Utah's
Radiology Technology Workforce:

A study of radiology technology workforce trends, demand and supply, and capacity to provide service

Prepared by

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Preface

The Utah Medical Education Council (UMEC) has been charged by statute to determine Utah's health care workforce requirements. The UMEC is to also recommend strategies to achieve the workforce objectives necessary to assure an adequate mix of well-trained health service providers. This report covers the workforce conditions of the non-physician radiology healthcare professionals.

INTRODUCTION

There are five types of professions in the radiology technology workplace: radiology practical technicians, radiology technologists, specialized technologists, radiologist assistants, and radiology practitioner assistants.

Radiology practical technicians (RPT) are limited to perform x-rays on only the chest, extremities, skull/sinuses, spine, and podiatric (see Chart 1). Formal education is not required.

Radiology technologists (RT) are allowed to perform more services than radiology practical technicians (see Chart 1). They hold an Associate of Applied Science degree (A.A.S.) and must pass a national certification examination administered by the American Registry of Radiologic Technologists (ARRT). After passing the ARRT examination, a registered radiology technologist (R.T.) has the privilege of using "R.T." after his/her name. The ARRT certification is recognized in all fifty states and in most foreign countries.

Individuals who are interested in specialized areas of radiology technology can work in those areas. The available areas are:

Ultrasound
Nuclear Medicine
Mammography
Bone Densitometry
Magnetic Resonance Imaging
Cardiovascular-Intervention
Computed Tomography
Quality management
Radiation Therapy
Dosimetry

Beginning in 2002 a radiologist assistant (RA) certification has been developed. This came about for two reasons: 1) a need to find alternate ways of providing high quality patient care by extending the capacity of the physician radiologist, and 2) the need to extend the career path of radiology technology in order to support recruiting and retention of radiology professionals. The American Registry of Radiologic Technologists (ARRT) certification as a radiologist assistant is on schedule for September 2005 introduction.

Weber State University developed a singular program in 1997 that produced similar certificates, but had some differences with the emerging RA certification. The Weber student is called a radiology practitioner assistant (RPA). The RPAs are a physician extender in radiology and can provide primary patient care in radiology health care services (see Chart 1). They must hold a current, active registration with the American Registry of Radiologic Technologists (ARRT), have completed an RPA educational program recognized by the Certification Board for Radiology Practitioner Assistant

(CBRPA), and be certified by the CBRPA. As the only program for radiology practitioner assistants, Weber State University leads the country in seeking ways to meet the growing demand for advanced imaging services.

Licensing, Certification, and Registration

ARRT uses "certification" to describe the one-time awarding of a certificate after an individual satisfies all eligibility requirements including the certification exam. "Registration" is the annual renewal of the certificate's validity. A registered technologist (R.T.) has satisfied standards for initial certification as well as complied with the ARRT Standards of Ethics and Continuing Education Requirements.

"Licensing" is most commonly used in referring to state laws. The State not ARRT is the authority that administers the license and grants an individual permission to practice radiologic technology within that state. Application for and renewal of a state license are separate from ARRT processes.

Although the ARRT examination is a voluntary certification exam, many states use the scores in licensing decisions. Approximately two-thirds of the states have licensing laws covering the practice of radiologic technology.

Thirty-five states utilize ARRT-administered exams for state licensing purposes. Those states are:

Arizona	Indiana	Nebraska	Tennessee
Arkansas	Iowa	New Jersey	Texas
California	Kentucky	New Mexico	Utah
Colorado	Louisiana	New York	Vermont
Connecticut	Maine	Ohio	Virginia
Delaware	Maryland	Oregon	Washington
Florida	Massachusetts	Pennsylvania	West Virginia
Hawaii	Mississippi	Rhode Island	Wyoming
Illinois	Montana	South Carolina	

Data is from the American Registry of Radiologic Technologists.

Chart 1. -- Roles of RPT and RT

	RPT	RT	Roles of RA and RPA as a Physician Assistant: RA	RPA
Diagnostic Radiology				
X-rays				
Chest	X	X	X	X
Extremities	X	X	X	X
Skull/Sinuses	X	X	X	X
Spine	X	X	X	X
Podiatric	X	X	X	X
Intravenous Pyelogram (IVP)		X	X	X
Joints (Arthrography)		X	X	X
Lower GI Tract (Barium Enema)		X	X	X
Upper GI Tract		X	X	X
Pediatric Voiding Cystourethrogram		X	X	X
Arteriogram				
Barium X-ray (Upper and Lower GI)			X	
Computed Tomography (CT or CAT)				
CT-Abdomen			X	X
CT-Angiography				
CT-Body			X	X
CT-Head			X	X
CT-Pediatric			X	X
Fluoroscopy			X	X
Magnetic Resonance Imaging (MRI)				
MR Angiography				X
MR-Body			X	
MR-Cardiac				X
Functional MRI-Brain				X
MR-Head			X	
MR-Musculoskeletal			X	
Mammography				X
Myelogram				
New Therapies				
Nuclear Medicine				
General			X	
Positron Emission Tomography (PET)				X
Pediatric			X	
Cardiac				X
Intravenous Pyelogram (IVP)			X	
Ultrafast CT			X	
Ultrasound				
Abdomen				X
Abdomen (Pediatric)				X
General				X
Musculoskeletal				X
Obstetric				X
Pelvis				X
Vascular				X
Venous (Extremities)				X

RPT = Radiology Practical Technician
RT = Radiology Technologist
RA = Radiologist Assistant
RPA = Radiology Practitioner Assistant

Chart 1. -- Roles of RPT and RT (cont.)

	RPT	RT	Roles of RA and RPA as a Physician Assistant: RA	RPA
Interventional Radiology				
Angiography				
Catheter Angiography				X
CT Angiography				X
MR Angiography				X
Venograms				X
Angioplasty and Vascular Stenting				
Embolization				
Catheter Embolization				
Uterine Fibroid Embolization				
Gastrostomy Tubes			X	X
Intravascular Ultrasound				
Foreign Body Extraction				
Needle Biopsy				
Ultrasound-Guided Breast Biopsy				X
X-ray Guided Breast Biopsy				X
Chemoembolization				
Cryotheraphy				
Blood Clot Filters				X
Injection of Clot-Lysing Agents				X
Catheters Insertions				X
Cancer Treatment				
Percutaneous Vertebroplasty				
Thrombolysis				X
Vascular Access Procedures				X
Vertebroplasty				
Venous Access Procedures				
Fistulagrams				X
Fistulaplaties				X
Declots				X
Permacath Placements				X
Central Venous Line Placement				X

RPT = Radiology Practical Technician
RT = Radiology Technologist
RA = Radiologist Assistant
RPA = Radiology Practitioner Assistant

Prepared by the Utah Medical Education Council, March 2004

I.
NATIONAL WORKFORCE TRENDS IN RADIOLOGY TECHNOLOGY

There is a growing concern about the shortage of trained healthcare professionals to provide the range of services required in the provision of quality and highly technical health care. A radiology technology workforce is critical in the provision of health care since it provides diagnostic, interventional, and therapeutic services. Since 1999, hospitals report an 8% increase in the demand for imaging technicians and 68% of the hospitals report increased difficulty in recruiting them (Health Forum 2001 & First Consulting Group 2001).

This section examines the national scene as a backdrop for comparing Utah's workforce requirements for the various levels of imaging skills required to meet the demand for quality healthcare services.

In 2000, the combined national total of radiology technologists, nuclear medicine technologists, and radiation therapists was slightly less than 200,000. The Bureau of Labor Statistics (BLS) forecasted the number of **additional** radiology technologists, nuclear medicine technologists, and radiation therapists that will be needed by 2010 as follows:

Radiology Technologists – 75,000
Nuclear Medicine Technologists – 8,000
Radiation Therapists – 7,000

A. National Supply

The following are the results of a survey of directors of educational programs: radiologic technology, nuclear medicine, and radiation therapy programs as reported by the American Society of Radiologic Technologists (ASRT) in the fall of 2003.

The ASRT estimates the number of additional radiology technologists, nuclear medicine technologists, and radiation therapists that will be working in 2010 is as follows:

Radiology Technologists – 50,866, or about two-thirds the number BLS forecasts will be required. However, 17.5% of the program directors indicated they planned to increase the enrollment in their programs.
Nuclear Medicine Technologists – 12,000
Radiation Therapists – 7,184

Compared to the demand above, the anticipated supply of additional nuclear medicine technologists and radiation therapists will meet estimated demand. However, a shortage of at least 24,134 radiology technologists is anticipated in 2010.

According to the ASRT report, 78.8% of radiologic technology, 66.7% of nuclear medicine, and 55.4% of radiation therapy programs are at full enrollment. A total of 26,683 qualified students were turned away from these programs in fall 2003. The breakout of students denied admission was:

Radiologic Technology Program – 23,550 students
Nuclear Medicine Program – 2,375 students
Radiation Therapy Program – 758 students

Data is from the fall 2003 report by the American Society of Radiologic Technologists.
Data is used with the permission by the American Society of Radiologic Technologists.

A National study "Workforce Problems and Strategies" by Kimberly E. Applegate MD and Carol M. Rumack MD determined that:

The imbalance between supply and demand is increasing. Each year, 1,000 to 1,100 residents finish their training in radiology and approximately 530 radiologists retire or die. The 2% annual increase in total radiologists is exceeded by the 3.5% to 5.0% annual increase in demand for radiology procedures and the annual increase in radiology relative value units being expended. Given the rapid expansion now being seen in consumers' use of electronic health resources available on the Internet…, demand fueled by more widespread knowledge of imaging may increase even beyond the levels currently predicted. As consumers become more informed about both noninvasive diagnostic technologies and their own right to make health care decisions, they are more likely to request these services (Applegate and Rumack 2003).

Further more the same study also determined that demand is increasing Western Europe and will likely add competition for those completing training since the supply is not growing as fast as the increase in service levels. It says that:

Between 1995 and 2000, United States and European combined volumes increased 19% for MRI examinations, 10% for catheterization-laboratory procedures, 10% for CT studies, 8% for ultrasound examinations, and 4% for nuclear medicine procedures. Radiography volumes did not change significantly during the same period, according to the American College of Radiology…In 2001, the Health Care Financing Administration projected trends that it had tracked since 1980 to arrive at predictions for 2008. By then, health care costs are expected to account for nearly 15% of the gross domestic product, compared with 9% in 1980. The distribution of those health care dollars will have shifted as well. The share of resources spent on long-term care will decrease slightly, from 7.1% to 7%. Costs for physicians' services will increase from 18.3% to 19.4% of health care spending, but spending for hospital services will decrease from 41.5% to 31.4%. Spending for administration, construction, and other costs will rise from 27% to 33%. Drug costs will show the most rapid growth, from 4.9% to 9.9% of spending. These figures imply that radiology departments will still be expected to do more with less, but will they be able to function with fewer radiologists? (Applegate and Rumack 2003).

B. Major Constraints
(ranked in order of severity)

1. Space – Classroom
2. Availability of Faculty – Those who are academically prepared (Master or Ph.D. degrees)
3. Funding
4. Equipment
5. Number of Clinical Sites

79% of radiologic science programs are at full enrollment. Of the programs that have capacity to enroll more students to meet the projected demand as stated above, 17.5% indicated in 2002 that they intended to expand enrollment beginning in the fall of 2003. The data are not yet available to determine how much expansion has occurred in one year. More expansion is anticipated over the next two or three years as state revenues improve.

C. Factors Contributing to the Difficulty in Recruiting Qualified Faculty

(ranked in order of importance)

1. Salary
2. Degree Requirements
3. Availability of Interested Applicants

Data is from the fall 2003 report by the American Society of Radiologic Technologists.
Data is used with the permission by the American Society of Radiologic Technologists.

D. Results of the Survey for Radiation Therapy Environmental Scan

Four key findings result from the *Environmental Scan of the Radiation Therapists' Workplace* survey conducted by the ASRT and the ASRT Education and Research Foundation:

- Technological advances have increased the quality of patient care even though the complexity of patient care has increased.
- Facilities are understaffed because of the inability to fill budgeted positions.
- Therapists who had training and experience in radiography before beginning their radiation therapy training appeared to be better prepared.
- Baccalaureate programs produced more skilled graduates (ASRT 2004).

E. Salary Trends

According to *Comparative Analysis of the 1997 and 2001 Radiologic Technologist Wage and Salary Survey* by the American Society of Radiologic Technologists (ASRT), this shortage phenomenon caused the increase of annual salaries of all specialties of radiology technologists (ASRT 2001). The annual salaries in 2001 of specialized radiology technologists were increased more than 11% from the annual salaries of 1997 (see Appendix A). In all regions, the annual salaries of radiology technologists in 2001 were also increased more than 13% from the annual salaries of 1997 (see Appendix A & B).

The phenomenon of higher salaries caught young people's interest in the radiologic profession and has resulted in increased enrollment. This has had a positive impact in Utah. For example, the number of applicants for Weber State's two-year on-campus Radiologic Sciences Program increased 3.6 times from 66 students in 1997 to 240 students in 2003 (see Appendix C).

F. National Experts' Recommendations

The Committee agrees with the recommendations made by national experts for addressing the shortage. These recommendations are:

- Implement radiologist assistant (RA) – Advanced practice that enhances the self-direction and ownership of one's work and responsibilities (Racette 2001). Radiologist assistant (RA) is distinct from the radiology practitioner assistant (RPA), who is a graduate from a single program at Weber State University in Utah (RSNA 2004).
- University education to develop the critical-thinking skills, writing skills, case study analysis group-decision making and debate for professional practice (Racette 2001).
- Exploration of distance educational programs for underserved and rural areas (Racette 2001).
- Programs to recruit minority students (Racette 2001).
- Reconsideration of using unqualified radiology practical technicians who lead only to declines in quality patient care (Sanchez 2002).
- Reconsideration of training of radiology practical technicians (limited radiography technicians) because of poor quality and lack of knowledge of radiology technology (Sanchez 2002).
- Necessity of cross-training radiology technologists (Sanchez 2002).
- Increasing reimbursement rates to make technologist salaries more attractive (Racette 2001).
- Embracing the baccalaureate degree as the minimum professional education standard for the radiology technologist to receive higher wages.

  e.g. workers (full time, age 25 and older) with an associate degree earn about $32,000 annually, while workers with a bachelor's degree earn about $40,000 (Sanchez 2000).

  The Committee agrees with this recommendation for those who work outside of private office settings. However, the Utah data indicate a demand for technicians in private physician and chiropractic offices. Therefore, we recommend that the technician programs be continued to help meet the need for private office radiological services.

- Continuing the promotion of the field to young people and keeping enrollment figures up (ASRT 2002).
- Continuing support for the national effort to standardize radiologic technology education (Hubert 2001).

II.
UTAH'S RADIOLOGY TECHNOLOGY ENVIRONMENT
Licensing, Programs & Capacity

To practice in Utah those providing radiology services must be licensed at one of two levels: a Technician or Technologist.

A. License and Certification

Technicians

The Utah licensure law, R156-54-Radiology Technologist and Radiology Practical Technician Licensing Act Rules, requires radiology practical technicians (also called limited radiography technicians) to pass the ARRT Limited Scope of Practice in Radiography Examination for (a) core; and (b) one or more of the following sections: chest, extremities, skull/sinuses, spine, and podiatric. In place of passing one or more of the sections, radiology practical technicians may substitute passing the Utah Limited Scope Osteoporotic Exam, covering bone densitometry, with a minimum score of 75% accuracy (Utah Administrative Code, R156-54-Radiology Technologist and Radiology Practical Technician Licensing Act Rules). Radiology practical technicians are limited to diagnostic imaging techniques on the chest, extremities, skull/sinuses, spine, and podiatric under the direction and supervision of a physician radiologist or a radiology practitioner. Formal education, however, is not required by the state licensing law.

Technologists

Radiology technologists may obtain licensure by completing a four-year bachelor of science degree in radiology, or they may complete a two-year associate degree or equivalent radiologic educational program, and pass the American Registry of Radiologic Technologists (ARRT) examination in one of three primary certifications: Radiography, Nuclear Medicine Technology, and Radiation Therapy Technology. Radiology technologists may also get a license by passing the Nuclear Medicine Technology Certification Board Examination (NMTCB). Radiology technologists are trained to perform diagnostic imaging techniques under the direction and supervision of a radiologist or a radiology practitioner.

Licenses are renewed every two years in an odd numbered year.

Radiology education programs can include classroom courses, seminars, lectures, labs, training sessions or conferences, and must be approved by or conducted under the sponsorship of:

(a) an accredited institution of higher education; or
(b) American Society of Radiologic Technologists or other similar professional organizations; or
(c) an acute care hospital or medical treatment facility; or
(d) a professional association representing one of the licensed professions regularly engaged in radiologic procedures

(Utah Administrative Code, R156-54-Radiology Technologist and Radiology Practical Technician Licensing Act Rules).

Although accreditation is voluntary, many certification bodies have deemed

graduation from an accredited program a prerequisite for a certification examination. With additional education, an individual can be certified by passing the examinations of the following National certification bodies:

The American Registry of Radiologic Technologists (ARRT) in nine post-primary specialty areas:

Computed Tomography
Magnetic Resonance Imaging
Mammography
Quality Management
Sonography
Bone Densitometry
Vascular Sonography
Cardiac-Interventional
Vascular-Interventional

The American Registry of Diagnostic Medical Sonographers (ARDMS):

Diagnostic Medical Sonography
Vascular Technology
Diagnostic Cardiac Sonography
Ophthalmic Ultrasound

The Nuclear Medicine Technology Certification Board (NMTCB):

Nuclear Medicine Technology
Nuclear Cardiology Technology

The Medical Dosimetrist Certification Board (MDCB):

Medical Dosimetry

Cardiovascular Credentialing International (CCI):

Cardiovascular Technology
Cardiovascular Invasive
Echocardiography
Vascular Ultrasound

The Certification Board for Radiology Practitioner Assistant (CBRPA)

However, some schools require R.T. certification before they will admit an individual to the training needed to certify in the specialized areas.

Specialist
Specialists do not require a different license to practice in Utah. However, to work in Utah those is the specialized areas must have completed required courses, or have a certain amount of clinical experience, and must be certified in each area of specialization.

Radiology Assistants and Radiology Practitioner Assistants
The Utah licensure law does not state any rules or requirements for either radiologist assistants or radiology practitioner assistants because their scope of practice is envisioned as an extension of the radiology technologist. Therefore, a separate license is not necessary.

B. Supply Capacity in Utah (see Chart 2)

Programs for Radiology Practical Technicians

Utah has a training capacity of 130 radiology practical technicians per year at applied technology programs or medical technology programs. However, the radiology practical technicians from these schools cannot upgrade their licenses to radiology technologists because the curriculum set does not transfer to the college system.

Applied technology programs, medical technology programs, and two-year programs for radiology practical technicians (limited radiography technicians) in Utah are available at the following schools:

- American Institute of Medical & Dental Technology, Provo (20 students/semester---36 hr. program)
- Davis Applied Technology Center, Kaysville (30 students---66 hr. program)
- Dixie Applied Technology College on Dixie State College of Utah Campus, St. George (student interests determine number in program)
- Salt Lake Community College, Salt Lake City (30 students/semester---90 hr. night program), radiology practical technicians are trained through the Medical Assistant Program
- Stevens-Henager College (50 students---15 month day/20 month night programs, available on five campuses in Utah: Murray, Bountiful, Logan, Ogden, and Provo)

Utah's two year programs include:

- Salt Lake Community College, Salt Lake City (25-37 students/2 year program)
- Weber State University, Ogden (2 year program)

Students in these two programs can obtain the technician license at the end of the first year. Additionally, the students in two-year programs at Weber State University and Salt Lake Community College take the ARRT Limited Scope of Practice in Radiography Examination or the Utah limited Scope Osteoporotic Exam in order to have clinical experience at the hospital and for employment opportunities. After the completion of the program, radiology practical technicians from these two programs can upgrade their licenses to radiology technologists.

Programs for Radiology Technologists
Two state institutions have two-year programs for radiology technologists in Utah: the Radiologic Technology Program at Salt Lake Community College (SLCC) and the Radiologic Sciences Program at Weber State University (WSU).

The Radiologic Technology Program at Salt Lake Community College is a two-year program that accepts 25-37 students every year. The students receive an Associate of Applied Science degree (A.A.S.) upon completion of the program. The students are then ready to take a national examination, the American Registry of Radiologic Technologists (ARRT) Examination in Radiology Technology.

Table 1. – Salt Lake Community College Radiologic Technology Program

	1998	1999	2000	2001	2002	2003	Average
Accepted Students	25	25	37	33	30	37	31
Employment Rate	91%	87%	82%	89%	89%	97%	89%

In 2003, Salt Lake Community College accepted 37 students, with 98 pre-approved applicants currently on a waiting list to get into the Radiologic Technology Program. The applicant acceptance rate for Salt Lake Community College's Radioilogic Technology Program increased 1.5 times from 25 students in 1998 to 37 students in 2003 (see Table 1). An average of 31 students was accepted to the program and an average of 89% of graduated students was employed in the period 1998-2003 (see Table 1).

The Radiologic Sciences Program at Weber State University offers a two-year Radiography (X-ray) program. The students receive an Associate of Applied Science degree (A.A.S.) upon completion of the program.

The Weber State University Department of Radiologic Sciences operates a distributed learning program. The Department accepts students for clinical experience at Weber State campus and through outreach programs in Utah and neighboring states. The students are required to have clinical experience, which they receive at local hospitals in the designated areas. The students are occasionally gathered to the designated areas to receive lectures. Baccalaureate degrees (B.S.) or certifications are available depending on the student's wish upon the completion of the program (see Appendix D).

Since the students are required to have clinical experience, the number of applicants accepted into the radiology technology program depends upon how many clinical practices are available at hospitals or what the demand for radiology technologists is in Utah. Because of the increase in demand for radiology technologists, the number of accepted applicants is increasing. The applicant acceptance rate for Weber State's two-year on-campus Radiologic Sciences Program increased 1.8 times from 28 students in 1995 to 51 students in 2003 (see Appendix E). For Weber State's two-year outreach Radiologic Sciences Program, the applicant acceptance rate increased 3.7 times from 19 students in 1995 to 71 students in 2003 (see Appendix E).

Advanced and Specialized Programs

Weber State University has the advanced and specialized radiologic sciences programs. The University of Utah Health Sciences Center has a nuclear medicine program and began offering magnetic resonance imaging (MRI) and computed tomography (CT) programs in July 2004. Salt Lake Community College began offering a diagnostic medical sonography (ultrasound) program in the Fall Semester 2004.

Weber State University is the major institution in Utah that has advanced and specialized Radiologic Sciences Program. Weber State University's Radiologic Sciences Program was selected as the best training program in the country for its contributions and achievements for the 2001-2002 academic year. The selection was made by Auntminnie.com, a national organization of radiologists and medical imaging professionals (Media Relations Office 2002).

It has one advanced program and ten programs for specialized areas. The programs at Weber Sate University are:

Advanced Radiography
Bone Densitometry
Cardiac Sonography
Cardiovascular-Interventional Technology
Computed Tomography
Diagnostic Medical Sonography
Nuclear Medicine
Mammography
Magnetic Resonance Imaging
Magnetic Resonance Imaging/Computed Tomography
Radiation Therapy
(see Appendix B)

For the four-year on-campus Advanced Radiology Program, the rate increased 3.5 times from 18 students in 1995 to 63 students in 2003 (see Appendix E). The number of radiology technologists who completed the specialized areas increased 5 times from 30 students in 1994 to 152 students in 2003 (see Appendix E).

To apply for the advanced and specialized Radiologic Sciences Program at Weber State University, applicants must be an ARRT registered radiology technologist or acceptable equivalent as determined by the Department of Radiologic Sciences.

The Weber State Programs have expanded to meet the increasing demand for more radiology technologists and expanded areas of specialization. All students who graduate and choose to work find jobs relatively easily. For Weber State University graduates, the employment rate has been 100% for the last six years.

Because of the demand of advanced radiology technologists in Utah, Salt Lake Community College Radiologic Technology Program and the University of Utah Health Sciences Center will be offering specialized programs in 2004 for individuals who are interested in specialized areas of radiology technology.

Salt Lake Community College will begin a pilot training program in diagnostic medical sonography in August 2004 (Fall Semester 2004). The program will take two years to complete. This will be a day program of approximately 20 students and will be run under the direction of the School of Continuing and Community Education at Salt Lake Community College. The first students will receive a certificate of completion. After the program is submitted to and approved by the Board of Regents of Utah, the students will receive an Associate of Applied Science degree (A.A.S.) upon completion of the program (Catalog Description 3-25-04.doc. 2004).

Larry Kruger, Division Chair of the Radiologic Technology Program, said that this program is being offered at the request of the health community because of the shortage of ultrasound technicians in Utah (communication via e-mail, 8 June 2004).

Students must have completed the following courses before they will be admitted to the program:

- General Physics – PHY 1010
- Human Anatomy – BIOL 2050/2060
- Intermediate Algebra – MATH 1010 (unless the student has a

CPT score of greater than or equal to 43 on the college level math section)
- Communication – COM 1010 or 1200

(Catalog Description 3-25-04.doc. 2004)

The University of Utah Health Sciences Center has offered a nuclear medicine program since the early 1980s and will offer magnetic resonance imaging (MRI) and computed tomography (CT) programs in July 2004. Certification is available upon the completion of the program.

The plan of the University of Utah Health Sciences Center (2004) under the direction of Marlene Johnson, Technology Program Administrator, is as follows:

Existing Program

- Nuclear Medicine day program (five students---twelve month Certificate program) – since the early 1980s

Programs in Development to begin July 2004

- Nuclear Medicine Technology program will include a position emission tomography and a computed tomography (PET/CT). Applicants for this program must have a certificate in radiography, radiation therapy, or evidence of having completed training in another health profession such as nursing or physical therapy. A B.S. (with specific science course completed) will also qualify.
- Magnetic Resonance Imaging (MRI) day program (three-four students/semester---six-month Certificate program)
- Computerized Tomography (CT) day program (three-four students/semester---six-month Certificate program)

For the MRI or CT program at the University of Utah Health Sciences Center, a certification in radiography, radiation therapy, or nuclear medicine is required (University of Utah Health Sciences Center 2004).

Radiologist Assistants
There is no program in Utah. Weber State University is preparing a proposal to offer a radiologist assistant program.

Radiology Practitioner Assistants
Weber State University developed a singular program in the United States in 1997. The radiology practitioner assistants must hold a current, active registration with the American Registry of Radiologic Technologists (ARRT), have completed an RPA educational program recognized by the Certification Board for Radiology Practitioner Assistant (CBRPA), and be certified by the CBRPA.

A total of 75 students from 1998 to 2003 completed the radiology practitioner assistant program and 239 students are currently enrolled in the program. Of the 314 students that have graduated and/or are currently enrolled in the program, there are 126 females and 188 males. Students complete the program through the combination of independent, directed learning, computer enhancement and intensive face-to-face session. A radiologist evaluates the

clinical competency of the students. In 2003 there was a rapid growth in the practitioner assistant program. The radiology practitioner assistant program starting in Fall 2004 has accepted 110 new students (communication via e-mail, 21 April & 26 April 2004).

State's Capacity to Meet Future Workforce Requirements

The programs available through Salt Lake Community College, the University of Utah and Weber State University provide the range of training needed and if resources are available to provide the faculty, they can expand to meet changing market requirements for both increased graduates and advance specialization.

Weber State University's Radiologic Sciences Program has an ideal curriculum to expand radiology technologists' professional role in new professional arenas. The outreach training programs can also meet the needs of the rural parts of the state. This coupled with the increasing capability at Salt Lake Community College and the University of Utah should be able to keep pace with the total statewide demand for radiology services at all levels of professional preparedness. While Weber State offers programs through the following methods, it may become necessary for the other institutions to also provide training utilizing these methods:

- On-campus classroom
- Off-campus: Outreach or Regional Program
- Distance Learning
- On-line (limited courses)
- Independent Study

For example, in the Fall Semester 2003, there were 751 students enrolled through the various program options (see Appendix F). The curriculum of Weber State University gives opportunities to learn radiologic sciences to students who live in underserved and rural areas, are considered minorities, or to those who want to learn advanced radiography. However, one problem the Department of Radiological Sciences at Weber State University faces is a shortage of faculty. Seven faculty members must cover 751 students. As the demand of radiology technologists is increasing, the applicant pool for the Radiologic Sciences Program is increasing. However, the capacity of acceptance is limited because of the lack of faculty (see Appendix E).

Weber State University receives some state appropriated funds for its radiologic sciences program: 50% of the sonography program and 100% of the radiography program. Other specialized programs are self-funding. However, lack of adequate state appropriation is the main reason that the department does not have enough faculty. Dr. Robert Walker, Chairman of the Radiologic Sciences Program, said, "If we could have appropriated money to hire more faculty, we will be able to make the program more efficient, to enhance the quality of the technologists, and to make it easier to accept more students" (interview by author, 11 August 2003). Dr. Robert Walker added that he needs at least two additional faculty and a professional staff for labs in order to make the Radiologic Sciences Program at Weber State University more efficient (interview by author, 11 August 2003). Solid groundwork has been laid to develop the Radiologic Sciences Program. With additional funding,

adequate faculty could be obtained to more effectively train the current group of applicants.

From Weber State University and Salt Lake Community College, Utah will have an estimated 852 graduated radiology technologists by 2010 (see Table 2). If the renewal rate continues until 2010, the State will have 712 out of 1,419 currently active radiology technologists from 2003, and an estimated 1,564 radiology technologists in 2010 (see Table 2). However, the current supply condition will result in a shortage of at least 89 radiology technologists in 2010 based on the projected minimum demand of 1,653 radiology technologists for 2010. This will continue the current ratio of 60.4 radiology technologists per 100,000 people in 2010. The projected shortage of 89 radiology technologists could be 50% less than the actual demand. With technological advances, the aging of the population, and Salt Lake remaining a regional referral center, the shortage could realistically be 200.

The two-year Weber State technologist program cannot be easily expanded because current clinical facilities are at capacity. However, some expansion is possible through the Baccalaureate program.

Lisa Wood, Program Director of the Radiologic Technology Program, said that there are currently 98 students (pre-approved) on the waiting list for the two-year Salt Lake Community College Radiologic Technology Program. To accept these 98 students, the department needs three to four additional faculty. However, the day program is currently at capacity based on the clinical hospital facilities (communication via e-mail, 6 January 2004).

Table 2. – Shortage of Radiology Technologists in 2010

	2010
Projected Graduates from WSU and SLCC	852
Projected Active Licenses Retained	712
Projected Radiologist Technologists Supply	1,564
Projected Need to Maintain Current Ratio	1,653
Shortage	89

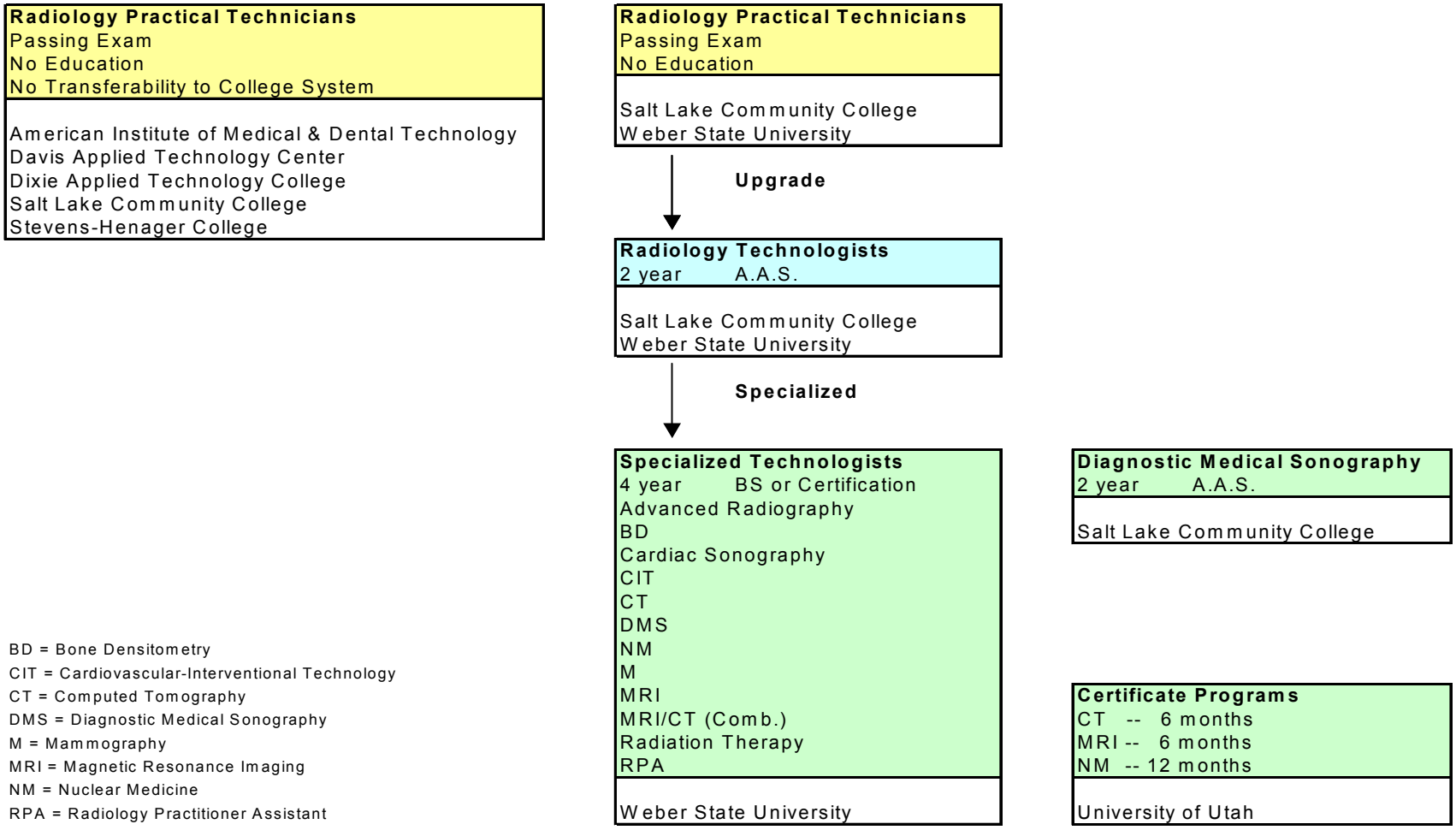
Summary

There are two institutions that have a two-year training program for radiology technologists: Weber State University and Salt Lake Community College. Weber State University has advanced and specialized radiologic sciences programs. Salt Lake Community College will offer a pilot training of a diagnostic medical sonography (ultrasound) program in August 2004 (Fall Semester 2004). The University of Utah has offered a nuclear medicine program since the early 1980s and will offer magnetic resonance imaging (MRI) and computed tomography (CT) programs in July 2004.

As the demand of radiology technologists is increasing, the applicant pool for the Radiologic Sciences Program is increasing. However, the capacity of acceptance is limited because Weber State University and Salt Lake Community College do not receive enough state appropriated money to hire more faculty. Utah may face a shortage of 89 radiology technologists in 2010 according to the current supply conditions.

There is a sufficient supply of radiology practical technicians in Utah; however, the demand of radiologic technology is shifting to an associate degree level. Therefore, it is necessary to reconsider the training curriculum of radiology practical technicians.

Chart 2. -- Supply Capacity in Utah



BD = Bone Densitometry
CIT = Cardiovascular-Interventional Technology
CT = Computed Tomography
DMS = Diagnostic Medical Sonography
M = Mammography
MRI = Magnetic Resonance Imaging
NM = Nuclear Medicine
RPA = Radiology Practitioner Assistant

Prepared by the Utah Medical Education Council, June 2004

III.
UTAH'S WORKFORCE TRENDS, SUPPLY, AND DEMAND FOR RADIOLOGY TECHNOLOGY

A. Radiology Practical Technicians

As shown in Table 3 there have been 1,242 valid licensed radiology practical technicians in Utah. However, during the period of 1992-2005, 26% dropped their licenses (expired) and 36% upgraded their licenses (see Table 3). 62% of those who obtained the radiology practical technician license have not remained technicians. A total of 70% of those who either let their license expire or dropped their licenses did so within four years of licensure (see Table 4).

Table 3. – License Status of Radiology Practical Technicians in Utah, 1992-2005

Lic_Status	Frequency	Percent	
Active	459	37%	
Expired	329	26%	
Upgraded	445	36%	62%
Others	9	1%	
Total	1242	100%	

Table 4. – Expired Licenses of Radiology Practical Technicians in Utah

		Frequency	Percent	Cumulative Percent
Valid Years	1	51	15.5	15.5
	2	81	24.6	40.1
	3	69	21.0	61.1
	4	31	9.4	70.5
	5	20	6.1	76.6
	6	23	7.0	83.6
	7	10	3.0	86.6
	8	18	5.5	92.1
	9	10	3.0	95.1
	10	6	1.8	97.0
	11	10	3.0	100.0
	Total	329	100.0	

Licensing period is from May 31 of each odd year. One full licensing period equals at least two years with license.
Prepared by the Utah Medical Education Council, January 2004

Table 5. – License Status of Radiology Practical Technicians by Gender in Utah, 1992-2005

	Active	Percent	Expired	Percent	Upgraded	Percent	Others	Percent	Total	Percent
F	397	39%	276	27%	328	33%	6	1%	1007	100%
M	62	26%	53	23%	117	50%	3	1%	235	100%
Total	459	37%	329	26%	445	36%	9	1%	1242	100%

Table 6. – Number of Active Radiology Practical Technicians by Gender in Utah, 1992-2005

Gender	Frequency	Percent
Female	397	86%
Male	62	14%
Total	459	100%

Table 7. – Active Licenses of Radiology Practical Technicians in Utah

		Frequency		Percent	Cumulative Percent
Valid Years	2	111		24.2	24.2
	3	80	Total	17.4	41.6
	4	43	of	9.4	51
	5	35	Valid Years	7.6	58.6
	6	50	7 to 15	10.9	69.5
	7	13		2.8	72.3
	8	14		3.1	75.4
	9	15		3.3	78.6
	10	15		3.3	81.9
	11	11		2.4	84.3
	12	29		6.3	90.6
	13	40		8.7	99.3
	14	2		0.4	99.8
	15	1		0.2	100
	Total	459	140	100	

Licensing period is from May 31 of each odd year. One full licensing period equals at least two years with license.
Prepared by the Utah Medical Education Council, January 2004

From Table 5 we see 459 (37%) technicians will have an active Utah license through 2005 and of these, 397 or 86% are female (see Table 6). These percentages indicate that radiology technology is a female-dominated profession. A total of 11% (140) of all technicians that have been licensed in

Utah (1242) maintain an active technician license longer than six years or three licensing cycles (see Table 7).

An average of 40% of radiology practical technicians upgraded their licenses to radiology technologists during the past ten years (see Table 8). The drop rate of radiology practical technician licenses is high because the students in two-year programs at Weber State University and Salt Lake Community College get the radiology practical technician license for employment opportunities, and then upgrade their licenses to radiology technologist upon completion of the program. An average of 19% dropped their licenses after the first full licensing period, an average of 30% of dropped their licenses after five years, and an average of 48% dropped their licenses after ten years (see Table 8).

Table 9 shows the year the license was issued and the year the license expired. Table 10 shows the technician's age in the year of expiration.

Table 8. – Radiology Practical Technicians – Licensed in Utah 1992-2002
(Does not include upgraded licenses)

Issue Year	Licenses Issued	% Male	% Living Out-of-state	% Upgrading to Technologist License	% Not Renewing After First Full Licensing Period*	% Not Renewing After First Full Licensing Period Living Out-of-State	% Expiring After Five Years	% Expiring After 10 Years
1992	104	17%	9%	10%	23%	5%	28%	52%
1993	148	18%	3%	37%	16%	4%	33%	44%
1994	74	30%	7%	53%	23%	6%	28%	
1995	63	21%	10%	37%	11%	0%	27%	
1996	63	16%	6%	52%	14%	11%	21%	
1997	67	24%	13%	43%	21%	29%	36%	
1998	76	15%	7%	47%	25%	11%	34%	
1999	132	14%	8%	39%	15%	20%		
2000	137	20%	7%	47%	28%	8%		
2001	120	16%	4%	50%	14%	6%		
2002	140	16%	1%	31%				
Average	*102*	*19%*	*7%*	*40%*	*19%*	*10%*	*30%*	*48%*

Licensing period is from May 31 of each odd year. One full licensing period equals at least two years with license.
Prepared by the Utah Medical Education Council, January 2004

Table 9. – Utah Radiology Practical Technicians-Licenses Issued and Expired (1992-2003)

Utah Rad-Technicians Licenses Year of Expiration									
Issue Year	**1993**	**1995**	**1997**	**1999**	**2001**	**2003**	**Active Through 2005**	**Total Issued**	**% Active Through 2005**
1992	4	20	5	8	7	10	50	104	48%
1993		24	14	11	10	6	83	148	56%
1994		4	13	4		3	50	74	68%
1995			7	5	5	7	39	63	62%
1996			5	4	4	2	48	63	76%
1997				14	3	7	43	67	64%
1998				8	11	7	50	76	66%
1999					20	10	102	132	77%
2000					17	21	99	137	72%
2001						17	103	120	86%
2002						17	123	140	88%

Licensing period is from May 31 of each odd year. One full licensing period equals at least two years with license.

Prepared by the Utah Medical Education Council, November 2003

Table 10. – Radiology Practical Technicians-Age During Year of Expiration (1993-2003)

Expiration Year	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**	**55-59**	**60-64**	**65+**	**Total Expired**
1993	2					1					3
1995	7	12	11	6	5		1		3	1	46
1997	4	14	6	7	4	5	3		1		44
1999	11	10	8	3	7	7	4	2		2	54
2001	12	21	11	8	8	3	5	2	3		73
2003	19	24	13	11	12	9	6	7		2	103
Average	9	16	10	7	7	5	4	4	2	2	54

Total Active Licenses or technicians who upgraded to a technologist license

Expiration Year	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**	**55-59**	**60-64**	**65+**	**Total Active Licenses**
2005	188	204	163	76	77	74	56	20	14	5	877

Licensing period is from May 31 of each odd year. One full licensing period equals at least two years with license.

Prepared by the Utah Medical Education Council, November 2003

B. Radiology Technologists

In Utah, there have been 2,082 radiology technologist licenses issued since 1991 (see Table 11). 1,419 out of 2,082 are currently active (see Table 11). Sixty-nine percent, or 980 of the 1,419 active licensed radiology technologists, are female (see Table 12). This indicates that radiology technology is a female-dominated profession.

Table 11. – License Status of Radiology Technologists in Utah, 1991-2003

Lic_Status	Frequency	Percent
Active	1419	68%
Expired	618	30%
Others	45	2%
Total	2082	100%

Table 12. – Number of Active Radiology Technologists by Gender in Utah, 1991-2003

	Utah		U.S. (ARRT)	
Gender	Frequency	Percent	Frequency	Percent
Female	980	69%	166,806	73.4%
Male	439	31%	60,489	26.6%
Total	1419	100%	227,295	100.0%

US data from the American Registry of Radiologic Technologists

The Utah Radiology Technologists and Radiology Practical Technicians Licensing Act was implemented in 1989. Therefore, radiology technologists had to get their licenses in 1991 and 550 licenses were issued (see Table 13).

A total of 618 (30%) of Utah's licensed radiology technologists dropped their licenses in the period 1991-2003 (see Table 14). Sonographers and MRI technologists drop their Utah technologist license after the completion of advanced programs and register with the American Registry of Diagnostic Medical Sonographers (ARDMS) and the American Registry of MRI Specialists (ARMRIT). Therefore, the number of those leaving the profession is lower than what the following data suggest. An average of 17% of radiology technologists dropped their licenses after the first full licensing period, 29% dropped their licenses after five years, and 34% dropped their licenses after ten years (see Table 13).

Table 13. – Radiology Technologists – Licensed in Utah 1991-2002

Issue Year	Licenses Issued	% Male	% Living Out-of-state	% Not Renewing After First Full Licensing Period	% Not Renewing After First Full Licensing Period Living Out-of-State	% Expiring After Five Years	% Expiring After 10 Years
1991	550	33%	5%	4%	8%	16%	25%
1992	264	30%	9%	12%	10%	21%	39%
1993	159	35%	9%	15%	4%	30%	38%
1994	107	38%	14%	17%	44%	26%	
1995	130	32%	15%	16%	24%	39%	
1996	104	34%	20%	14%	47%	27%	
1997	111	36%	10%	14%	19%	40%	
1998	86	33%	21%	26%	36%	33%	
1999	112	28%	15%	20%	46%		
2000	110	35%	13%	29%	31%		
2001	127	25%	9%	17%	27%		
2002	134	27%	15%				
Average	*166*	*32%*	*13%*	*17%*	*27%*	*29%*	*34%*

Licensing period is from May 31 of each odd year. One full licensing period equals at least two years with license.
Prepared by the Utah Medical Education Council, October 2003

Table 14. – License Status of Radiology Technologists by Gender in Utah, 1991-2003

	Active	Percent	Expired	Percent	Others	Percent	Total	Percent
Female	980	69%	402	29%	32	2%	1414	100%
Male	439	66%	216	32%	13	2%	668	100%
Total	1419	68%	618	30%	45	2%	2082	100%

On average, 23 radiology technologists age 25-29 drop their licenses annually compared to an average of 2 radiology technologists age 20-24. Further analysis was conducted regarding those who dropped their licenses. The findings are as follows:

- 68% of radiology technologists who dropped their licenses moved out of Utah.
- 78% of radiology technologists who dropped their licenses, but who live in Utah, are married. The actual number is 173.
- 66% of married radiology technologists who dropped their

licenses and live in Utah have one or more dependents. The actual number is 112.

Table 15 shows the year the license was issued and the year the license expired for Utah radiology technologists. Table 16 shows the age of Utah radiology technologists in the year of expiration.

Summary as to numbers of active radiology practical technicians and radiology technologists

There are 459 active licensed radiology practical technicians and 1,419 active licensed radiology technologists in Utah. 397 (86%) of technicians and 980 (69%) of the technologists are female. Radiology technology is a female-dominated profession.

An average of 48% of radiology practical technicians dropped their licenses and 34% of radiology technologists dropped their licenses within ten years. Even though 40% of radiology practical technicians upgraded their licenses to radiology technologists during the past ten years, radiology practical technicians' drop rate after ten years is higher than radiology technologists' drop rate. 11% of all technicians that have been licensed in Utah remain a technician for more than six years or the length of three licensing cycles.

Some probable conditions for radiology technologists' dropping their licenses include moving out of Utah, getting married, or having children (refer Appendix C).

C. Utah Salary Comparison

Appendix B shows that the average annual salary of Region VIII, to which Utah belongs, has increased 18.61% between 1997 and 2001, but it is lower than the average annual salary of all regions. Utah does not have adequate data for salaries of radiology professionals to see whether Utah's salary matched the national level. Therefore, Utah needs to conduct a survey in order to get sufficient data to determine if salary levels are contributing to Utah's shortage of an adequate radiology workforce.

Table 15. – Utah Radiology Technologists – Licenses Issued and Expired (1991-2003)

Utah Rad-Technologists Licenses year of Expiration									
Issue Year	**1993**	**1995**	**1997**	**1999**	**2001**	**2003**	**Active Through 2005**	**Total Licenses Issued**	**% Active Through 2005**
1991	24	29	32	31	22	25	387	550	70%
1992	16	15	25	12	17	17	162	264	61%
1993		24	16	8	11	12	88	159	55%
1994		4	14	10	5	9	65	107	61%
1995			21	18	12	11	68	130	52%
1996			9	6	13	12	64	104	62%
1997			2	14	20	8	67	111	60%
1998				5	17	6	58	86	67%
1999					22	15	75	112	67%
2000					5	27	78	110	71%
2001					1	21	105	127	83%
2002						16	118	134	88%

Licensing period is from May 31 of each odd year. One full licensing period equals at least two years with license.

Prepared by the Utah Medical Education Council, December 2003

Table 16. – Radiology Technologists Age During Year of Expiration (1993-2003)

Expiration Year	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**	**55-59**	**60-64**	**65+**	**Missing**	**Total Expired**
1993	1	5	12	7	6	4	1	1	1	1	1	40
1995	1	17	17	15	10	1	2	3	3	2	1	72
1997	1	31	20	20	13	15	9	7	2		2	120
1999	1	19	18	17	13	13	9	4	4	3	3	104
2001	3	32	28	23	17	12	9	8	5	3	6	146
2003	6	34	29	32	20	22	17	10	3	2	6	181
Average	*2*	*23*	*21*	*19*	*13*	*11*	*8*	*6*	*3*	*2*	*3*	*111*

Current Licenses (Active Through 2005)

Expiration Year	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**	**55-59**	**60-64**	**65+**	**Missing**	**Total Active Through 2005**
2005	21	172	192	204	186	191	178	121	57	28	69	1419

Licensing period is from May 31 of each odd year. One full licensing period equals at least two years with license.

Prepared by the Utah Medical Education Council, December 2003

D. Workforce Data

Radiology Practical Technicians

Utah radiology practical technicians' license addresses spread into 23 out of 29 counties and they practice in 23 counties (see Table 17). Radiology practical technicians are distributed statewide.

41% of radiology practical technicians are employed at hospitals and 34% of practical technicians are employed at doctor's offices (see Table 18).

The employment category "Temp" means that 3% of radiology practical technicians work for temporary agencies, and "Other" means that 10% of technicians hold their licenses, but are not working in the profession so far as UMEC staff can tell according to the job classification codes (see Table 18).

Radiology Technologists

Utah radiology technologists' license addresses spread into 26 out of 29 counties and they practice in 23 counties (see Table 19). Radiology technologists are distributed statewide.

79% of radiology technologists are primarily employed at hospitals according to employment area and county of license address in Utah (see Table 20).

The employment category "Other" means that 3% of radiology technologists hold their licenses, but are not working in the profession (see Table 20).

Summary

A high ratio of radiology technologists' work for hospitals compared to radiology practical technicians.

Table 17. -- Utah Radiology Practical Technicians by County of License Address and County of Practice* (3rd Quarter 2001)

County of License Address	County of Practice: Beaver	Box Elder	Cache	Carbon	Davis	Duchesne	Emery	Iron	Juab	Kane	Millard	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Wayne	Weber	Total	Percent
Beaver	3																							**3**	0.8%
Box Elder		14	2		1																			**17**	4.6%
Cache		1	8																					**9**	2.4%
Carbon				4																				**4**	1.1%
Davis					28							22											3	**53**	14.2%
Duchesne					1	2																		**3**	0.8%
Emery							1																	**1**	0.3%
Iron	1							3																**4**	1.1%
Juab												2							2					**4**	1.1%
Kane	1									1														**2**	0.5%
Millard											1													**1**	0.3%
Morgan												2											2	**4**	1.1%
Salt Lake					1							118				1			3					**123**	33.1%
San Juan													3											**3**	0.8%
Sanpete				1					1					5										**7**	1.9%
Summit												4				8				2				**14**	3.8%
Tooele			1									2					1							**4**	1.1%
Uintah																		1						**1**	0.3%
Utah												8		1					41					**50**	13.4%
Wasatch																4				1				**5**	1.3%
Washington												1									7			**8**	2.2%
Wayne															1							2		**3**	0.8%
Weber					7							2											37	**46**	12.4%
Out of State												2					1							**3**	0.8%
Total	5	15	11	5	38	2	1	3	1	1	1	163	3	6	1	13	2	1	46	3	7	2	42	**372**	100%
Percent	1.3%	4.0%	3.0%	1.3%	10.2%	0.5%	0.3%	0.8%	0.3%	0.3%	0.3%	43.8%	0.8%	1.6%	0.3%	3.5%	0.5%	0.3%	12.4%	0.8%	1.9%	0.5%	11.3%	100%	

Adjusted for central-paying institutions (IHC, University of Utah, etc.) to account for individuals working in one county that receive wages from a central office in another county
Prepared by the Utah Medical Education Council, March 2002

Table 18. -- Utah Radiology Practical Technicians by Employment Area and County of License Address

(3rd Quarter 2001)

Includes only Radiology Practical Technicians that are working in Utah

	Employment Categories										
Counties	Temp	Doctor's Offices	Podiatrists Offices	Chiropractors' and "Other" Clinicians' Offices	Hospitals	Skilled Nursing Facilities	Medical Labs / Home Health / Allied Health	Colleges	Govt. & Public Health	Other	Totals
Beaver					5						5
Box Elder		8		2	2				1	2	15
Cache		5			6						11
Carbon					2		1		1	1	5
Davis	2	21	1	1	9	1	1		2		38
Duchesne					2						2
Emery									1		1
Iron					2				1		3
Juab					1						1
Kane										1	1
Millard					1						1
Salt Lake	6	50	4		70		1	14	2	16	163
San Juan		2			1						3
Sanpete		1			4					1	6
Sevier										1	1
Summit		10							2	1	13
Tooele					1				1		2
Uintah					1						1
Utah	4	19	1	1	11			2		8	46
Wasatch		3									3
Washington		1	2		2			1		1	7
Wayne							1	1			2
Weber		5		2	29	1		1		4	42
Totals	12	125	8	6	149	2	4	19	11	36	372
Percents	3%	34%	2%	2%	40%	1%	1%	5%	3%	10%	100%

Prepared by the Utah Medical Education Council, March 2004

Table 19. -- Utah Radiology Technologists by County of Licenses Address and County of Practice (3rd Quarter 2001)

County of License Address	County of Practice																							Total	Percent
	Beaver	Box Elder	Cache	Carbon	Davis	Duchesne	Garfield	Grand	Iron	Juab	Kane	Millard	Salt Lake	San Juan	Sanpete	Sevier	Summit	Tooele	Uintah	Utah	Wasatch	Washington	Weber		
Beaver	3																							3	0.2%
Box Elder		11			3																		1	15	1.2%
Cache			24		1								1											26	2.1%
Carbon				16																				16	1.3%
Davis					89								83				1						9	182	14.9%
Duchesne				1	1	7													2					11	0.9%
Emery				1																				1	0.1%
Garfield							2																	2	0.2%
Grand								5						1										6	0.5%
Iron	1								13															14	1.1%
Juab	2									4										3				9	0.7%
Kane											3													3	0.2%
Millard												7												7	0.6%
Morgan					6								2										4	12	1.0%
Rich													1											1	0.1%
Salt Lake					5								426					1		2			1	435	35.7%
San Juan								1						4										5	0.4%
Sanpete										1					9									10	0.8%
Sevier															1	5								6	0.5%
Summit													4				1				2		2	9	0.7%
Tooele					1								14					10						25	2.1%
Uintah																			9					9	0.7%
Utah			1		2								50							149				202	16.6%
Wasatch																					6			6	0.5%
Washington													1									52		53	4.4%
Weber		4	1		20								11										104	140	11.5%
Out of State			2										8											10	0.8%
Total	6	15	28	18	128	7	2	6	13	5	3	7	601	5	10	5	2	11	11	154	8	52	121	1218	100%
Percent	0%	1%	2%	1%	11%	1%	0%	0%	1%	0%	0%	1%	49%	0%	1%	0%	0%	1%	1%	13%	1%	4%	10%	100%	

Adjusted for central-paying institutions (IHC, University of Utah, etc.) to account for individuals working in one county that receive wages from a central office in another county.

Prepared by the Utah Medical Education Council, January 2003

Table 20. -- Utah Radiology Technologists by Employment Area and County of License Address

Includes only radiology technologists that are working in Utah

(3rd Quarter 2001)

County of License Address	Employment Categories							Total
	Medical Equipment & Labs	Doctor's Offices	Hospitals	Allied Health	Colleges	Gov. & Public Health	Other	
Beaver			3					**3**
Box Elder		3	12					**15**
Cache		8	16				2	**26**
Carbon		4	12					**16**
Davis	4	22	141	3	3	3	6	**182**
Duchesne			9				2	**11**
Emery			1					**1**
Garfield			2					**2**
Grand			5				1	**6**
Iron	1		12		1			**14**
Juab		1	8					**9**
Kane	1		2					**3**
Millard			7					**7**
Morgan		3	7		1		1	**12**
Rich			1					**1**
Salt Lake	12	45	347	4	9	6	12	**435**
San Juan			3				2	**5**
Sanpete			10					**10**
Sevier			6					**6**
Summit		4	4				1	**9**
Tooele	1	3	18	1	1		1	**25**
Uintah	1	1	7					**9**
Utah	5	17	166	1	6	4	3	**202**
Wasatch		1	5					**6**
Washington		4	47				2	**53**
Weber	2	17	112		2		7	**140**
Out of State		4	4				2	**10**
Total	**27**	**137**	**967**	**9**	**23**	**13**	**42**	**1218**
Percent	2%	11%	79%	1%	2%	1%	3%	100%

Prepared by the Utah Medical Education Council, January 2003

E. Demand in Utah

At the national level, hospitals are facing a severe shortage of radiology technology workforce. This condition is also true for Utah hospitals. This national shortage impacts Utah since Utah programs are not training enough to meet the total statewide need. Some studies estimate the shortage of radiology technology workforce as follows:

- There are currently over 30,000 vacancies nationwide (The American Society of Radiologic Technologists).
- An additional 75,000 radiology technologists, 7,000 radiation therapists, and 8,000 nuclear medicine technologists will be needed nationwide by 2010 (The United States Bureau of Labor Statistics).
- By 2030, some 62,000 radiology technologists will be needed to meet patient demand, but only about 34,000 will likely be available (The American College of Radiology).
- Radiologic examinations will be performed 450 million times in 2010 based on an approximation using the number of radiologic examinations performed in 2000, which was 300 million times (Racette 2001).

Radiology Practical Technicians
According to the report of *The Healthcare Workforce Shortage and Its Implications for America's Hospitals* by First Consulting Group (FCG 2001), there are severe shortages (over 20% vacancy rate) of radiology practical technicians (imaging technicians) since 1999. 42% of hospitals have experienced an increase in the number of radiology practical technician vacancies (see Appendix G).

Nationally, even though there is a severe shortage of radiology technologists, employers are trying to avoid filling the shortage with radiology practical technicians. The main reasons for not hiring radiology practical technicians in place of radiology technologists are that radiology practical technicians do not have enough practical experience, they lack the knowledge of radiology technology, and they are unqualified (Sanchez 2002).

Table 21. – Radiology Practical Technicians in Utah

		Utah
Radiology Practical Technicians	2003*	459
Per 100,000 Population		19.5
Radiology Practical Technicians	2010**	Unpredictable
Per 100,000 Population		

Source: Bureau of Labor Statistics; Bureau of the Census

* Based on 2,351,467 of the Utah population of 2003

** Based on 2,737,190 estimate of the Utah population of 2010 by Population Division, Population Paper Listing #47, Population Electronic Product #45, U.S. Bureau of the Census

Based on the 2002 Utah population, Utah has 19.5 radiology practical technicians per 100,000 people in 2003. Compared to Utah's 60.4 radiology technologists per 100,000 people in 2003, the number of 19.5 radiology practical technicians per 100,000 people is extremely low. A total of 459 of radiology practical technicians are active in Utah (see Table 21). From this data it would appear there is a severe shortage of radiology practical technicians in Utah. In reality the numbers reflect the low market demand for radiology practical technicians. In Utah, hospitals prefer to hire radiology technologists who are specialized in several areas or specialized technologists. Some hospital administrators (telephone interview by the director of UMEC, 2003) explain the reasons as follows:

- If one radiology technologist is specialized in three different areas, he/she can be hired at one salary, saving the hospital the expense of hiring the equivalent abilities of three individual radiology technologists that only specialize in one area and one radiology practical technician.

- If one radiology technologist is specialized in three different areas, a hospital can afford to pay a higher salary to the radiology technologist instead of paying salaries to three radiology technologists and one radiology practical technician.

Because of these reasons, hospitals prefer to hire advanced and specialized radiology technologists. The demand is shifting to advanced technology. The job market is limited for radiology practical technicians. Therefore, it is very difficult to predict the 2010 demand for radiography practical technicians in Utah. With decreasing market demand, radiology practical technicians' license drop rate is high because they cannot find a job and a majority continue their education and become technologists.

The existing programs appear more than adequate to meet decreasing market demand for technicians.

Radiology Technologists

For the last five years, Utah has basically held a steady rate. Continuing this rate, however, is questionable.

In 2003, Utah had 1,419 active radiology technologists for a rate of 60.4 radiology technologists per 100,000 people, based on the 2003 Utah population. In 1998, Utah had 60.5 radiology technologists per 100,000 people as compared to the national radiology technologists of 58.3 per 100,000 people. Utah ranked 25th among 50 states in the per capita employment of radiology technologists (see Table 22).

In order to keep the same 60.4 radiology technologists per 100,000 people in 2010, Utah needs a total of 1,653 active radiology technologists. According to the estimate of Utah's current capacity to supply radiology technologists, Utah has capacity to produce 1,564 radiology technologists. Unless the difference can be recruited from out of state, the Utah rate will drop to 57 radiology technologists per 100,000 people in 2010 (see Appendix H). This number shows that Utah, by 2010, will face a shortage of 89 radiology technologists (see Appendix H). This is assuming 100% of graduates enter practice in Utah. With a

national shortage, some Utah graduates will likely be enticed to other states, thus increasing the actual Utah shortage and drop in rank.

Table 22. – Radiology technologists in Utah

		Utah	US	Rank
Radiology Technologists	1998	1,270	157,480	35/49
Per 100,000 Population		60.5	58.3	25/50
Radiology Technologists	2003*	1,419		
Per 100,000 Population		60.4		
Radiology Technologists	2010**	1,653		
Per 100,000 Population		60.4		
Nuclear Medicine Technologists	1998	50	13,360	39/45
Per 100,000 Population		2.4	4.9	46/46
Nuclear Medicine Technologists	2003*	144***	17,550****	
Per 100,000 Population		6.1	6.0	

Source: Bureau of Labor Statistics; Bureau of the Census

* Based on 2,351,467 of the Utah population of 2003

** Based on 2,737,190 estimate of the Utah population of 2010 by Population Division, Population Paper Listing #47, Population Electronic Product #45, U.S. Bureau of the Census

*** Based on 50 Utah nuclear medicine technologists in 1998 and 69 nuclear medicine technologists who completed the specialized area at Weber State Univ., and 25 nuclear medicine technologists who completed the specialized area at University of Utah from 1999 to 2003

**** Based on 17,550 of the U.S. nuclear medicine technologists in 2003 by Bureau of Labor Statistics

Specialized Technologists

One example of specialized technologists is nuclear medicine technologists. According to the data of 2003, Utah has 144 nuclear medicine technologists, or 6.1 technologists per 100,000 people, which eclipsed the national average of 6.0 (see Table 22). In 1998, Utah had 2.4 nuclear medicine technologists per 100,000 people. The rank of Utah was 46th among 46 states (see Table 22). Between 1998 and 2003, the number of nuclear medicine technologists increased 2.9 times from 50 in 1998 to 144 in 2003 (see Table 22). In other specialized areas such as diagnostic medical sonography, cardiac sonography, mammography, cardiovascular-interventional technology, magnetic resonance imaging, computed tomography, radiation therapy, and radiology practitioner assistants, the number of technologists is increasing. Data from Weber State University shows that radiology technologists who completed the specialized areas increased 2.7 times from 57 radiology technologists in 1998 to 152 radiology technologists in 2003 (Appendix E). These data show that the demand for specialized technologists is increasing in Utah. In response to the increased demand, both, Salt Lake Community College and University of Utah started new programs for specialized technologists in 2004. However, Utah needs to consider

increasing the capacity for training specialized radiology technologists.

Radiologist Assistants and Radiology Practitioner Assistants

The demand for radiologist assistants in Utah is uncertain as this level of training and certification is very new; however, Weber State University is preparing a proposal to offer a radiologist assistant program which shows there is an increasing demand. A total of 75 students from 1998 to 2003 completed the radiology practitioner assistant program and 239 students are currently enrolled in the program. 314 students (females-126; males-188) have graduated and/or are currently enrolled in the program. Those students are from 43 different states and seven radiology practitioner assistants are working in Utah. 110 new students have been accepted for the program in Fall 2004. There was a rapid demand and growth of the practitioner assistant program in 2003 in Utah and nationwide. None of the graduates of this program have had difficulty obtaining employment. Weber faculty has helped develop the general curriculum that guides the fourteen schools starting the Radiologist Assistant Programs. The double programs at the advanced level require evaluation in the next five years to see if there is sufficient difference in market demand to warrant their continuation.

Summary

By 2010, Utah will face a shortage of at least 89 radiology technologists in order to keep 60.4 radiology technologists per 100,000 people in 2010 – the same as 2003. The demand for advanced technologists is increasing in Utah. However, it took Utah five years to reach the national level of nuclear medicine technologists in 1998. Utah needs to consider increasing the capacity of training for radiology technologists in specialized areas. The job market for radiology practical technicians is limited because they lack the desired skills. Continued monitoring of the market demand for the advanced-trained student must occur. The increasing demand for more specialization and the projected physician shortages all indicate that both the Radiologist Assistant and Radiology Practitioner Assistant will be in high demand even though the demand in Utah doesn't appear to be as strong as in other parts of the country.

IV.
NEW CHALLENGES IN RADIOLOGY

A. Need for Radiology Technologists Working in an Advanced Clinical Role

In 2002 the Advance Practice Advisory Panel advocated a new level of trained radiology professional. "The radiology community faces many challenges today, including increased patient demand, a growing shortage of radiologists and radiology technologists, and the rapid expansion of new technology. In this fluctuating environment, it may be time for the radiology workplace to introduce a new type of radiology technologist, a person whose advanced clinical skills can extend the role of the radiologist. Working with the supervision of a radiologist, an advanced-level radiology technologist could take responsibility for patient assessment, patient education and patient management; perform fluoroscopy and other radiology procedures; and make initial image observations. By assuming responsibility for these tasks, the advanced-level technologist would improve productivity, increase patient access to radiology services, and enhance the overall quality of patient care" (Advanced Practice Advisory Panel 2002).

The Advanced Practice Advisory Panel suggests the title of "radiologist assistant" for the radiology technologists working in an advanced clinical role. The following is the Panel's consensus statement on the radiologist assistant (RA).

Definition:

A radiologist assistant is an advanced-level radiology technologists who enhances patient care by extending the capacity of the radiologists in the diagnostic imaging environment. The radiologist assistant is an ARRT-certified radiographer who has completed an advanced academic program encompassing a nationally recognized radiologist assistant curriculum and a radiologists-directed clinical preceptorship. With radiologist supervision, the radiologist assistant performs patient assessment, patient management, fluoroscopy and other radiology procedures. The radiologist assistant also makes initial observations of diagnostic images, but does not provide an official interpretation (final written report) as defined by the *ACR Standard for Communication: Diagnostic Radiology* (Advanced Practice Advisory Panel 2002).

The Need for Radiologist Assistants:

- The growing shortage of radiology technologists and radiologists
  - Aging radiology technologists[’] and radiologists[’] workforce
  - Decline of individuals entering the profession
    Radiology technologists – 10,629 (1994) to 7,434 (2001)
    Radiologists – 4,236 (1994) to 3,600 (1999)
- The soaring demand for medical imaging procedures

- Aging U.S. population
- Enhanced & new technologies

- The radiology community's desire to enhance the overall quality of patient care
  - New technologies (e.g. CT, MRI, interventional radiology services, etc.)

The Advanced Practice Advisory Panel said:

By taking a lead role in patient assessment and management and by performing procedures such as fluoroscopy, the radiologist assistant could reduce the amount of time required of radiologists, allowing them to focus on the medical requirements of interpretation…Incorporation of radiologist assistants can improve efficiency and productivity, permitting greater numbers of patients to be examined or treated (2002).

Educational Preparation:

- The educational preparation for the radiologist assistant (RA) should be a minimum of a baccalaureate degree.
- The course of study follow[s] a prescribed curriculum that contains both academic and clinical components. The clinical portion of the radiologist assistant's education should consist of a preceptorship with a radiologist.
- The [completion] of a standardized national curriculum for radiologist assistant programs.
- A national certification process [is being] developed so that graduates of radiologist assistant programs can prove their competency upon completion of their education. [This should be in place for the first graduates in 2006] (Advanced Practice Advisory Panel 2002).

B. Roles and Responsibilities

What the RA Can

The radiologist assistant's primary areas of responsibility are all performed with the supervision of a radiologist and include:

1. Taking responsibility for patient assessment, patient management and patient education. This includes accessing the clinical history from the patient records, obtaining informed consent, and evaluating the condition of patients before and after procedures (Health Insurance Portability and Accountability Act – HIPAA approved).
2. Evaluating image quality, make initial image observations and communicate observations to the supervising radiologist.
3. Performing selected examinations by facilitating the diagnostic imaging process, injecting contrast agents, including fluoroscopy.
4. Communicating the radiologist's findings to the referring physician (Advanced Practice Advisory Panel 2002 & Radiological Society of North America 2004).

What the RA Cannot Do

- Substitute for the radiologist. The radiologist assistant does not interpret images. The supervising radiologist retains responsibility for final image interpretation. The RA does not act independently, as some nurse practitioners are able to do.
- The radiologist assistant does not make diagnoses. The supervising radiologists retains responsibility for preparing a final written report.
- Provide preliminary, official, or other interpretations of the imaging findings.
- Prepare a final written report.
- The radiologist assistant does not prescribe medications or therapies (Advanced Practice Advisory Panel 2002 & Radiological Society of North America 2004).

Supervision Level:

- The radiologists provide an appropriate level of supervision for the radiologist assistant. This level of supervision should be consistent with the educational preparation and experience level of the radiologist assistant, and may change over time as the radiologist assistant gains more expertise (Advanced Practice Advisory Panel 2002).

Regulation:

- The radiologist assistant is an enhancement of the radiology technology profession. Because of this status, the radiologist assistant is covered under existing radiology technologist statutes as well as under state medical practice acts that authorize radiologists to delegate the performance of tasks with their supervision. For these reasons, the panel believes that separate state certification or licensure is not necessary for the radiologist assistant.

- Regulations in some states prohibit some of the proposed roles and responsibilities of the radiologist assistant. Therefore, the American College of Radiology and the American Society of Radiologic Technologists will develop materials to promote the role of radiologist assistants in all states (Advanced Practice Advisory Panel 2002).

Other Issues:

- The ASRT is [assessing] its code of ethics for radiology technologists to determine if additional content is needed to address the expanded roles and responsibilities of radiologist assistants.

- The [national] advisory panel [has recommended] the incorporation of radiologist assistants into the *ACR Standards* (Advanced Practice Advisory Panel 2002).

The Panel believes that:

As radiology strives to meet the challenges brought on by increasing

patient demand and growing work force shortages, the time is right to introduce a health care professional who can extend the role of the radiologist by functioning as an advanced-level radiology technologist. The introduction of the radiologist assistant into the health care system represents an innovative, cost-effective way to meet patient needs while also improving the quality, efficiency and productivity of radiologic care (Advanced Practice Advisory Panel 2002).

C. National Training Efforts

Four institutions were awarded the American Society of Radiologic Technologists (ASRT) Education and Research Foundation Program Development Grants:

- Loma Linda University
- Midwestern State University
- University of North Carolina at Chapel Hill
- University of Medicine and Dentistry of New Jersey

The first radiologist assistant program in the United States started in September 2003 at Loma Linda University in California. They accepted ten students for 2003 and will accept 10-12 students in 2004. Other institutions are planning to start their programs in the next 18 to 24 months (ASRT 2004).

In 1997 Weber State University established the first radiology assistant program in the nation named: "Radiology Practitioner Assistant Program" (American Academy of Physician Assistants 2002). This program differs slightly from the radiologist assistant program in the curriculum of study and required degree of the radiologist assistant (ASRT 2004).

Chart 1 shows the expanded roles that radiologist assistants (RA) and radiology practitioner assistants (RPA) can assume compared to radiology practical technicians (RPT) and radiology technologists (RT).

In the United Kingdom, all radiology technologists are educated to write reports on the examinations they perform, but they cannot diagnose (Racette 2001). For nearly 30 years, U.K. radiology technologists have extended their roles similar to U.S. radiologist assistants or radiology practitioner assistants. However, medical supervision is not required in the U.K. (Quan 2004).

D. Certification as a Radiologist Assistant

A committee of physicians and R.T.s of the American Registry of Radiologic Technologists (ARRT) has been developing ARRT's Radiologist Assistant certification program. The ARRT certification as a radiologist assistant is on schedule for September 2005 introduction (ARRT 2003). Updated information on ARRT's development of the Radiologist Assistant certification program is available at www.arrt.org in the "R.A. Update" section.

E. National Demand

The demand for radiologist assistants and radiology practitioner assistants is uncertain as this level of training and certification is very new; however, the thirteen schools starting new programs

for radiology assistants show there is an increasing demand. The thirteen programs are:

- Loma Linda University
- Midwestern State University
- University of North Carolina at Chapel Hill
- University of Medicine and Dentistry of New Jersey
- Bloomsburg University of Pennsylvania
- Massachusetts College of Pharmacy and Health Sciences
- Northern Kentucky University
- Ohio State University
- Quinnipiac University
- S.U.N.Y. Upstate Medical University
- University of Alabama at Birmingham
- Virginia Commonwealth University
- Washington Hospital Center

Weber State University is preparing proposals to offer a radiologist assistant program at the Baccalaureate degree (B.S.) level and move the radiology practitioner assistant program to a graduate level.

V.
CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

1. Utah's colleges and universities have the ability to produce well-trained professionals at all levels. However, the capacity of acceptance is limited because Weber State University and Salt Lake Community College do not receive enough state appropriated money to hire more faculty.

2. Utah will likely face a shortage of between 89 and 200 radiology technologists by 2010 according to the current supply condition. In order to avoid a shortage, Weber State University and Salt Lake Community College need more state appropriated money to hire more faculty and expand their programs.

3. Utah has a training capacity of 130 radiology practical technicians per year. However, nationally the demand is for specialists and technologists with baccalaureate training. In Utah there is still a demand for technicians in private physician and chiropractic offices. Therefore, Utah needs to continue training at all levels, but hold the technician capacity constant at the 130 level for the next two or three years to see if demand diminishes similar to the national trend. The capacity for baccalaureate technologist and specialty training should be expanded to fulfill the need for more advanced training. The demand at the baccalaureate and specialty levels will continue to increase because of the number of procedures needed due to population growth and advances in technology.

4. Radiology practical technicians from applied technology programs and medical technology programs cannot upgrade their licenses to radiology technologists because the curriculum set does not transfer to the college system. National leaders in radiological sciences suggest that an associate degree should be the entry-level requirement for a radiology profession.

5. Utah's radiology technology workforce committee believes the state licensing law should be strengthened because presently a person could possibly pass the exam without formal training and get a license, but not be technically competent to provide radiological services.

6. The national demand for radiologist assistants (R.A.) is growing. The demand for radiologist assistants in Utah is uncertain as this level of training and certification just began in the fall of 2003 at Loma Linda University and twelve universities are planning to launch R. A. programs. Weber State University is to be commended for preparing a proposal to offer a radiologist assistant program consistent with

the changing demand for this type of professional. The national emphasis for more advanced training and certification will accelerate the demand for this level of training in Utah.

7. The Utah Division of Occupational and Professional Licensing (DOPL) uses two licensing codes: radiology practical technicians and radiology technologists for licensing all radiology technology professionals. Therefore, it is not possible to capture the numbers of advanced trained radiology professionals working in Utah. The addition by DOPL of identifying licensing codes for advance trained radiology professions would be extremely valuable in monitoring demand for the specialists of radiology technology, radiologist assistants, and radiology practitioner assistants to professional licensing numbers.

8. Current data sources are not adequate to analyze the causes for the high rate of radiology professionals dropping their Utah licenses. Further analysis must wait until there are resources to conduct a survey of radiology professionals licensed in Utah.

B. Recommendations to Reduce the Shortage of Radiology Technology Workforce

1. The UMEC should work with the schools, Board of Education, Board of Regents, and private entities to identify funding possibilities to expand the radiologic programs at Weber State University and Salt Lake Community College to keep up with the expanding Utah demand for these professionals.

2. If the state legislature cannot increase the state appropriated money to Weber State University and Salt Lake Community College, the state needs to help them seek ways to expand their programs.

3. Industry representatives should meet with training programs and identify the changes that need to be made to conform training curriculum to market needs.

4. The applied programs should upgrade training to the associate level with a curriculum that is acceptable for transfer to the college system.

5. Utah Administrative Code, R156-54, Radiology Technologist and Radiology Practical Technician Licensing Act Rules are very vague. The administrative law needs to be reviewed and revised in order to prevent people from being able to pass the exam and gain a license, but lack the technical skills to be competent.

6. The demand for more advanced training and certification of radiology technology of specialists, radiologist assistants, and radiology practitioner assistants will increasingly

accelerate. A cooperative effort between the Department of Workforce Services, the Board of Regents, Community & Economic Development, and other public entities along with key entities from the private health care systems should be undertaken to develop strategies to cope with this accelerating demand for more levels of training and expanded program output.

7. The Utah Division of Occupational and Professional Licensing (DOPL) needs to consider adding codes for the specialists of radiology technology, radiologist assistants, and radiology practitioner assistants to professional licensing numbers. If the codes are made more specific, the state will be able to trace and grasp the numbers of advanced trained radiology professionals.

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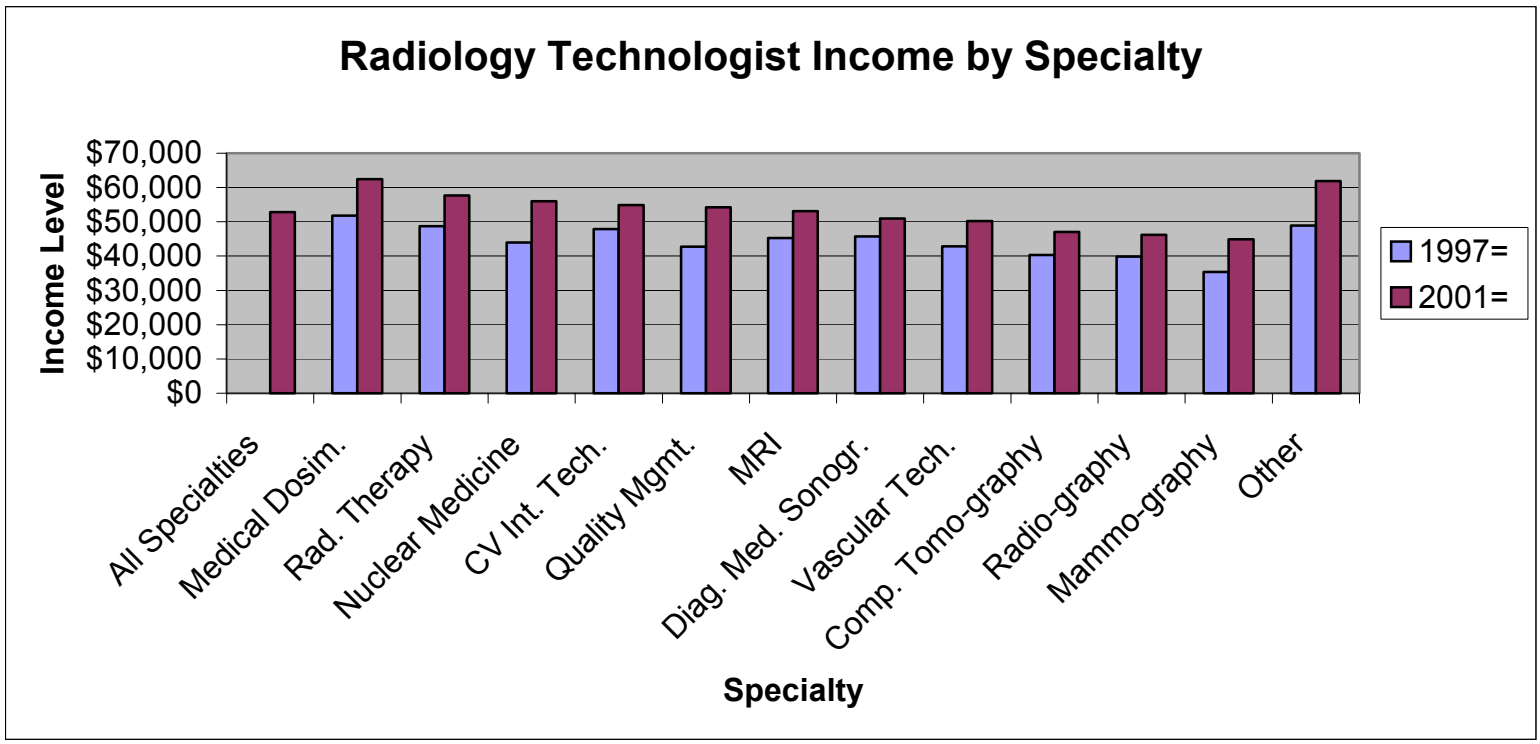
Appendix A

National Average Annual Salary by Specialty by Year Surveyed

	All Specialties	Medical Dosim.	Rad. Therapy	Nuclear Medicine	CV Int. Tech.	Quality Mgmt.	MRI	Diag. Med. Sonogr.	Vascular Tech.	Comp. Tomo-graphy	Radio-graphy	Mammo-graphy	Other
1997=	n/a	$51,780	$48,707	$43,979	$47,899	$42,745	$45,293	$45,703	$42,833	$40,338	$39,850	$35,333	$48,916
2001=	$52,842	$62,442	$57,713	$55,992	$54,872	$54,255	$53,080	$50,927	$50,167	$47,040	$46,159	$44,899	$61,906
% Inc.=	n/a	20.59%	18.49%	27.32%	14.56%	26.93%	17.19%	11.43%	17.12%	16.61%	15.83%	27.07%	26.56%
1997 n=	(n/a)	(32)	(192)	(129)	(57)	(12)	(114)	(92)	(6)	(69)	(385)	(75)	(7)
2001 n=	(1,781)	(101)	(441)	(95)	(81)	(44)	(136)	(52)	(9)	(93)	(416)	(89)	(62)



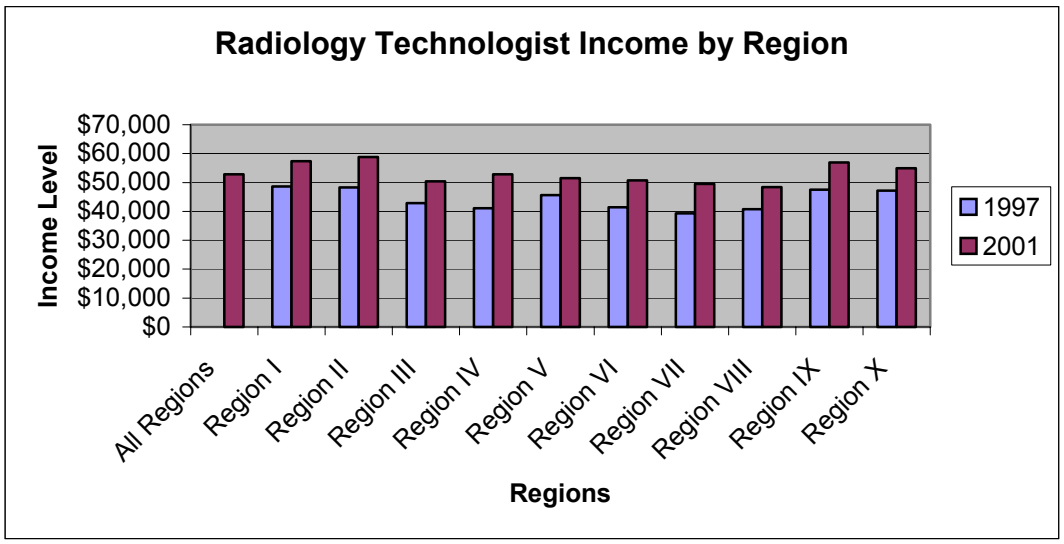
Base: Respondents Answering Work Full-Time (n=varied)
Note: Some Year 1997 Data Not Available

Data is from the November 2001 report by the American Society of Radiologic Technologists.
Data is used with permission by the American Society of Radiologic Technologists.

Appendix B

Average Annual Salary by Region by Year Surveyed

	All Regions	Region I	Region II	Region III	Region IV	Region V	Region VI	Region VII	Region VIII	Region IX	Region X
1997=	n/a	$48,630	$48,295	$42,887	$41,067	$45,582	$41,383	$39,289	$40,787	$47,515	$47,174
2001=	$52,840	$57,405	$58,794	$50,346	$52,788	$51,557	$50,775	$49,460	$48,378	$56,892	$54,889
% Inc.=	n/a	18.04%	21.74%	17.39%	28.54%	13.11%	22.70%	25.89%	18.61%	19.73%	16.35%
1997 n=	(n/a)	(138)	(68)	(131)	(269)	(154)	(149)	(133)	(100)	(74)	(103)
2001 n=	(1,612)	(150)	(119)	(157)	(300)	(206)	(180)	(169)	(102)	(103)	(126)



Base: Respondents Answering Work Full-Time (n=varied)
Note: Some Year 1997 Data Not Available

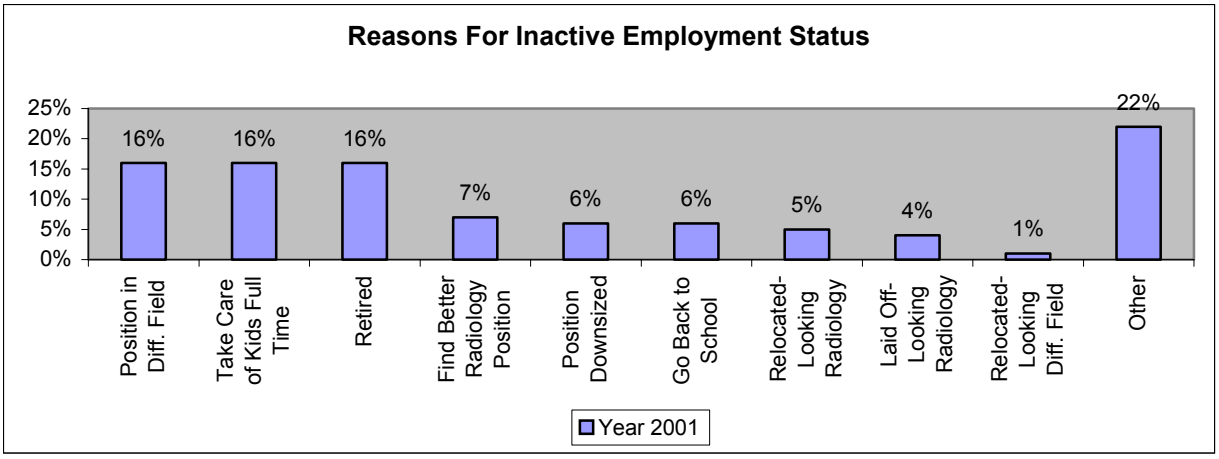
Data is from the November 2001 report by the American Society of Radiologic Technologists.
Data is used with permission by the American Society of Radiologic Technologists.

Region I -- Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
Region II -- New York, New Jersey
Region III -- Pennsylvania, Delaware, District of Columbia, Maryland, Virginia, West Virginia
Region IV -- Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee
Region V -- Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin
Region VI -- Arkansas, Louisiana, New Mexico, Oklahoma, Texas
Region VII -- Iowa, Kansas, Missouri, Nebraska
Region VIII -- Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming
Region IX -- Arizona, California, Nevada
Region X -- Alaska, Hawaii, Idaho, Oregon, Washington

Appendix C

Reasons for Inactive Employment Status

Position in Diff. Field	Take Care of Kids Full Time	Retired	Find Better Radiology Position	Position Downsized	Go Back to School	Relocated-Looking Radiology	Laid Off-Looking Radiology	Relocated-Looking Diff. Field	Other
16%	16%	16%	7%	6%	6%	5%	4%	1%	22%



Data is from the November 2001 report by the American Society of Radiologic Technologists.
Data is used with permission by the American Society of Radiologic Technologists.

Appendix D

Degrees and Programs Offered at Weber State University

			Credit Hour Requirement
A.A.S. Degree			
	Radiography		68
B.S. Degree (or Certification)			
	Advanced Radiologic Sciences		
	Emphasis		
		Advanced Radiologic Sciences (Major and Minor)	30-48
		Bone Densitometry	
		Vascular Interventional Technology	37
		Computed Tomography (CT)	37
		Magnetic Resonance Imaging (MRI)	37
		Computed Tomography/MRI Combination	37
		Mammography	
		Quality Management	
	Nuclear Medicine		29
	Radiation Therapy		37
	Diagnostic Medical Sonography		
	Emphasis		
		Medical	4 Semesters
		Cardiac	4 Semesters
	Radiology Practitioner Assistant		5 Semesters

Tuition for the school year 2003/4, for full-time students

	Utah residents	non-resident
2 Semesters	$2,130	$7,456
Student Fees	$502	$502

Appendix E

Radiologic Sciences Program (Weber State University)

	2 yr-Rad. Tech. (on-campus AAS)			2 yr-Rad. Tech. (outreach AAS)			4 yr-Advanced Radiology (on-campus only)		
	Applicant	Accepted	%	Applicant	Accepted	%	Applicant	Accepted	%
1995-1996	103	28	27%	80	19	24%	57	18	32%
1996-1997	98	25	26%	59	15	25%	40	20	50%
1997-1998	66	30	45%	35	20	57%	36	30	83%
1998-1999	116	38	33%	45	20	44%	64	45	70%
1999-2000	111	35	32%	57	26	46%	109	81	74%
2000-2001	118	45	38%	87	27	31%	99	57	58%
2001-2002	140	45	32%	94	50	53%	89	66	74%
2002-2003	164	45	27%	92	50	54%	183	65	36%
2003-2004	240	51	21%	237	71	30%	78	63	81%

Number of Radiology Technologists who completed the specialized areas

	Advanced Radiography	Diagnostic Medical Sonography	Cardiac Sonography	Nuclear Medicine	Mammography	Cardiovascular-Interventional Technology	Magnetic Resonance Imaging/Computed Tomography (Comb.)	Magnetic Resonance Imaging	Computed Tomography	Radiation Therapy	Radiology Practitioner Assistants	Radiologic Sciences--Totals
1994	0	16	n/a	5	0	n/a	6	n/a	n/a	3	n/a	30
1995	0	13	n/a	10	0	2	3	n/a	n/a	9	n/a	37
1996	0	13	n/a	7	0	0	10	n/a	n/a	12	n/a	42
1997	7	18	n/a	7	1	1	8	n/a	n/a	6	n/a	48
1998	0	29	n/a	7	1	1	5	n/a	n/a	9	5	57
1999	2	24	n/a	10	2	2	19	1	2	11	10	83
2000	1	20	5	7	3	1	12	2	1	11	14	77
2001	2	27	7	14	1	2	10	0	1	32	9	105
2002	1	14	6	18	1	2	9	4	2	29	14	100
2003	3	25	9	20	4	2	3	6	2	55	23	152
			Begun in 1999			Begun in 1994		Split out in 1998	Split out in 1998		Begun in 1997	

The numbers of applicant don't mean that the applicants are pre-approved.

Second-time applicants have advantage to get in the program. (Students must apply for the program every year).

There is a list of students, who are eligible, to fill the vacancy if someone drop out during the first semester.

Appendix F

* This is the status as of this date, August 8, 2003.

Weber State University Dumke College of Health Professions
Department of Radiologic Sciences

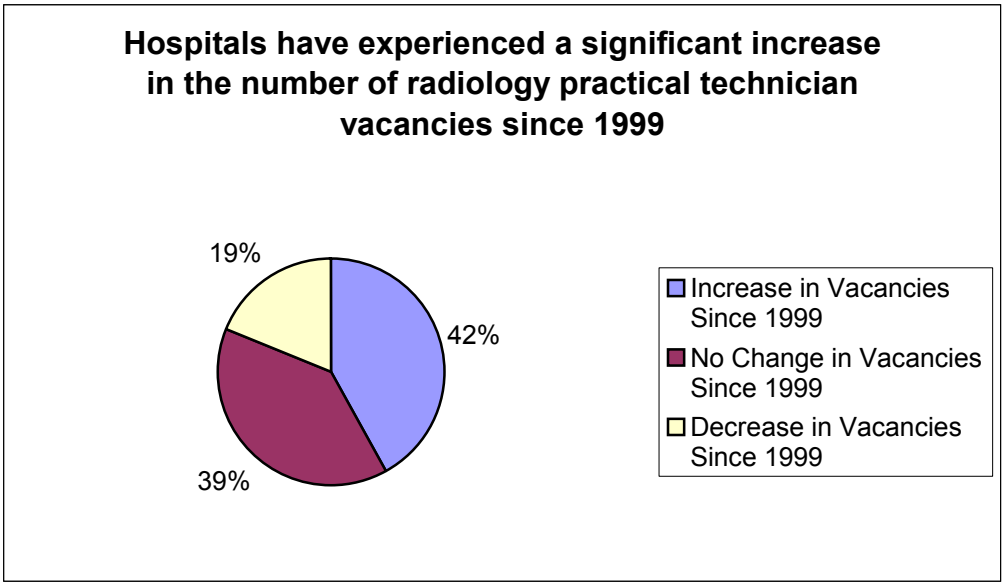
Enrollment - Fall Semester, 2003

First-year Radiologic Technology		129
Campus	47	
Outreach	19	
Wyoming	26	
Four-Corners	18	
Provo	19	
Second-year Radiologic Technology		111
Campus	50	
Outreach	20	
Wyoming	8	
Four-Corners	15	
Provo	18	
Navajo Radiography Program		4
Montana Radiography Program		43
Cardiovascular-Interventional Technology		
Campus		1
Regional		1
Advanced Radiography		
Campus		2
Regional		2
Mammography		3
Quality Management		1
Magnetic Resonance Imaging/Computed Tomography		
Campus/First Year		2
Campus/Second Year		3
Regional/First Year		3
Computed Tomography		
Campus		7
Regional		1
Minor		1
Magnetic Resonance Imaging		
Campus		6
Regional		2
Nuclear Medicine		
Campus		8
Regional		16
Radiation Therapy		
Campus		15
Regional		51
Diagnostic Medical Sonography/Medical Emphasis		
Campus/First Year		16
Campus/Second Year		15
Regional/First Year		13
Regional/Second Year		15
Diagnostic Medical Sonography/Cardiac Emphasis		
Regional/First Year		12
Regional/Second Year		12
Radiology Practitioner Assistant		
Group A/First Year		49
Group B/First Year		47
Second Year		50
Distance Learning		110
Total Student Enrollment/Fall 2003		751

Appendix G

National Data of Radiology Practical Technician Vacancies

Increase in Vacancies Since 1999	42%
No Change in Vacancies Since 1999	39%
Decrease in Vacancies Since 1999	19%



N = 371
P < 0.05

Data is from the fall 2001 report by the First Consulting Group.

Appendix H

Forecast of number of Radiology Technologists of Utah in 2009

	1993	1995	1997	1999	2001	2003	2005	2007	2009	Valid in 2009
Number of Active Radiology Technologists	2032	1961	1841	1737	1595	1419	1211	976	712	712 estimate
Number of Radiology Technologists Who Did Not Renew Their License	39	71	120	104	142	176	208 estimate	235 estimate	264 estimate	

Forecast of number of Radiology Technologist of Utah in 2009
Weber State University

	2003	2004	2005	2006	2007	Total of 2009
2 yr-Rad. Tech. (on-campus)	51	54	57	60	63	285
2 yr-Rad. Tech. (outreach)	71	65	71	77	84	368
4 yr-Rad. Tech. (on-campus)	63	83	89			235
Salt Lake Community College						
2 yr-Rad. Tech.	37	38	40	42	44	201
Total	222	240	257	179	191	1089

On Average 17% Not Renewing After First Full Licensing Period			43/254	30/174	31/184	
On Average 29% Expiring After Five Years	64/222	69/239				
Total Number of Expiration	64	69	43	30	31	237

Total Number of Rad. Tech. from WSU and SLCC in 2009	1089 - 237 = 852	852 estimate

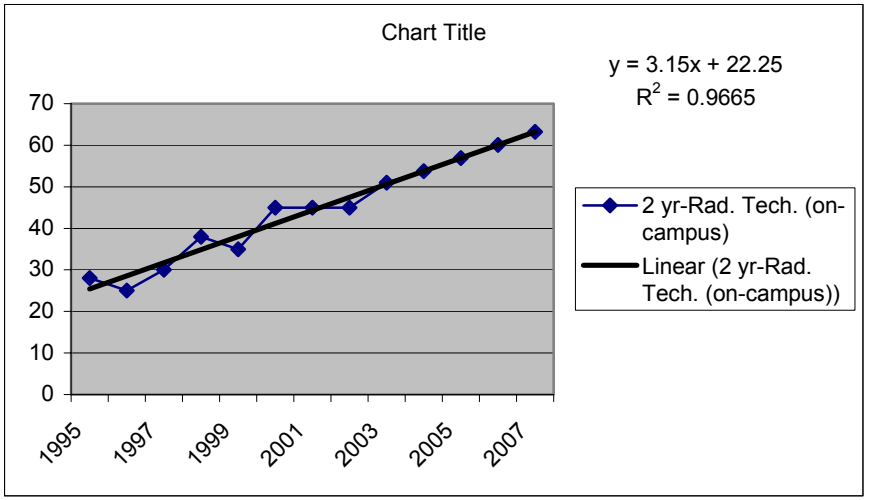
Number of Radiology Technologist in 2009	Total of 2009
712 + 852 = 1564	1564 estimate

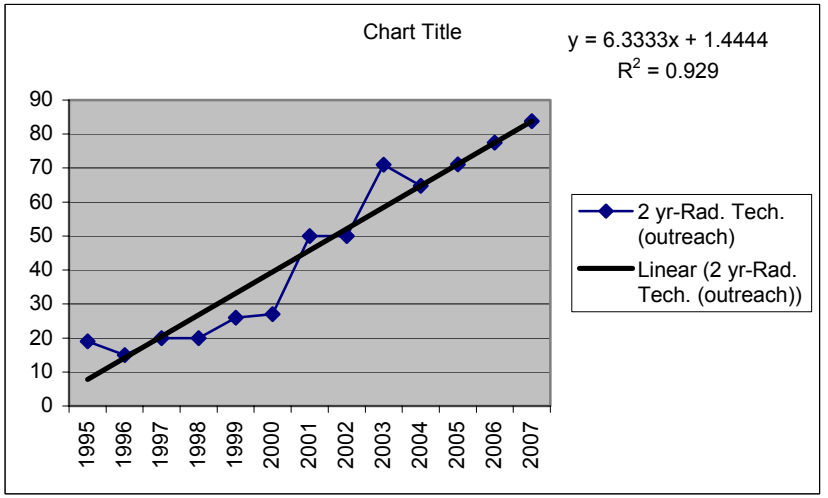
The projected shortage of radiology technologists in 2010 (Table 2) is based on these numbers.

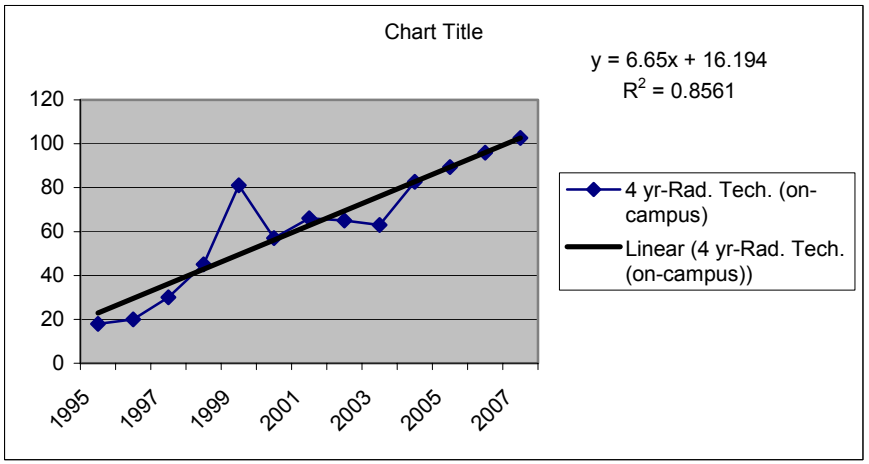
Appendix I

Forecast of WSU's acceptant used for Appendix H

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
2 yr-Rad. Tech. (on-campus)	28	25	30	38	35	45	45	45	51	54	57	60	63
2 yr-Rad. Tech. (outreach)	19	15	20	20	26	27	50	50	71	65	71	77	84
4 yr-Rad. Tech. (on-campus)	18	20	30	45	81	57	66	65	63	83	89	96	103
										estimate			





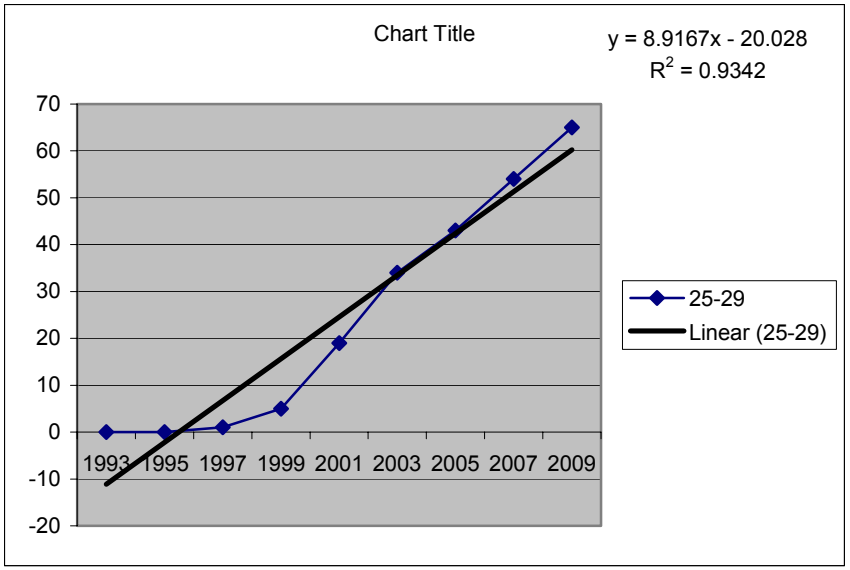


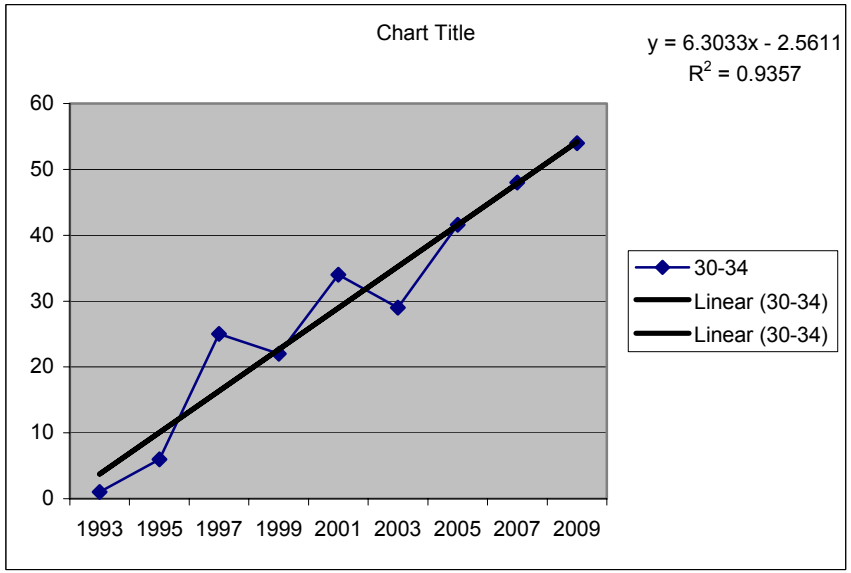
Appendix J

1

Number of Radiology Technologists Who May Not Renew Their Licenses by 2009 Used for Appendix H

	1993	1995	1997	1999	2001	2003	2005	2007	2009	Total
<24	.	.	.	.	.	6	6	6	6	24
25-29	.	.	1	5	19	34	43	54	65	221
30-34	1	6	25	22	34	29	42	48	54	261
35-39	5	18	20	19	25	32	35	39	43	236
40-44	12	18	23	11	18	20	20	20	21	163
45-49	7	13	14	15	14	22	22	24	26	157
50-54	6	5	17	14	13	17	20	22	24	138
55-59	4	2	10	10	8	10	12	13	15	84
60-64	1	3	8	1	5	4	5	5	6	38
65+	3	6	2	7	6	2	4	4	4	38
Total	39	71	120	104	142	176	208 estimate	235 estimate	264 estimate	1359 estimate





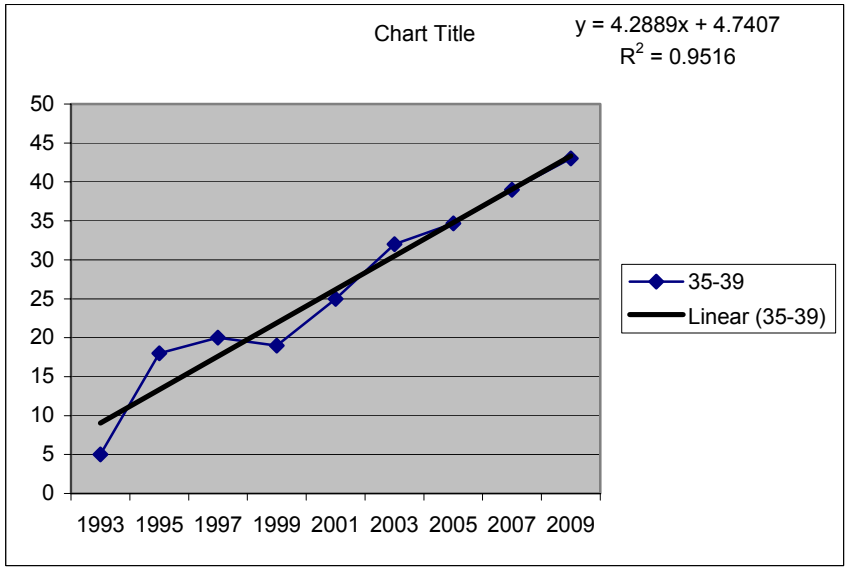


Chart Title
y = 4.2889x + 4.7407
R2 = 0.9516
50
45
40
35
30
25
20
15
10
5
0
1993 1995 1997 1999 2001 2003 2005 2007 2009
35-39
Linear (35-39)

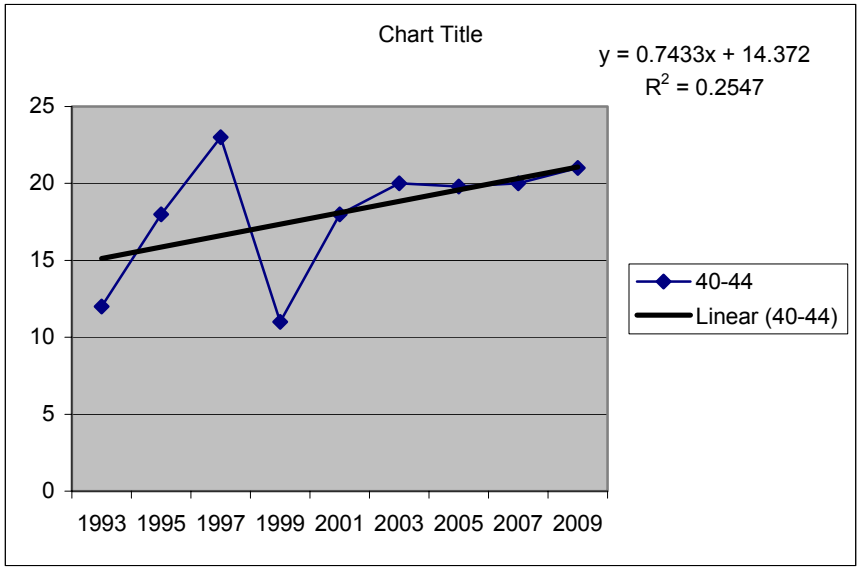


Chart Title
y = 0.7433x + 14.372
R2 = 0.2547
25
20
15
10
5
0
1993 1995 1997 1999 2001 2003 2005 2007 2009
40-44
Linear (40-44)

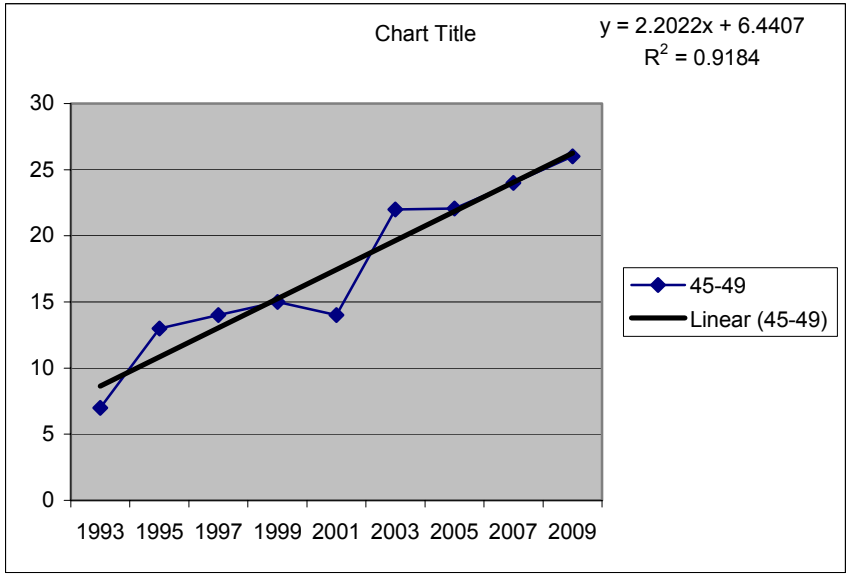


Chart Title
y = 2.2022x + 6.4407
R2 = 0.9184
30
25
20
15
10
5
0
1993 1995 1997 1999 2001 2003 2005 2007 2009
45-49
Linear (45-49)

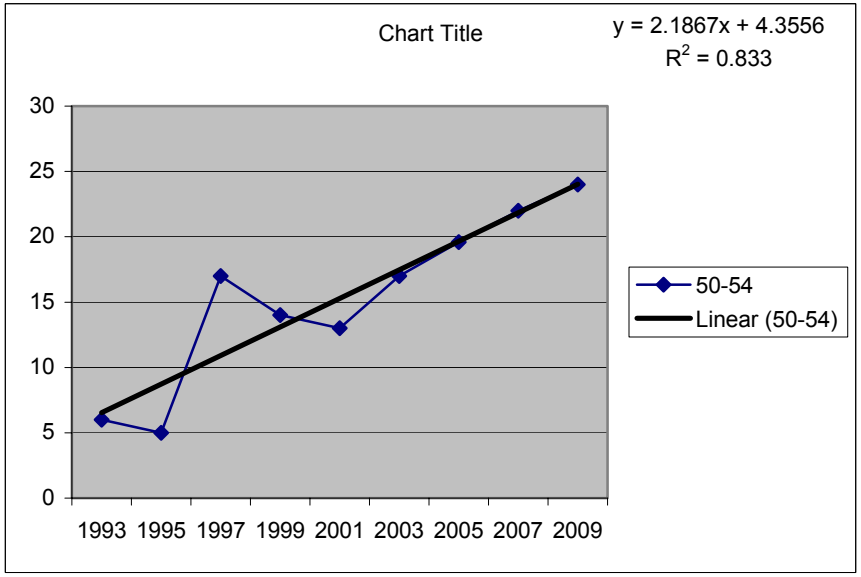


Chart Title
y = 2.1867x + 4.3556
R2 = 0.833
30
25
20
15
10
5
0
1993 1995 1997 1999 2001 2003 2005 2007 2009
50-54
Linear (50-54)

3

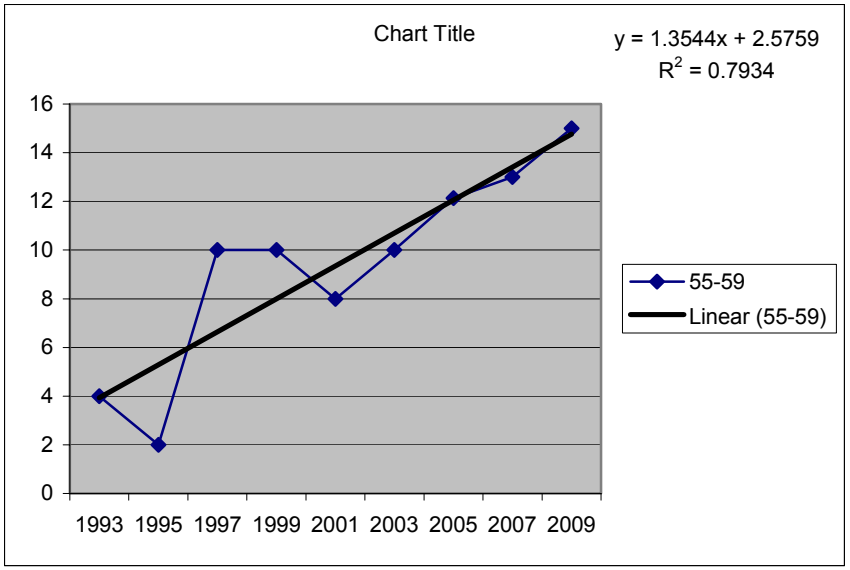


Chart Title
y = 1.3544x + 2.5759
R2 = 0.7934
16
14
12
10
8
6
4
2
0
1993 1995 1997 1999 2001 2003 2005 2007 2009
55-59
Linear (55-59)

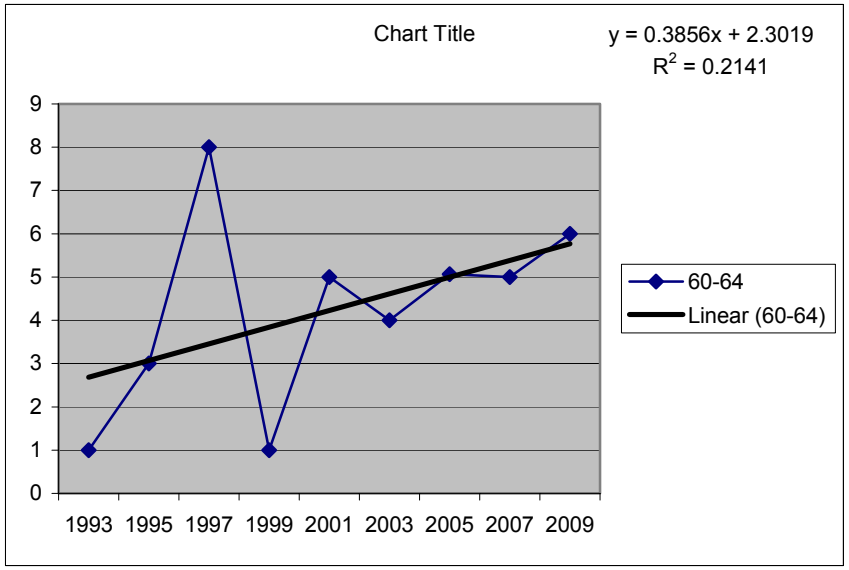


Chart Title
y = 0.3856x + 2.3019
R2 = 0.2141
9
8
7
6
5
4
3
2
1
0
1993 1995 1997 1999 2001 2003 2005 2007 2009
60-64
Linear (60-64)

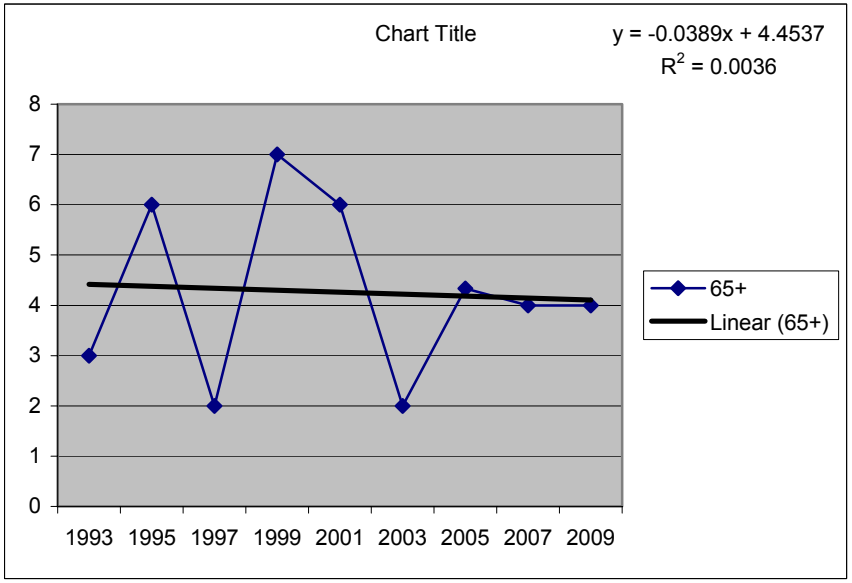


Chart Title
y = -0.0389x + 4.4537
R2 = 0.0036
8
7
6
5
4
3
2
1
0
1993 1995 1997 1999 2001 2003 2005 2007 2009
65+
Linear (65+)

Appendix K

Forecast of SLCC's acceptant used for Appendix H

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
2 yr-Rad. Tech.	25	25	37	33	30	37	38 estimate	40	42	44