidence intervals around the estimated total entering-class enrollment in these three disciplines are ± 908 students for radiography, ± 249 for radiation therapy and ± 195 students for nuclear medicine technology. There is also 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., 28% of radiography PDs plan to increase their enrollments in the near future, potential variations in number of applicants due to changes in reimbursement rates for radiologic procedures, etc.). Moreover, the retention profiles (i.e., ratios between number currently practicing in a discipline and those who passed their initial certification exam in that discipline a certain number of years earlier) are based on calculating backward from a single point in time (March 2002) and might not be representative of what will happen to the 2002 to 2010 new-certificant cohorts.

Overall, however, our best current estimate is that radiation therapy and nuclear medicine are producing new practitioners at or above the correct rate to meet the 2010 demand estimated by BLS, while radiography is likely to come up well short (by about 30%) of the projected demand unless enrollments and/or retention rates are increased.

References

1. American Society of Radiologic Technologists. Enrollment snapshot of radiography, radiation therapy and nuclear medicine programs, November 2001. Available at: www.radsciresearch.org. Accessed September 2002.
2. American Registry of Radiologic Technologists. ARRT-recognized educational programs. Available at: www.arrt.org. Accessed September 2002.
3. American Registry of Radiologic Technologists. 2001 annual report of examinations. Available at: www.arrt.org/website/newsite/Psychometrics/AnnualReportofExams.pdf. Accessed September 2002.

Appendices

Appendix A: Questionnaire

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Radiography, Radiation Therapy and Nuclear Medicine Enrollment Survey

Indicate the 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)

Please help us document the overall trends in enrollments over the past three years.

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

2000

9	
---	--

2001

/	3	
---	---	--

2002

/	✓	
---	---	--

2. Is your program currently at full enrollment?

- No If "no," approximately how many additional students could be accommodated by your program?

10		
----	--	--
- Yes 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
- Possibility of closing
- Will be closing

If your program is closing, how many more years will the program 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 do not complete the program, e.g., 30-%)?

Attrition rate

2	0
---	---

 %

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

- No
- Yes

If "yes," how has the attrition rate varied?

- Increased
- Decreased
- Increased some years, decreased others

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2 1 4

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

7. Rank order the following factors with respect to how seriously they limit enrollments 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 enrollment.

- Funding Space Equipment Number of qualified applicants Availability of faculty
 Other (Please specify) _____

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

No Yes

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

- Salary Degree requirements Availability of interested applicants
 Other (Please specify) _____

9. Does your institution or any of your affiliates have training programs for R.T. aides (i.e., assistants who carry out patient processing, patient lifting and positioning, delivery of records and images, etc., but *not* actual imaging or therapy procedures?)

No Yes

If "yes," may we contact you for further information about the nature of this training?

- No Yes, at this telephone number or e-mail address _____

If "no," do you know of any other program that trains R.T. aides?

- No Yes, but I am not at liberty to name that program

- Yes, and I can share the name, location or other contact information for that program

10. Are you or your institution interested in developing a program to train radiologist assistants? (Information on this newly developing rung on the R.T. career ladder is available at www.asrt.org by clicking on "Professional Development" and then "Radiologist Assistant.")

No Yes

If "yes," may we contact you to discuss this possibility further?

- No Yes, contact me through the information provided in question 8 or at the following telephone number
e-mail address _____

11. Are you and your faculty able to take advantage of professional development opportunities?

No Yes

If "yes," mark all areas that apply.

- Instructional technology Assessment techniques and strategy Instructional design
 Other (Please specify) _____

Thanks very much for your help. Please return the survey via e-mail to rharris@asrt.org or in the enclosed business reply envelope to:

Richard Harris, Director of Research
ASRT
Department of Education & Research
PO Box 51060
Albuquerque NM 87181-9980

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

Appendix B: Comments Written on Questionnaire or E-mailed Separately

	Frequency
Blank	516
[top of 1st page:] Program closed as of 7/5/02 due to budget problems.	1
Closed effective 7/03. Wrapping up senior students.	1
In a previous response to your survey, I quickly answered question 10, thinking it [applied] to "Radiographer" assistants and not "Radiologist" assistants. We do have 2 of my former students in the RPA program & 2 of our current clinical sites are sponsoring their clinical education.... My answer regarding my legislative concerns would apply only to the Radiography assistants. [The 'prev resp': No. I am also the Legislative chairman for the FSRT. I believe this type of program could have serious implications	1
P.S. I am very much opposed to idea of "aides" and establishing training for them condones the practice.	1
Q1. Enrollments: 2001, 8 RTT cert. 2002, 11 RTT cert., 12 2-year RTT 6. attrition varied?: N/A - new programs 8. Diff recr fac?: "!!!!"	1
Q1: Relabelled as 99-2000, 2000-2001, 2001-2002. Q9: Some affiliates hire R.T. aides (no formal training program that I know of, other than orientation to dept procedures, etc).	1
Q1: The number of applications slightly increased from 2001 to 2002. The number of qualified applicants has not increased at the same rate the applications have. We formally begin the advertisement and formal process for the next class after October 1. However, as of today, 9/23/02, there are already 46 applications on file. While the numbers are better this is a reflection on the economy. When the economy or job market is not good our numbers go up. This year is no different than the past years. It is very cyclical.	1
Q1: This is difficult for us to determine.	1
Q1: We limit enrollment to 25 per semester.	1
Q10 (no): Associate degrees only at this institution.	1
Q11: Occasionally	1
Q2: 120 on waiting list. Only interviewed 28 to get 19.	1
Q2: First time in 5 years, I had enough qualified applicants to turn away	1
Q2. Full enrollment: Didn't check yes or no, then: For 1st year students, about 5 turned away. For 2nd year students, lost 2 students from this class last year.	1
Q2. Full enrollment? [said "No"] could take 1 more: Our program is accredited for many more students than we presently enroll, and we can increase enrollment greatly IF any students over the 10 we normally accept are prepared to travel one hour outside of our immediate area for their clinical education. 11. Prof'l dev: As we are a state institution there is no money for travel to any prof'l meetings; all prof'l dev has to be done inhouse and has to be "home grown", i.e. cost the institution nothing	1
Q2. How many qualified studs turned away? "Unable to definitively determine qualified status as students are reviewed in chronological order by application date (open admission); however, we currently have an application list of about 300 applicants, of which an estimated 50% are not presently qualified. 3. changes? "Increased last year and now plan to maintain expanded enrollment figures." 5. attrition: roughly 50-55% do not complete; however, this rate seems to be lessening now that jobs are more prevalent. 6. attrition varied?: attrition was higher than usual in mid - late 90s but seems to have improved over the past 2 years.	
7. space: especially clinical space based on supervision standards. avail. of faculty: Increased faculty resources in a time of funding cuts by state, is going to be more of an issue than in the past. In addition, retirements that all of health care educn will be facing in the next few years will have a huge negative impact on programs. 8. difficult recruit? qualified faculty w experience in educl technologies and learning methodologies are almost non-existent.	
Q2: Not at "full enrollment" as defined by JRC. I choose NOT to take 28 because of clinical sites and lab space. Q5: 50-60%. College has open-door policy. Selective admission is NOT done.	1
Q3: For now	1

Q3: Increased in CT x 15 efiju(???) in 2002	1
Q3. Plan decr: Unless the job market remains strong. It is getting tighter in our geographic area.	1
Q3.Plan to increase: "Started this year" 5.Attrition: > 10%. 11. Prof'l dev opps: "No, very seldom."	1
Q3: Plan to increase upon completion of the outpatient facility -- availing us to more diagnostic x-ray rooms.	1
Q3: We are inactive as of 7/1/02.	1
Q4: We will operate until 2009 when we will lose accreditation due to masters degree requirement. Q5: 2000: 0/6; 2001: 1/6; 2002: 0/6. [Bottom of qnr:] Why don't you ask PDs directly what impact they feel the masters degree will have on their programs or on the number of schools we will have after 2009?	1
Q5: 20% projected [2002 1st year of prog]	1
Q5: 5 year average	1
Q5. Attrition: +10% variation	1
Q5. Attrition: 1996-2000=22%	1
Q5. Attrition: 6% 99, 9% 2000, 4% 01.	1
Q5. Attrition: 65-70% 10. Interested in RA prog?: "Not sure". Didn't check Y or N wrt contacting.	1
Q5: but attrition rate is decreasing (we're losing less students). Q6: Was about 30-40% during 90's. Now about 10%-15%. Q8: Don't know. Haven't tried.	1
Q5: Over last 4 yrs, 1999-2002.	1
Q6. attrition varied: "N/A -- new program' 9. Difficult recruit fac?: "!!!!"	1
Q6,attrition rate: 15-20%	1
Q6, attrition: 30-40%	1
Q7 [next to "availability of faculty":] Clinical sites	1
Unknow - stopped taking applications in January.	1
Total	553