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Greater Sacramento Region

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CENTER OF EXCELLENCE
Northern California Region

Los Rios Community College District
1410 Ethan Way
Sacramento, CA 95825
(916) 563-3221
milant@losrios.edu

www.coecc.net

An Initiative of





Mission: The Centers of Excellence, in partnership with business and industry, deliver regional workforce research customized for community college decision making and resource development.

Vision: We aspire to be the premier source of regional economic and workforce information and insight for community colleges.

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Centers of Excellence, Economic and Workforce Development Program

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Despite the economic recession, employers in the Sacramento region may need to hire as many as 350 diagnostic imaging positions over the next three years due to growth and expected retirements.

– Source: Center of Excellence Survey, 2010

Executive Summary

The demand for diagnostic imaging professionals is on the rise. The five factors driving the demand for trained medical professionals in the imaging field include:

- The population is aging and the need for imaging services is growing proportionally.
- The aging population includes an aging workforce and increased retirements of baby-boomer generation workers are expected in the imaging field.
- An explosion of technological developments is resulting in the development of new jobs and specialties.
- The number of people going into imaging professions (as measured by first-time applicants taking certification exams) has declined steadily in the past few years, aggravating the gap between the number of jobs and qualified candidates. There has been a concurrent drop in the number of accredited schools and programs in radiology technology.
- The healthcare industry is somewhat “recession proof” and is not expected to experience significant job losses due to the economy.

Five occupations were selected for inclusion in this study: radiological technologists and technicians, diagnostic medical sonographers, cardiovascular technologists and technicians, nuclear medicine technologists, and radiation therapists. This study also assesses the demand for subspecialty modalities such as CT and mammography.

To supplement secondary research on education, training and licensing requirements, as well as career pathway options, the Northern California Center of Excellence (COE) conducted a survey of 38 healthcare organizations. The survey findings indicate that employers plan to hire about 130 diagnostic imaging workers in the next 12 months and as many as 230 workers in the next three years. In addition, employers may have additional job openings due to high levels of expected retirements.

The majority of employers (60% to 78%) reported difficulty in finding qualified entry-level applicants for three out of the four occupations. Employers reported the greatest difficulty in finding qualified diagnostic medical sonographers with 48 percent reporting great difficulty and 30 percent reporting some difficulty. Subspecialties are also in high demand with a majority (59% to 85%) of employers reporting difficulty finding entry-level applicants with subspecialty expertise.

Given that there is a high demand for applicants with subspecialty expertise, there is a need to expand the existing radiologic technology program to provide subspecialty training such as PET, SPECT, and MRI. In addition, the COE recommends that the community college system continuously monitor the imaging field to assess the demand for new subspecialty modalities and training needs.

Introduction

This research brief is intended to assist community colleges understand the current challenges related to the supply and demand of diagnostic imaging occupations in the Sacramento region.¹ In this report, the Center of Excellence reviews the projected demand for five diagnostic imaging occupations. It includes an overview of trends in healthcare; training, education and licensing requirements; estimated employment, job growth and retirement expectations; career ladders; employer workforce issues and challenges; and local training programs.

Industry Overview

The growing demand for healthcare services and the rapid development of medical imaging equipment and processes are driving occupational change and growth in the medical imaging field, which is commonly known as diagnostic medical imaging. As a discipline, medical imaging can be considered part of a broader imaging science field including other modalities as varied as remote sensing (taking images by aerial reconnaissance) and electronic printing.² The development of imaging devices capable of displaying objects and structures not previously visible has created new challenges with the problems of formation, acquisition, compression, transmission, and analysis of images.³ Two other major developments in the medical imaging field are: the ability to produce three dimensional images instead of the two dimensional “slices” traditionally produced by CT, MRI and ultrasound technologies; and the new digital nature of the field, including electronic storage and transmission of images.⁴

Medical imaging workers use techniques and processes to create images of the human body (or parts of the body) for clinical or medical purposes. The field also encompasses measurement and recording techniques that do not produce images, but instead produce maps containing positional information (i.e. electroencephalography (EEG) and magneto-encephalography). In clinical settings, medical imaging is most often diagnostic. In lab settings, the application and interpretation of medical images becomes an integral part of medical research.⁵

The application of modern technology to the medical imaging field has resulted in highly specialized applications such as: electron microscopy (used in anatomic pathology), fluoroscopy (uses x-rays to produce real-time images of internal structures); magnetic resonance imaging (MRI) which uses magnets to create images, nuclear medicine (using images from gamma cameras to detect regions of biological activity associated with disease); photo acoustic imaging (a hybrid biomedical modality based on the photo acoustic effect); positron emission tomography (PET) which is similar to nuclear medicine using an isotope to measure glucose uptake in tumors, projection radiography (uses barium with x-ray); tomography (including linear tomography, poly tomography, zonography, orthopantomography; and the

¹ The Sacramento Region includes Sacramento, El Dorado, Placer, Sutter, Yolo and Yuba Counties.

² Fowler, Elizabeth M, “Careers: Vast Growth In Imaging Is Forecast,” New York Times, January 8, 1991 found online at <http://query.nytimes.com/gst/fullpage.html?res=9D0CE7DA1538F93BA35752C0A967958260>

³ Siam Conference Theme, May 15-17, 2006, online at <http://www.siam.org/meetings/is06/>

⁴ Hemrick, Wayne, “A Little More on the Rapidly Growing Field of Medical Imaging.” December 2, 2008. EzineArticles.com, found online at <http://ezinearticles.com/?A-little-More-on-the-Rapidly-Growing-Field-of-Medical-Imaging&id=1751275>

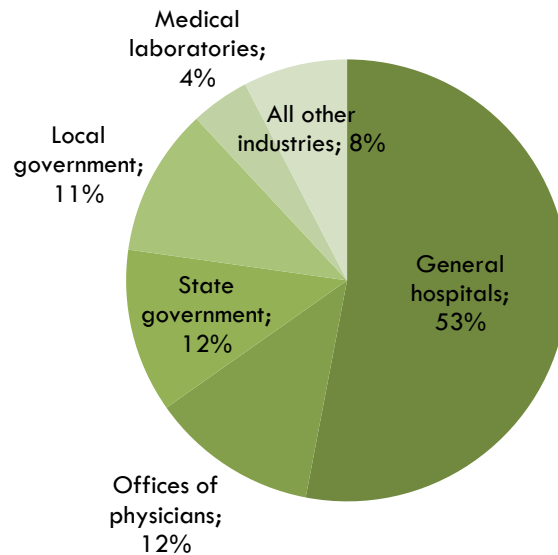
⁵ Wikipedia, “Medical Imaging,” online at http://en.wikipedia.org/wiki/Imaging_studies

most commonly known computed tomography (CT), and ultrasound (using high frequency sound waves).⁶

Employers

More than half of all medical imaging employees in the region work in hospital settings, followed by offices of physicians and state government. In the Sacramento Region, there are several hospitals systems that employ medical imaging workers, including Kaiser Permanente, Sutter Health Sacramento Sierra Region, Catholic Healthcare West, and UC Davis as well as other smaller hospitals, clinics and labs.

Exhibit 1: Medical Imaging Employment by Setting⁷



Industry Demand

Healthcare costs have more than tripled in the last ten years from \$714 billion in 1990 to \$2.5 trillion in 2009. Healthcare spending now accounts for 17.3 percent of the gross domestic product with accelerated growth expected in future years.⁸ Five factors are driving the increased demand for healthcare services as well as the demand for trained medical professionals in the imaging field:

- The population is aging and the need for imaging services is growing proportionally.
- The aging population includes an aging workforce and increased retirements of baby-boomer generation workers are expected in the imaging field.
- An explosion of technological developments is resulting in the development of new jobs and specialties.
- The number of people going into imaging professions (as measured by first-time applicants taking certification exams) has declined steadily in the past few years, aggravating the gap between the number of jobs and qualified candidates. There has

⁶ Ibid

⁷ EMSI Complete Employment - 4th Quarter 2009

⁸ U.S. Department of Human and Health Services, Centers for Medicare and Medicaid Services, <http://www.cms.hhs.gov/NationalHealthExpendData/>

been a concurrent drop in the number of accredited schools and programs in radiology technology.⁹

- The healthcare industry is somewhat “recession proof” and is not expected to experience significant job losses due to the economy.¹⁰

Occupational Overview

Radiography (x-ray), the original form of medical imaging, is divided into *diagnostic* radiography and *therapeutic* radiography (radiation therapy). Radiography or radiologic technology is the largest medical imaging discipline and the entry point to the field.

The five occupations studied in this report were selected from the allied health field because they are the core occupations of the medical imaging field that require an AA-degree or community college certificate-level education for entry. The occupations are: radiological technologists and technicians, diagnostic medical sonographers, cardiovascular technologists and technicians, nuclear medicine technologists, and radiation therapists.¹¹

Table 2 – Medical Imaging Occupations and Sub-Specialties Licensed by the American Registry of Radiologic Technologists (ARRT)

| Occupations | Description | Licensing and Certification Requirements |
|--|---|---|
| Radiologic Technologist <ul style="list-style-type: none"> • Computed Tomography (CT) • Magnetic Resonance Imaging (MRI) • Mammography • Limited License X-ray Technician (<i>this specialty is not licensed by ARRT</i>) | Produce x-ray films (radiographs) of parts of the human body for use in diagnosing medical problems, prepare patients for examinations and position patients so that the parts of the body can be appropriately radiographed. Radiographers position radiographic equipment and set controls on the machine. They also develop film and keep patient records. ¹² | Basic license required as foundation for other medical imaging licenses and/or eligibility to sit for some other certification examinations. Applicants who hold an ARRT certificate for Radiography can automatically apply and receive California licenses in Diagnostic Radiology. Applicants who do not have ARRT certification must provide a copy of a graduation diploma from a Department of Health approved school in diagnostic radiologic technology and sit for the California examination. The California Department of Public Health (CDPH) also approves schools for radiologic technologists. Current standards will be revised in 2011. At this time, schools that have JRCERT accreditation meet the requirement. ¹³ |

⁹ “The Personal Crunch: A Crisis in the Radiologic Technology Workforce,” an iPaper found online at <http://www.scribd.com/doc/3634107/A-Crisis-in-the-Radiologic-Technology-Work-Force>

¹⁰ Altman, Alex, “A Few Bright Spots Amidst Rising Unemployment,” TIME, November 7, 2008, found online at <http://www.time.com/time/business/article/0,8599,1857411,00.html>

¹¹ Bates, Timothy and Chapman, Susan A. , Tracking the Supply of Health Professions Education Programs in California, California,” April 2007, Health Workforce Tracking Collaborative, UCSF Center for the Health Professions, found online at

http://www.cpec.ca.gov/CompleteReports/ExternalDocuments/HWTC_Tracking_the_Supply_4-16-07.pdf

¹² Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2008-09 Edition, Radiologic Technologists and Technicians, on the Internet at <http://www.bls.gov/oco/ocos105.htm>

¹³ California Department of Public Health, Memo regarding Approved California Radiologic Technologist (RA) Schools, August 29, 2007, found online at <http://ww2.cdph.ca.gov/pubsforms/forms/Documents/RadHealth/cdph8200.pdf>

| Occupations | Description | Licensing and Certification Requirements |
|--|--|--|
| Registered Radiologic Assistant | As a radiologist extender in the diagnostic imaging environment, Radiologist Assistants have three major areas of responsibility. First, they take a leading role in patient management and assessment. Second, the radiologist assistant performs selected radiology examinations and procedures under the supervision of a radiologist. And third, the radiologist assistant may be responsible for evaluating image quality, making initial image observations, and forwarding those observations to the supervising radiologist. ¹⁴ | <ol style="list-style-type: none"> 1. Be ARRT certified and registered in radiography; 2. Have one year of acceptable clinical experience; 3. Complete a radiologist assistant educational program recognized by ARRT; 4. Have earned a baccalaureate degree; 5. Be in compliance with the ARRT ethics requirements; 6. Complete didactic coursework addressing the topics listed in the ARRT Content Specifications for the Registered Radiologist Assistant Examination. These topics should be covered as a part of a nationally recognized curriculum such as the one published by the ARRT; 7. Complete the ARRT clinical requirements.¹⁵ |
| Radiation Therapist | Radiation therapists function as part of a team, alongside a physician specializing in radiation oncology and a medical dosimetrist that delivers radiation-based medical treatment. The radiation therapist uses x-rays and computerized tomography to help locate cancerous growths in a patient and project high intensity radiation at targeted cancer cells. ¹⁶ | Radiation therapists are required to have Certification in Therapeutic Radiologic Technology issued by the State of California, Department of Health Services. Applicants who hold an ARRT certificate for Radiation Therapy can automatically apply and receive California licenses in Diagnostic Radiology. ¹⁷ |
| Nuclear Medicine Technologist | Nuclear medicine technologists perform procedures using radiopharmaceuticals and specialized cameras to detect biological changes in the structure or function of human tissues and organs. These both prepare and administer radiopharmaceuticals, which emit signals that are then captured on film and are typically enhanced through digital processing techniques. ¹⁸ | The state of California licenses individuals to use radiopharmaceuticals for therapeutic and medical purposes. To be licensed, individuals must have passed one of three national certification exams or take the California state examination. Completion of an accredited program with clinical experience or detailed documentation of specific clinical experience in numerous procedures is also necessary for licensure. ¹⁹ |

¹⁴ Association of Registered Radiologic Technologists, “Registered Radiologic Assistant Role Delineation, January 2005,” found online at <http://www.arrt.org/radasst/finalraroledelineation.pdf>

¹⁵ Association of Registered Radiologic Technologists, “Checklist for Certification as Radiologic Assistant,” found online at <http://www.arrt.org/radasst/finalraroledelineation.pdf>

¹⁶ Bates, Timothy and Chapman, Susan A. , Tracking the Supply of Health Professions Education Programs in California, California,” April 2007, Health Workforce Tracking Collaborative, UCSF Center for the Health Professions, found online at http://www.cpec.ca.gov/CompleteReports/ExternalDocuments/HWTC_Tracking_the_Supply_4-16-07.pdf

¹⁷ California Department of Public Health, Memo regarding Approved California Radiologic Technologist (RA) Schools, August 29, 2007, found online at <http://ww2.cdph.ca.gov/pubsforms/forms/Documents/RadHealth/cdph8200.pdf>

¹⁸ Bates, Timothy and Chapman, Susan A. , Tracking the Supply of Health Professions Education Programs in California,” April 2007, Health Workforce Tracking Collaborative, UCSF Center for the Health Professions, found online at http://www.cpec.ca.gov/CompleteReports/ExternalDocuments/HWTC_Tracking_the_Supply_4-16-07.pdf

¹⁹ California Department of Public Health, Memo regarding Approved California Radiologic Technologist (RA) Schools, August 29, 2007, found online at <http://ww2.cdph.ca.gov/pubsforms/forms/Documents/RadHealth/cdph8200.pdf>

| Occupations | Description | Licensing and Certification Requirements |
|---|--|---|
| <p>Cardiovascular Technologists and Technicians</p> <ul style="list-style-type: none"> • Invasive Cardiology (Cardiac-Interventional Radiography) • Echocardiography • Vascular-Interventional Radiography | <p>Invasive Cardiology Technicians assist physicians with cardiac catheterization procedures in which a small tube, or catheter, is threaded through a patient's artery from a spot on the patient's groin to the heart. Technologists also may prepare and monitor patients during open-heart surgery and during the insertion of pacemakers and stents that open up blockages in arteries to the heart and major blood vessels.</p> <p>Echocardiography Technologists specialize in noninvasive tests that do not require the insertion of probes or other instruments into the patient's body. This area of practice includes giving electrocardiograms (EKGs) and sonograms of the heart. Cardiovascular technicians who specialize in EKGs, stress testing, and those who perform Holter monitor procedures are known as <i>cardiographic or electrocardiograph (or EKG) technicians</i>.</p> | <p>In California, one year of formal training is required to practice as a cardiovascular technologist or technician.²⁰ Certification is voluntary, though many employers prefer/hire only candidates who are certified by Cardiovascular Credentialing International (CCI) or the American Registry of Diagnostic Medical Sonographers (ARDMS). CCI offers four certifications—Certified Cardiographic Technician (CCT), Registered Cardiac Sonographer (RCS), Registered Vascular Specialist (RVS), and Registered Cardiovascular Invasive Specialist (RCIS). ARDMS offers Registered Diagnostic Cardiac Sonographer (RDCS) and Registered Vascular Technologist (RVT) credentials.²¹</p> |
| <p>Diagnostic Medical Sonography</p> <ul style="list-style-type: none"> • Sonography • Bone Densitometry • Breast Sonography • Vascular Sonography | <p>Diagnostic medical sonographers use special equipment to direct non-ionizing, high frequency sound waves into areas of the patient's body. Sonographers operate the equipment, and direct the patient to move into positions that will provide the best view. Viewing the screen during the scan, sonographers look for subtle visual cues that contrast healthy areas with unhealthy ones. They decide whether the images are satisfactory for diagnostic purposes and select which ones to store and show to the physician.</p> | <p>The State of California does not regulate the field of ultrasound technology. However, most hospitals require that ultrasound technicians become registered through the professional organization, American Registry of Diagnostic Medical Sonographers (ARDMS) or Cardiac Credentialing International of Raleigh North Carolina. To maintain current registration, 30 hours of continuing education every three years is required. Recently, the ARRT also began offering a sonography certification. See http://www.arrt.org/sonpilot/execsummary.pdf.²²</p> |

*See Appendix C for more information about specialized licensing requirements.

New sub-specialties of medical imaging emerge on a regular basis as new equipment and modalities appear. At this time, most of the training on these new procedures and equipment is done by the companies that develop and distribute the equipment. Experienced Radiologic Technicians are usually chosen to participate in this upgraded training. After the training is more established, the community colleges are more likely to incorporate it into their degree or certificate programs, as they have done in the past with MRI, CT scanning, and mammography.

20 Lindler, Vanessa, Woo, Lorraine, and Chapman, Susan , “Diagnostic Medical Imaging Professionals in California, UCSF Center for the Health Professions, 2003, found online at http://www.futurehealth.ucsf.edu/pdf_files/Diagnos_Imaging_Brief2.pdf

21 Bureau of Labor Statistics, U.S. Department of Labor, Occupational Outlook Handbook, 2008-09 Edition, Cardiovascular Technologists and Technicians, on the Internet at <http://www.bls.gov/oco/ocos100.htm>

22 Bates, Timothy and Chapman, Susan A. , Tracking the Supply of Health Professions Education Programs in California,” April 2007, Health Workforce Tracking Collaborative, UCSF Center for the Health Professions, found online at http://www.cpec.ca.gov/CompleteReports/ExternalDocuments/HWTC_Tracking_the_Supply_4-16-07.pdf

Career Ladders

The career ladder for imaging professionals varies from employer to employer. A detailed career ladder can be found in Appendix E. There are three general routes used to provide a career ladder for medical imaging professionals:

Multiple Modalities - In some organizations, a career ladder for the Radiologic Technician is available as sub-specialties are added. A Tech 1 would be trained only as a Radiologic Technologist. If that person becomes certified in Mammography or CT or MRI he/she would become a Tech 2. If certified in three of these modalities, they could become a Tech 3.

Upward Advancement/Radiologic Assistant - To create a true vertical career pathway in radiologic technology rather than one built horizontally on employees training in multiple modalities, new career levels both above and below the current position of registered radiologic technologist are needed. The Radiologic Assistant position was recently created by the American Society of Radiologic Technologists (ASRT), the American College of Radiology and the American Registry of Radiologic Technologists (ARRT) and offers a step up for licensed and experienced Radiologic Technologists. Radiologic Assistants have more autonomy and more responsibility for decision making²³ and will hold a BA or graduate-level certificate when they qualify for their certification.²⁴ ASRT also recognizes a pre-professional level is known as the Radiologic Technology Aide.²⁵

Administrative Opportunities - Experienced Radiologic Technologists also may be promoted to leads, supervisors, chief radiologic technologists, and, ultimately, department administrators or directors. Depending on the institution, courses or a master's degree in business or health administration may be necessary for specific director's level position.²⁶

Projected Workforce Demand

In the spring of 2010, the COE conducted a telephone and online survey with 38 healthcare organizations that hire diagnostic imaging workers in the region. This information was collected to assess the current outlook and hiring challenges of local hospitals, clinics, and labs.

Despite the economic recession, employers in the Sacramento region plan to hire diagnostic imaging positions over the next 12 months and three years. As shown in Table 3, radiologic technologists and technicians is expected to have the most job openings, followed by diagnostic medial sonographers and cardiovascular technologists and technicians. Information on the median hourly earnings for each imaging occupation can be found in Appendix D.

²³ American Society of Radiologic Technologists, "Career Advancement for Radiologic Technologists," found online at https://www.asrt.org/content/recruitmentretention/RetentionTools/Career_Advancement.aspx

²⁴ Association of Registered Radiologic Technologists, "Recognition Criteria for Radiologic Assistant Education Programs," July 1, 2005, found online at <http://www.arrt.org/radasst/pgmrecognitioncriteria.pdf>

²⁵ Mehallow, Cindy, "Radiologist Assistant Career Path Expands Rad Tech Role," found online at <http://career-advice.monster.com/career-planning/healthcare/Radiologist-Assistant-Career-Path-E/home.aspx>

²⁶ AllAlliedHealthSchools.com, "Radiologic Technology Careers," found online at <http://www.allalliedhealthschools.com/faqs/radiographer.php>

Table 3: Medical Imaging Occupations 12-Month and 3-Year Growth Projections²⁷

| SOC Code | Description | 2010 Jobs | 12-Month Projected Growth | 12-Month Projected Growth Rate | 3-Year Projected Growth | 3-Year Projected Growth Rate |
|-------------------|--|--------------|---------------------------|--------------------------------|-------------------------|------------------------------|
| 29-1124 | Radiation therapists ²⁸ | 132 | 7 | 5.3% | 19 | 14.4% |
| 29-2031 | Cardiovascular technologists and technicians | 230 | 15 | 6.5% | 47 | 20.4% |
| 29-2032 | Diagnostic medical sonographers | 248 | 23 | 9.3% | 36 | 14.7% |
| 29-2033 | Nuclear medicine technologists | 124 | 7 | 5.5% | 14 | 11.2% |
| 29-2034 | Radiologic technologists and technicians | 937 | 74 | 7.9% | 90 | 9.6% |
| Total Jobs | | 1,671 | 132 | 7.9% | 228 | 13.6% |

Employers were asked to estimate the number of employees that will be eligible to retire in the next 3 and 5 years. Cardiovascular technologists/technicians and radiological technologists/technicians are expected to have the highest level of retirements over the next five years. This could equate to an additional 138 job openings for these two occupations and about 190 job openings for the four imaging occupations listed below.

Table 4: Eligibility to Retire in the Next 3 and 5 Years²⁹

| SOC Code | Description | Eligible to Retire in Next 3 Years | # of Expected Job Openings in Next 3 Years | Eligible to Retire in Next 5 Years | # of Expected Job Openings in Next 5 Years |
|-------------------|--|------------------------------------|--|------------------------------------|--|
| 29-2031 | Cardiovascular technologists and technicians | 6.7% | 16 | 22.2% | 51 |
| 29-2032 | Diagnostic medical sonographers | 9.0% | 22 | 10.4% | 26 |
| 29-2033 | Nuclear medicine technologists | 10.6% | 13 | 20.0% | 25 |
| 29-2034 | Radiologic technologists and technicians | 7.0% | 66 | 9.3% | 87 |
| Total Jobs | | | 116 | | 189 |

²⁷ Center of Excellence Imaging Occupation Survey, 2010; EMSI Complete Employment - 4th Quarter 2010.

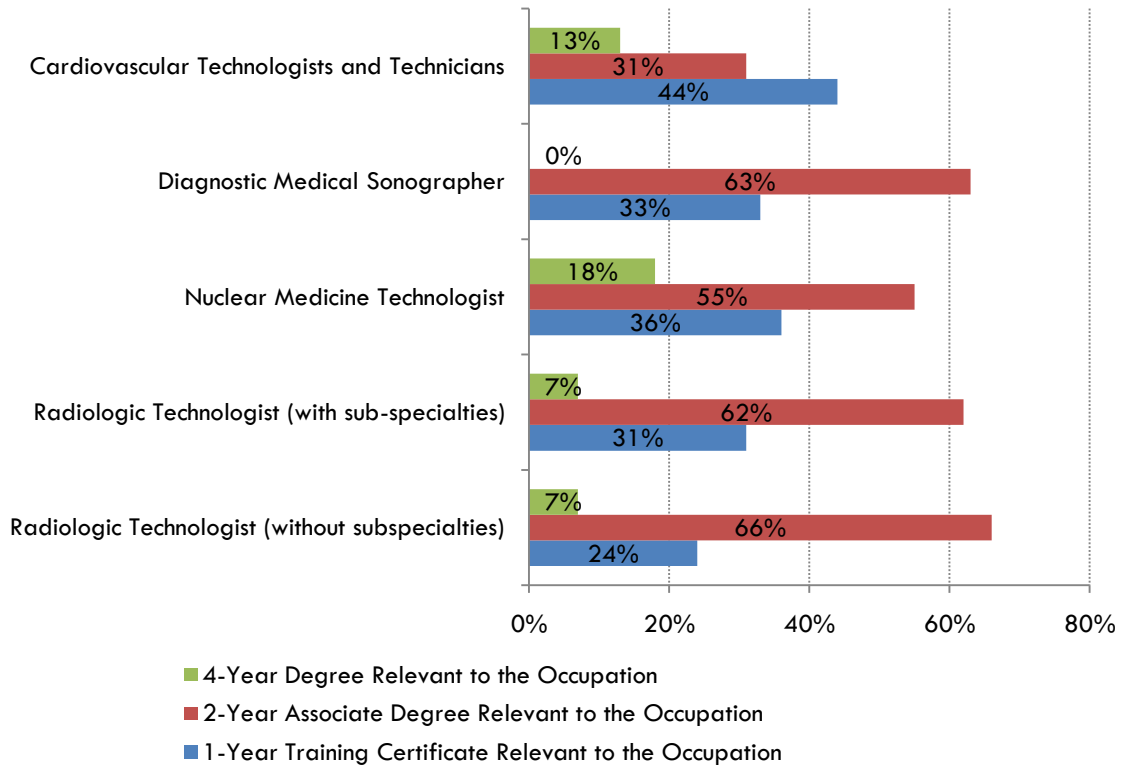
²⁸ Because the survey sample response is fewer than 15 employers for this occupation, the projection data is based on EMSI Complete Employment estimates, 4th Quarter 2010.

²⁹ Center of Excellence Imaging Occupation Survey, 2010. Data for radiation therapists was not included due to a small sample size.

Employer Needs and Challenges

Employers in the Sacramento Region were asked to identify the minimum hiring requirements for successful applicants. As shown in Exhibit 3, the majority of employers require an Associate degree relevant to the occupation for four out the five occupations. Cardiovascular technologists/technicians is the only occupation in which employers indicated a preference for a one-year training certificate relevant to the occupation.

Exhibit 3: Minimum Education Requirements for Successful Applicants³⁰

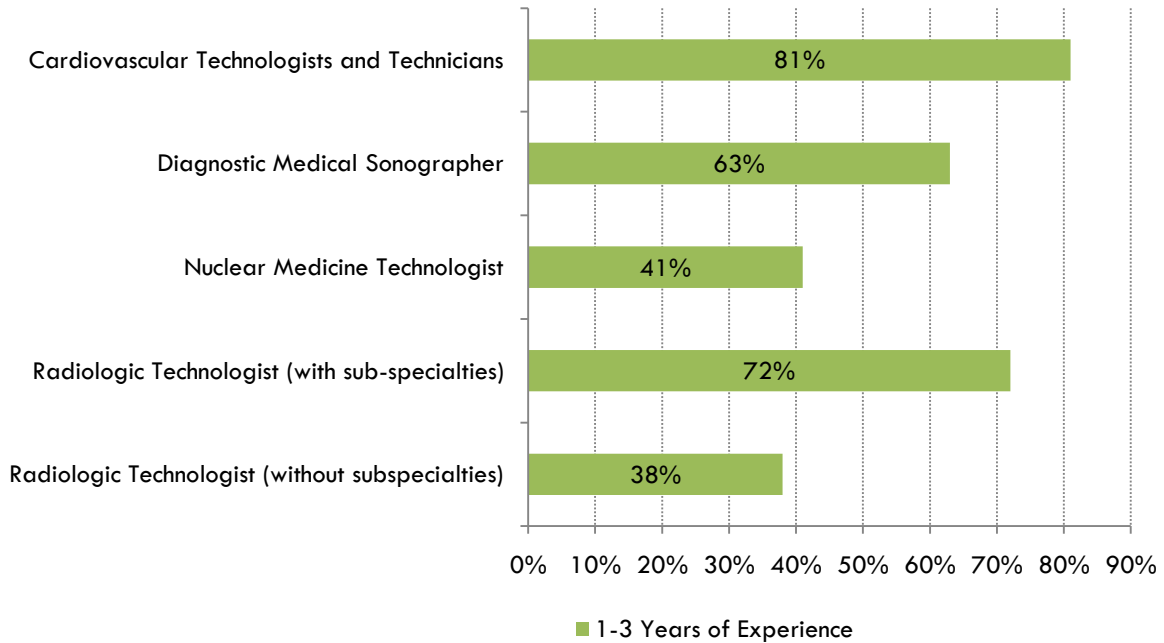


Employers were also asked if they preferred to hire applicants that obtained a degree from a community college, private education institution, or 4-year university. Seventy-one percent (71%) indicated that they had no preference, 13 percent preferred community college programs, eight percent preferred 4-year universities, and only five percent preferred private education institutions. The primary reason cited for not having a preference is that entry level applicants are prepared for the position if they have passed the state licensing requirements. In addition, employers said that they are more likely to screen on personality and work ethic than educational background.

³⁰ Center of Excellence Imaging Occupation Survey, 2010. Survey respondents were given the option to mark multiple education requirements as some occupations require both a formal degree and certificate. Data for radiation therapists was not included due to a small sample size.

Exhibit 4 displays the minimum work experience requirements of successful applicants in the imaging field. With the exception of nuclear medicine technologists and radiological technologists without specialties, the majority of employers require one to three years of work experience. This is likely a reflection of a competitive job market driven by the weak economy. However, as the economy recovers employers may ease their work experience requirements.

Exhibit 4: Minimum Work Experience Requirements for Successful Applicants³¹



As shown in Exhibit 5, the majority of employers (60% to 78%) reported difficulty in finding qualified entry-level applicants for three out of the four occupations. Employers reported the greatest difficulty finding qualified diagnostic medical sonographers with 48 percent reporting great difficulty and 30 percent reporting some difficulty. Seventy percent of employers reported difficulty finding nuclear medicine technologists and 60 percent reported difficulty finding cardiovascular and interventional radiological technologists.

The majority of employers (59% to 85%) are also experiencing difficulty finding entry-level applicants with subspecialty expertise. Employers indicated the greatest difficulty finding qualified applicants with Positron Emission Tomography (PET) and Single Photon Emission Computer Tomography (SPECT).

³¹ Center of Excellence Imaging Occupation Survey, 2010. Data for radiation therapists was not included due to a small sample size.

Exhibit 5: Level of Difficulty Finding Entry-level Applicants that Meet the Organization’s Hiring Standards³²

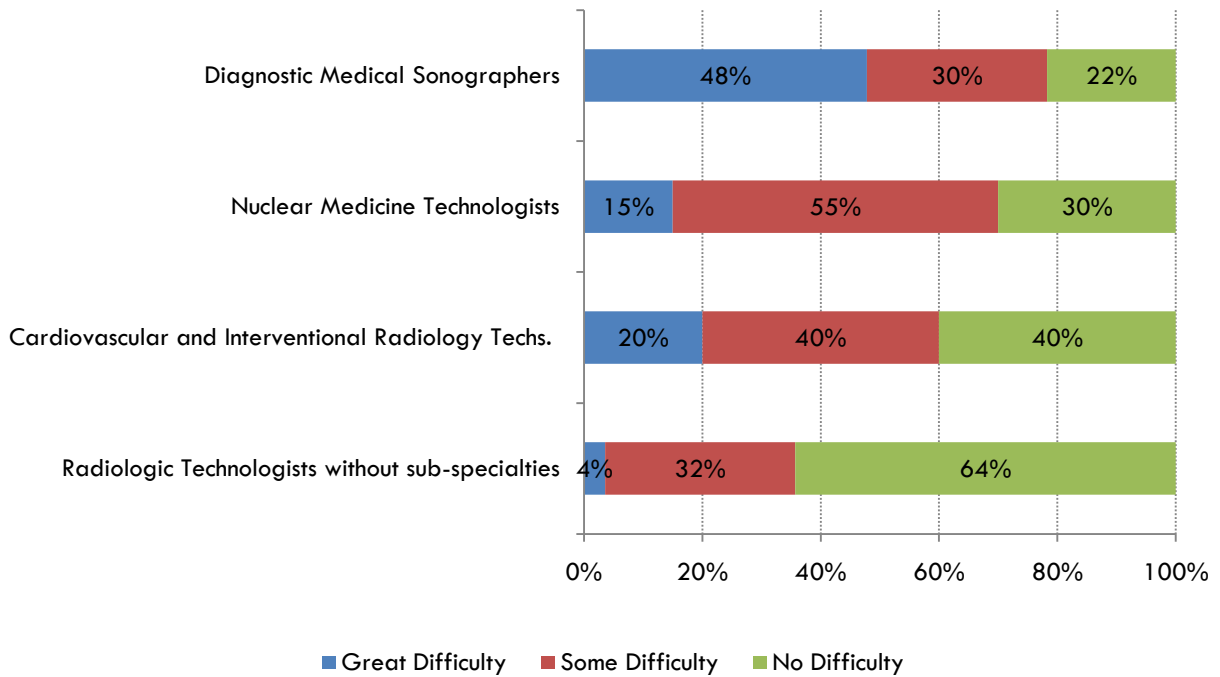
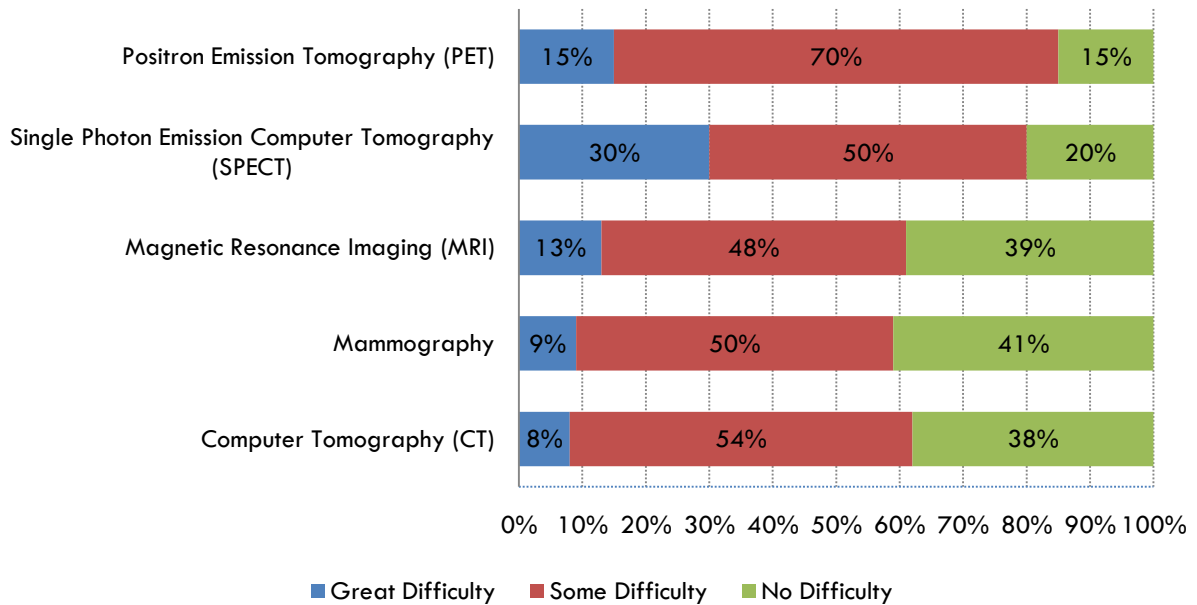


Exhibit 6: Level of Difficulty Finding Entry-level Applicants with Subspecialty Expertise and the Appropriate Licensing Requirements³²



³² Center of Excellence Imaging Occupation Survey, 2010. Data for radiation therapists was not included due to a small sample size.

Regional Training Programs

In the Sacramento Region, there are six training providers that are planning or currently offer digital imaging programs. Yuba College offers a Radiologic Technology program that is accredited by the State of California Department of Public Health, Radiation Health Branch and the Joint Review Committee on Education in Radiologic Technology (JRCERT). Coursework can be completed in Marysville or Sacramento, depending on availability of clinical sites. Cosumnes River College is developing an Ultrasound Technician program with an expected launch date of Fall 2011. Below is a list of training programs available in the region:

Table 5: Digital Imaging Training Providers in the Sacramento Region

| County | Institution | Programs |
|------------|-----------------------------------|---------------------------------------|
| Sacramento | College of Career Training | Diagnostic Medical Sonography |
| | Cosumnes River College | Ultrasound Technician (Planned) |
| | National University ³³ | Radiation Therapy |
| | United Medical Institute | Ultrasound Technologist |
| | United Medical Institute | Vascular Technology |
| | United Medical Institute | Echocardiography Technologist |
| | United Medical Institute | Electrocardiographic (EKG) Technician |
| | Western Career College | Diagnostic Medical Sonography |
| Yuba | Yuba College | Radiologic Technology |

Conclusion and Recommendations

The healthcare industry is considered somewhat “recession proof” and is not expected to experience significant job losses due to the economy. In fact, the imaging field is expected to grow by 13.6 percent, adding 230 new jobs and 115 replacement jobs over the next three years. The majority of these jobs are in radiologic technology (90 new jobs, 65 replacement jobs), followed by cardiovascular technologists and technicians (45 new jobs, 15 replacement jobs). Employers reported some difficulty finding qualified entry-level applicants for all of the occupations, as well as difficulty finding subspecialty modalities. Given the small size of the imaging field, the Center of Excellence recommends the following action steps:

- Expand the existing radiologic technology program to provide in-demand subspecialty training such as PET, SPECT, and MRI.
- Partner with online programs to expand training options in cardiovascular and nuclear medicine technology.
- Identify employers who want to partner to offer student and faculty internships, onsite visits, guest lecturers or other education learning opportunities.
- Raise awareness of medical diagnostic imaging occupations among career counselors to promote as a viable career pathway.
- Continue to monitor the field to assess the demand for new subspecialty modalities and training needs.

³³ National University is currently seeking accreditation for this program by the California Department of Public Health, Radiologic Health Branch and the Joint Review Committee on Education in Radiologic Technology (JRCERT).

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Appendix A: How to Utilize this Report

This report is designed to provide current industry data to:

- Define potential strategic opportunities relative to an industry's emerging trends and workforce needs;
- Influence and inform local college program planning and resource development;
- Promote a future-oriented and market responsive way of thinking among stakeholders; and,
- Assist faculty, Economic Development and CTE administrators, and Community and Contract Education programs in connecting with industry partners.

The information in this report has been validated by employers and also includes a listing of what programs are already being offered by colleges to address those workforce needs. In some instances, the labor market information and industry validation will suggest that colleges might not want to begin or add programs, thereby avoiding needless replication and low enrollments.

About the Centers of Excellence

The Centers of Excellence (COE), in partnership with business and industry, deliver regional workforce research customized for community college decision making and resource development. This information has proven valuable to colleges in beginning, revising, or updating economic development and Career Technical Education (CTE) programs, strengthening grant applications, assisting in the accreditation process, and in supporting strategic planning efforts.

The Centers of Excellence Initiative is funded in part by the Chancellor's Office, California Community Colleges, Economic and Workforce Development Program. The total grant amount (grant number 09-305-017 for \$102,500) represents funding for multiple projects and written reports through the Center of Excellence. The Centers aspire to be the premier source of regional economic and workforce information and insight for California's community colleges.

More information about the Centers of Excellence is available at www.coecc.net.

Important Disclaimer

All representations included in this report have been produced from primary research and/or secondary review of publicly and/or privately available data and/or research reports. Efforts have been made to qualify and validate the accuracy of the data and the reported findings; however, neither the Centers of Excellence, COE host District, nor California Community Colleges Chancellor's Office are responsible for applications or decisions made by recipient community colleges or their representatives based upon components or recommendations contained in this study.

Appendix B: Community Support and Resources

There is an array of resources available for regional colleges to address and monitor the imaging workforce needs of the healthcare community. The following table summarizes the resources and potential partnerships that can be leveraged.

| Organization | Service Area (Type of Organization) | Description of Resources |
|---|--|--|
| UC Davis Medical Center www.ucdmc.ucdavis.edu/radiology | Greater Sacramento (Healthcare & Education Institution) | Training (through partnership with Yuba College) |
| California Society of Radiologic Technologists www.csrt.org | Statewide (Industry Association) | Continuing education, Seminars, Access to Job Opportunities, Scholarships |
| California Department of Public Health www.cdph.ca.gov | Statewide (Government) | Industry laws and regulations, Job opportunities, Licenses & Certifications |
| California Community Colleges healthoccupations.org | Statewide | Job descriptions |
| Society of Diagnostic Medical Sonography www.sdms.org | National (Industry Association) | Access to Employers, Industry Standards |
| UC Davis Cancer Center www.ucdmc.ucdavis.edu | Statewide (Healthcare & Education Institution) | Clinical training (through partnership with Foothill College) |
| Nuclear Medicine Technology Certification Board www.nmtcb.org | National (Industry Regulation) | Certification examinations |
| UC San Diego Extension extension.ucsd.edu | Statewide (Educational Institution) | Education and Clinical Training |
| American Society of Radiologic Technologists www.asrt.org | National (Industry Association) | Access to Employers, Industry Standards, Examination Resources, Continuing Education |
| Society of Nuclear Medicine – Northern California Chapter www.interactive.snm.org | Northern California (Industry Association) | Access to Employers, Industry Standards, Continuing Education, Scholarships/Grants |

Appendix C: Certification and Licensing Requirements

Certifications Offered³⁴

Primary Pathway

- Radiography
- Nuclear Medicine Technology
- Radiation Therapy
- Sonography
- Magnetic Resonance Imaging

Post-Primary Pathway

ARRT offers twelve post-primary certifications. Candidates for post-primary certification must be registered by ARRT in the appropriate supporting discipline to be eligible.

- Cardiovascular-Interventional Radiography (Note: No longer available for new candidates)
- Mammography
- Computed Tomography
- Magnetic Resonance Imaging (Note: Both a primary and post-primary track)
- Quality Management
- Sonography (Note: Both a primary and post-primary track)
- Bone Densitometry
- Vascular Sonography
- Cardiac-Interventional Radiography
- Vascular-Interventional Radiography
- Breast Sonography
- Registered Radiologist Assistant

³⁴ The American Registry of Radiologic Technicians, "Certifications Offered", found online at <http://www.arrt.org/index.html?content=examinations/examlist.htm>

California Licensing Requirements

| CT, PET, SPECT, CT/PET or CT/SPECT procedure | Certification required |
|--|---|
| CT Scan (single mode machine) | CRT or student in an RHB-approved RT School per Health and Safety Code §106975(b). |
| PET Scan (single mode machine) | CTNM or student per 17 CCR 30540. |
| CT Scan (dual mode machine) | <ol style="list-style-type: none"> 1. CRT (supervision by S&O holder), or 2. CTNM with ARRT CT certificate (Performance by the CTNM must be under supervision of an authorized user specified on a radioactive material (RAM) medical license.) or 3. A student in an RHB-approved RT School per Health and Safety Code §106975(b). This student can be a CTNM. |
| PET Scan (dual mode machine) | <ol style="list-style-type: none"> 1. CTNM, or 2. CRT with NMTCB PET certificate, or 3. A student per 17 CCR 30540. <p>Performance must be under supervision of an authorized user specified on a RAM medical license.</p> |
| CT/PET scan (dual mode machine) | <ol style="list-style-type: none"> 1. CTNM with ARRT CT certificate, 2. CRT with NMTCB PET certificate, or 3. A Student in both an approved RT school AND NMT program (e.g. an individual enrolled simultaneously in an RT school and an NMT program). <p>Performance by either CRT or CTNM may only be under supervision of an authorized user specified on a RAM medical license.</p> <p>RSA-00-1 rescinded effective December 31, 2007.</p> |
| SPECT (single mode machine) | <ol style="list-style-type: none"> 1. CTNM, or 2. A student per 17 CCR 30540. <p>Performance may only be under supervision of an authorized user specified on a RAM medical license.</p> |
| CT/SPECT (dual mode machine) | <ol style="list-style-type: none"> 1. CTNM with ARRT CT certificate (Performance may only be under supervision of an authorized user specified on a RAM medical license), or 2. A Student in both an approved RT school AND NMT program (e.g. an individual enrolled simultaneously in an RT school and an NMT program). Supervisor of student must be authorized user specified on a RAM medical license who also possesses either an X-ray “Radiology Supervisor and Operator Certificate” or “Radiography Supervisor and Operator Permit.” <p>(NOTE: CRTs are not authorized for SPECT in any capacity unless dually certified as a CTNM.)</p> |

Source: California Department of Health Services³⁵

³⁵ State of California, Department of Health Services, Operator Certification Requirements, June 18, 2007, found online at <http://www.cdph.ca.gov/certlic/radquip/Documents/RHB-HT-CT-PET-AB2720.pdf>

Appendix D: Imaging Occupation Median Hourly Earnings³⁶

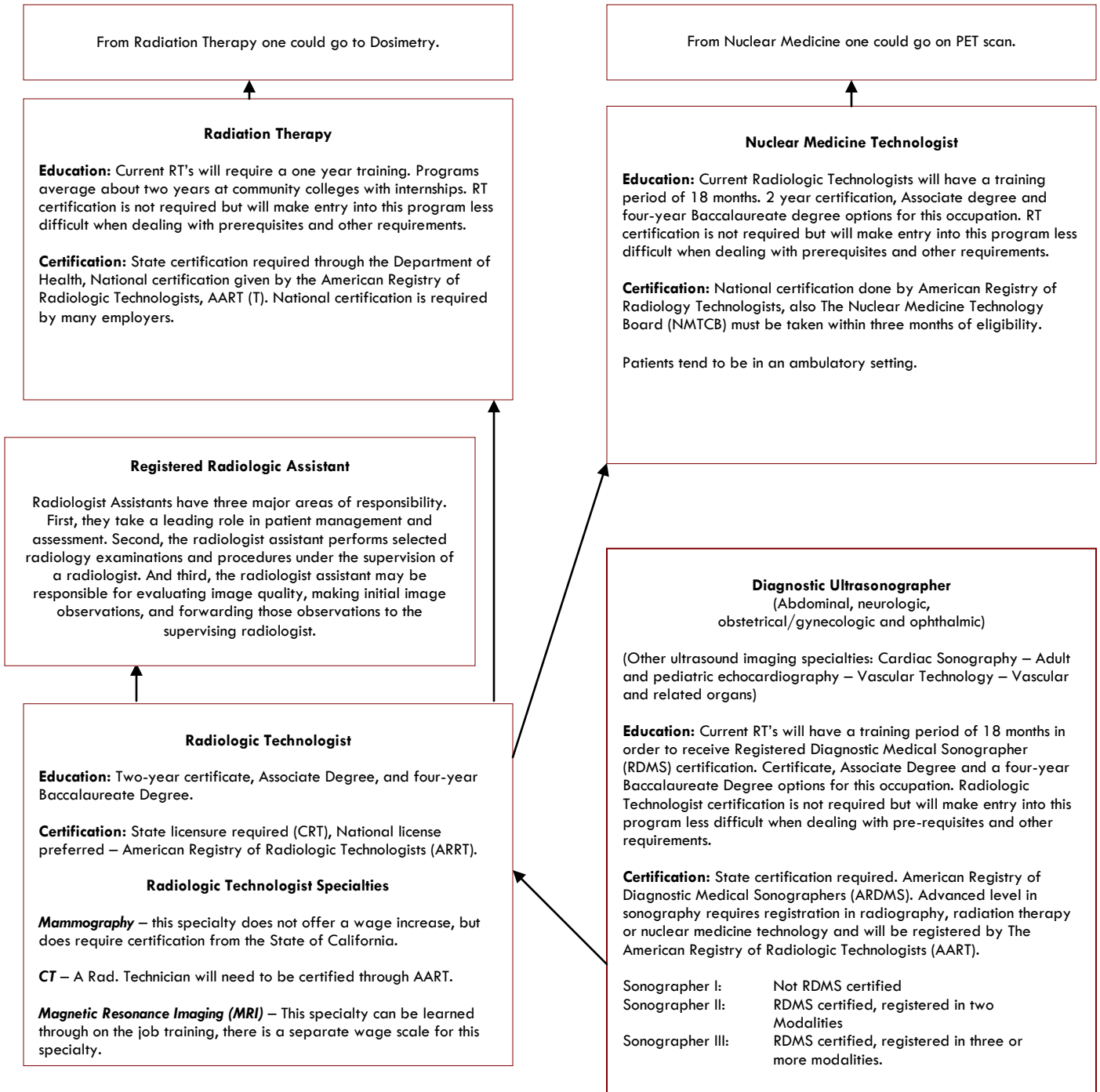
| Occupation | Entry Level | (New Hires) Experienced |
|---|--------------------|--------------------------------|
| Cardiovascular and Interventional Radiology Technologists and Technicians | \$34.30 | \$39.17 |
| Diagnostic Medical Sonographers | \$32.30 | \$36.62 |
| Nuclear Medicine Technologists | \$37.26 | \$42.61 |
| Radiation Therapists | \$32.00 | \$47.00 |
| Radiologic Technologists with sub-specialties, such as CT, MRI, Mammography, & PET, SPECT | \$31.00 | \$35.63 |
| Radiologic Technologists without sub-specialties | \$30.00 | \$33.00 |

Notes:

- Entry Level– new hires with less than 1 year of experience
- Experienced– new hires with 3 years of experience
- Benefits are not included in the estimate

³⁶ Center of Excellence Imaging Occupation Survey, 2010.

Appendix E: Career Ladder³⁷



³⁷ Adapted from: Shirley Ware Educational Center, "The Career Mapping Project," December, 2002, found online at <http://74.125.47.132/search?q=cache:!URtZPuevUJ:www.seiu-uhw.org/documents/swec/CareerLadderMappingProject.pdf+career+ladder+mapping&hl=en&ct=clnk&cd=1&gl=us>, page 26.