2012

Labor Market Information Updates

Medical Imaging Occupations

The Boston Healthcare Careers Consortium regularly gathers labor market data from participating institutions and compiles occupational briefs. These reports are meant to provide a real-time snapshot of supply, demand, and anticipated needs.

Workforce Initiatives
Boston Private Industry Council, Inc
1/27/2012

Massachusetts Industry-Occupation Employment Projections 2008-2018

Industry	2008 Employment	2008 Employment Percent Distribution	Projected 2018 Employment	Projected 2018 Employment Percent Distribution	Change 2008-2018 Number	Change 2008-2018 Percent
Radiologic Technologists and Technicians						
Total employment, all workers	6,290	100%	6,940	100%	650	10.3
Hospitals	4,470	71%	4,880	70.4%	410	9.3
Offices of Physicians	870	13.8%	990	14.2%	120	13.7
Medical and Diagnostic Laboratories	560	8.9%	640	9.3%	80	14.6
Federal Government, Excluding Post Office	70	1.1%	70	1%	0	1.5
Nuclear Medicine Technologists						
Total employment, all workers	450	100%	490	100%	40	10
Hospitals	380	85.5%	420	84.6%	40	8.9
Diagnostic Medical Sonographers						
Total employment, all workers	1,030	100%	1,130	100%	100	10.5
Hospitals	830	81%	910	80%	80	9.1
Offices of Physicians	90	8.9%	100	9.1%	10	13.2
Cardiovascular Technologists and Technicians						
Total employment, all workers	1,260	100%	1,520	100%	260	20.4
Hospitals	1,070	85.2%	1,290	85%	220	20.1
Offices of Physicians	110	8.6%	140	8.9%	30	25

2010 Massachusetts Occupational Employment and Wage Statistics

Occupation Title	Median	Mean	Entry	Experienced
Radiologic Technologists and Technicians	$71,510	$78,920	$51,060	$92,860
Nuclear Medicine Technologists	$74,930	$73,020	$55,870	$81,590
Diagnostic Medical Sonographers	$79,990	$80,000	$63,290	$88,360
Cardiovascular Technologists and Technicians	$65,420	$66,900	$39,540	$80,590

Source: ***Massachusetts Department of Labor & Workforce Development Labor Market Information Publication***

Data from Boston Healthcare Careers Consortium Members

Demand Data from Employer*

Date responded: November 1, 2011

	Census by age				Vacancies	Testing Volume
	Under 45	**45-56**	**57-65**	**66 +**		
DX Diagnostic Radiography (X-ray) *12 institutions reporting*	341	142	60	11	13	Stable @ 7 institutions Increasing @3 institutions Declining @ 2 institutions
Mammography *9 institutions reporting*	52	88	61	5	5	Stable @ 3 institutions Increasing @3 institutions Declining @ 4 institutions* *One institution reported a slight decline most noticeably in diagnostic mammography-insurance issue
MRI Magnetic Resonance Imaging *9 institutions reporting*	138	91	35	0	17	Stable @ 4 institutions Increasing @3 institutions Declining @ 2 institutions
IR Interventional Radiology *7 institutions reporting*	55	16	12	0	7	Stable @ 1 institutions Increasing @4 institutions Declining @ 2 institutions
Bone Density *6 institutions reporting*	6	6	1	0	0	Stable @ 2 institutions Declining @ 3 institutions *At one institution in Dept. of Medicine* *At two institutions Diagnostic Techs perform exams*

Demand Data from Employers

	Census by age				Vacancies	Testing Volume
	Under 45	**45-56**	**57-65**	**66 +**		
Nuclear Medicine/PET *9 institutions reporting*	71	25	10	0	3	Stable @ 2 institutions Declining @ 6 institutions Decline in Nuclear @ 1 Increase in PET @ 1
Cardiac Echocardiography **Cardiac Sonography** *3 institutions reporting*	40	23	12	2	6	Stable @ 2 institutions *At one institution in CVI not Radiology*
CT *9 institutions reporting*	138	96	45	4	11	Stable @ 2 institutions Increasing @ 1 institutions Declining @ 6 institutions

*Institutions include teaching hospitals, regional hospitals, and community health centers.

In light of healthcare reform and cost controls, are you seeing a decrease in demand for services? Which ones? To what do you attribute this change? Are you changing your hiring practices as a result?

- There has been a decrease in demand for high end services (e.g. MRI, CT) as higher co-pays and increased deductibles (especially for specific imaging) are more common, and pressures on referring MDs to reduce imaging mount. Concern about radiation dose may also be driving reduction in CT volume.
- We expect no volume changes, up or down for the next 4-5 years. It will take that long for any significant changes to occur in imaging volume trends.
- Volume has shown a decrease in PET/CT scans. We are not sure what to attribute it to. It could be insurance related, as we are seeing more request for prior authorizations. All other modalities have been stable or increasing in volume.
- Decrease in demand for CT services; expect flat growth in Bone Density and flat volume in Nuclear Medicine/PET. The ordering of tests may be influenced by medical necessity and increases in co-pays.
- In the future anticipate growth in ultrasound hiring opportunities

- We are stable in bone density and ultrasound. We are seeing an increase in x-ray, mostly because of expanding hours (now 24/7). Mammography continues to increase over the last year, perhaps due to increased awareness, perhaps again due to available expanded (weekend) hours.
- There has been some drop in the high-end imaging volume due to Pay for Performance pressures and increased deductibles. We have actually reduced technical staff over the past 24 months.
- There are many factors that impact diagnostic imaging services. These include economic conditions, unemployment, healthcare benefits (co-payment, deductibles, tiered payments, etc.), radiation dose knowledge and cost to benefit ratio. I think it safe to say that we are experiencing a decline in some of the high-tech (CT, Nuc Med, MRI) services due to the reasons mentioned. It's anyone's guess though with the population getting older, utilization of diagnostic imaging will likely increase over the next decade. For Interventional Radiology, volume has been constant and ticking up slightly. The advancement of ablative technologies will help expand interventional offerings for less invasive therapeutic procedures over surgery. These minimally invasive procedures bring together the best for patient services along with better cost-benefit for the entire system. For now, we are concentrating efforts on reducing cost. This will undoubtedly have short term impact on the numbers of employees.

Does your facility anticipate growth in any testing areas – opening new facilities, new programs? What is the staffing plan? Will current staff be transferred or do you anticipate hiring new employees?

- We have no approved changes in service line, no new facilities. The staffing plan is based on volume needs, no changes expected. We encourage our staff to train in multiple modalities to ensure depth in modalities. It is also an ideal growth path for techs.
- There is very low turnover in medical imaging. Open positions are usually filled by per diems on staff.
- We currently have a cross training program in place to provide Diagnostic Radiology Techs a chance for advancement. We have an excellent community college partnership that provides us with the Diagnostic Radiology Techs that we need.
- I do not anticipate additional employees, but rather consolidation. For example, we are consolidating breast MRI and MRI into one staff on one magnet, instead of duplication of services and staff, because we have the capacity to do so.
- Increasing volume in Interventional Radiology and MRI

Data from Boston Healthcare Careers Consortium Members

Supply Data from Educators

	Existing Programs				
	2011-2012 Enrollment vs Capacity Numbers		2011 Graduation Numbers		**Pass Rates** on required licensure, certificate, and national registry exams post grad as applicable
	Certificate	Degree	Certificate	Degree	
DX Diagnostic Radiography (Xray)					
2 institutions reporting		52 enrolled out of a capacity of 75		40 out of 52 enrollees attained a degree	2011 grads: 92% to-date including full- and part-time programs. Mandatory for employment. 87% 2010 (Do not have complete results for 2011)
Mammography					
1 institution reporting	7 enrollees at one community college		6 out of 7 enrollees attained a certificate (1 left program for financial reasons)		2011 Grads: 100% pass rate based on 4 students who have taken the ARRT Advanced Mammography Certification Exam. Historically, all graduates who have taken the exam have passed. (100% pass rate).
MRI Magnetic Resonance Imaging					
2 institutions reporting	34 enrollees at two community colleges		34 out of 34 enrollees attained a certificate		2011 Grads: Only 1 student has taken the ARRT Advanced MRI Certification Exam to-date. (passed) Historically, all students who have graduated and have taken the test have passed.

Supply Data from Educators

CT **Computed Tomography**					
2 institutions reporting	35 enrollees at two community colleges		35 out of 35 enrollees attained a certificate		2011 Grads: Only one of six recent graduates has taken the ARRT Certification Exam. That student passed the exam. Historically, all CT graduates who have taken the exam have passed.
IR **Interventional Radiology**					
Bone Density					
Nuclear Medicine/PET **Positron Emission Tomography**					

How are current graduates doing in the job market after graduation? How long is it taking graduates to find employment upon completion of programs? Are they finding jobs in their fields?

- Of 17 full-time radiography graduates, 16 or 94% are currently working in the field. Five students got full-time positions and the remainder either part-time or per diem positions in radiography. Not every student was seeking full-time employment. The majority of the graduates had positions prior to graduation, or within one month of graduation. The class was exceptional.

- Data is not yet available for the part-time graduates, who only graduated in August. Most have not yet taken the ARRT Certification Exam, which is mandatory in this field. It is expected that they will have a more difficult time procuring positions because they finished their program later than most other radiography students. The market seems to have tightened up since early summer.

Supply Data from Educators

What kind of resource challenges do you face – availability of internships, equipment, qualified instructors, etc?

Medical Radiography: Availability of internships is the most significant challenge at this time. Many of the hospitals have been hosting programs from out-of-state, as well as a host of relatively new proprietary programs. This is impacting the number of slots for community college students. Additionally, as the job market has tightened, we have reduced the number of students accepted each of the last three years, at the request of our clinical affiliates.

Advanced Certificate Programs: Availability of internships has been the major issue with the Advanced Online Certificate Programs for Computed Tomography, Mammography and MRI. Many sites will only host employees if there is a known need in the particular modality. If a registered technologist works in a facility, for example, that does not have CT or MRI, and they wish to further their education in one of these modalities, it is almost impossible to find a clinical site in the Boston area.

The clinical internship required for all three advanced certificate programs is 100 hours. These programs were developed through collaboration with Partner's Healthcare, and the 100 hour clinical internship was specifically limited so that the student was given the opportunity to practice skills learned in didactic classes, begin working on their ARRT procedural requirements, and attain some basic competence. For **CT and MRI, in particular, it may take significantly longer for the student to finish the ARRT procedural requirements.** If the site recognizes potential in the student, and considers them for future employment, they may voluntarily offer extended time so that the student may complete all ARRT requirements for advanced certification. The host site is not obligated to do so. This was specifically agreed upon when the programs were designed so that Partners' and other host sites, in the event that a student failed to progress or was not a good fit for a given modality, could end the relationship at the 100 hour point.

Certification Exam Testing: Many facilities do not require CT or MRI certification at this time. Additionally, many students have economic issues and cannot justify spending the money to take the test at this time, particularly when it is not mandatory to have the certification. Students should ideally review all material, utilize the free Registry Review Seminar provided by the college in the summer following program completion, and then take the ARRT Advanced Certification Exam. However, due to economic constraints, many students are postponing examination.

Advertising: National Advertising (Hard copy or Online) has not been available to-date for our Advanced Certificate Programs. We have marketed only to local area professionals and institutions for the last three years. We have been promised funding from administration for

online advertising and are in the process of working with the college's web master, and expect to be marketing to a national audience for the next offerings of these programs.

MRI Instructors: It has been difficult to find and keep qualified MRI instructors. We have had three to-date, and are currently seeking one more instructor for the Spring 2012 semester. We do have two qualified candidates at this time.

NOTE: Currently it is not mandatory that applicants for the advanced standing certification have organized didactic classes. However, this is going to change in the near future, and our programs are positioned perfectly to meet the mandated didactic requirements.

In summary, we need:

- More Full- and part-time clinical slots for student internships in Medical Radiography.
- More clinical support for the Online Mammography, Computed Tomography and MRI Certificate Programs.
- National advertising, both hard copy and Web.
- Long-term commitment from our instructors, particularly in MRI.

Medical Imaging Career Pathways

Start here: Primary Pathways are the foundation to the medical imaging career ladder. Once you have attained credentials in a primary occupation, you can attain more credentials to move up the career ladder into a specialized post-primary occupation. For those with no professional experience in healthcare, two year Associate Degrees are the most common form of education. There are some certificate programs for healthcare professionals seeking to specialize in medical imaging. Four year Bachelors Degrees are also available. All of these occupations require certification by the national registry boards the American Registry of Radiologic Technologists (ARRT) or the American Registry for Diagnostic Medical Sonography (ARDMS).

NUCLEAR MEDICINE
Nuclear medicine technologists utilize radioactivity to diagnose and treat disease.

DIAGNOSTIC MEDICAL RADIOGRAPHY
Radiologic technologists, also known as radiographers create images of the inside of the body that are used to diagnose medical problems.

DIAGNOSTIC MEDICAL SONOGRAPHY
Medical Sonographers utilize ultrasound equipment to obtain an image and provide physicians with diagnostic information for treatment.

CARDIAC SONOGRAPHY
Cardiac Sonography, or Echocardiography, is a medical profession of Sonographers that specialize in the anatomy and function of the heart.

Next Step: Post-primary pathways are specialized occupations which generally require you to be registered in one of the primary occupations, such as Radiologic Technology, as a pre-requisite. One can attain post-primary credentials through on the job training or an advanced certificate program. The ARRT or the ARDMS provide registry for the following post-primary fields.

COMPUTED TOMOGRAPHY (CT)
Technologists utilize CT scanners to produce cross-section images of patients' internal organs and tissues for the diagnosis of medical issues.

BONE DENSITOMETRY
Technologist's utilize a special type of x-ray equipment to measure bone mineral density and content. The ISCD provides certification.

MRI TECHNOLOGY
MRI technologists use magnetic resonance imaging (MRI) to take pictures of the interior of the body that are used by physicians to diagnose and treat medial problems.

CARDIAC/VASCULAR SONOGRAPHY
Cardiac or Vascular Sonography is a medical profession of Sonographers that specialize in the anatomy and function of the heart and blood vessels.

MAMOGRAPHY:
The mammographer is a registered radiologic technologist who produces radiographic images of the breast that are to diagnose and treat medical problems.

CARDIAC/VASCULAR INTERVENTIONAL RADIOLOGY (IR)
IR Technologists assist Interventional Radiologists (MDs) in the performance of minimally invasive treatments, using radiologic imaging for guiding the procedure.

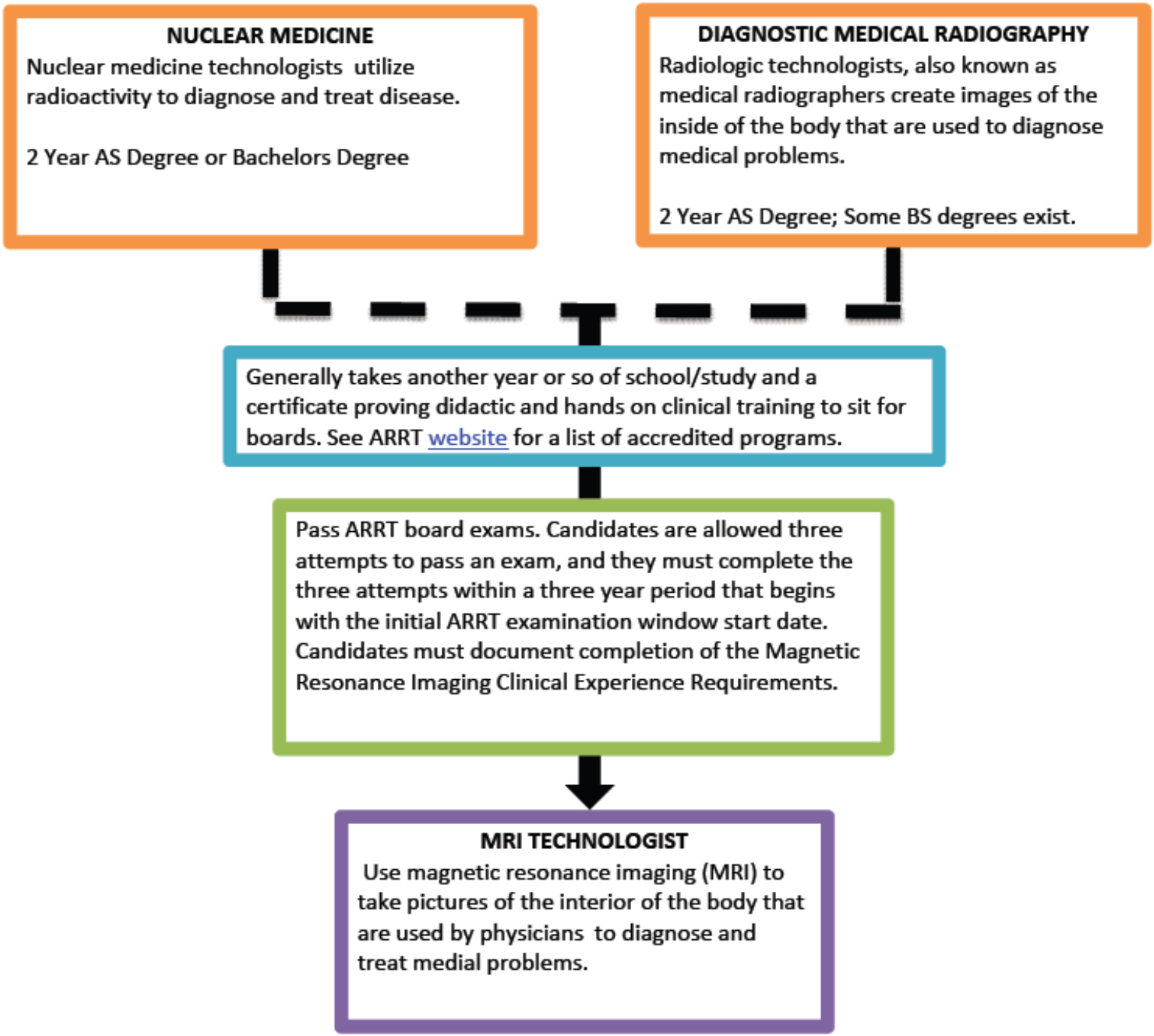
Advanced pathways are occupations which are generally obtained through a bachelors degree program, or require multiple years or training and experience. You must meet the ARRT requirements to become certified.

- Primary Pathway
- Post-Primary Pathway
- Advanced Pathway

RADIATION THERAPY
It is most common pathways is to go directly into a 2-4 year Radiation Therapy program. However, it is possible to go to an advanced program and add certification if you are a registered Radiologic Technologist. You must meet the ARRT requirements to become certified.

RADIOLOGIST ASSISTANT
Registered Radiologist Assistants (R.R.A.s) are advanced-level radiographers who extend the capacity of the radiologist.

MRI TECHNOLOGIST PATHWAY



VASCULAR SONOGRAPHER PATHWAY

DIAGNOSTIC MEDICAL SONOGRAPHY

Medical Sonographers utilize ultrasound equipment to obtain an image and provide physicians with diagnostic information for treatment.

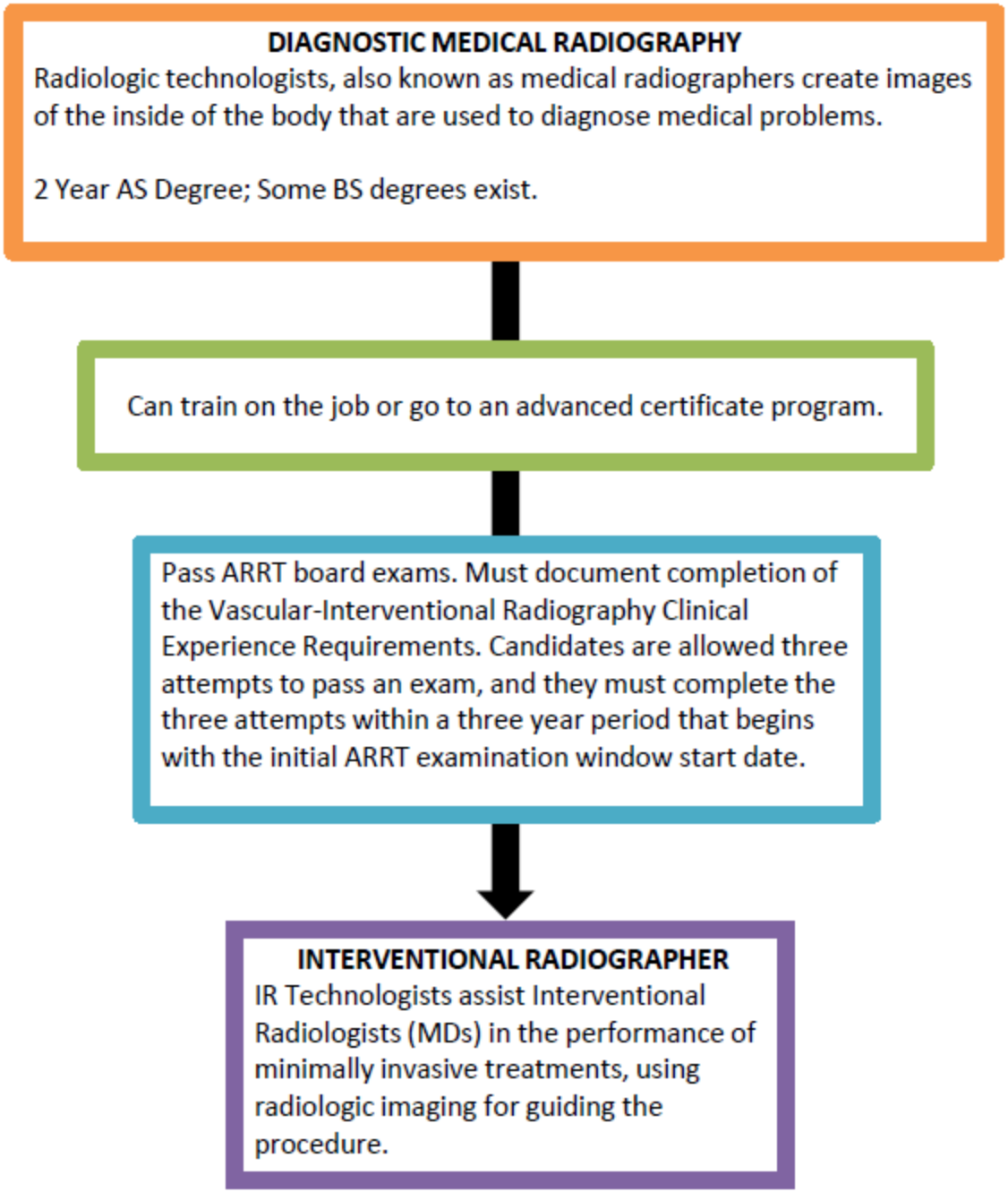
Can take additional credits to add to basic Ultrasound credentials (for example, OB, Small Parts, Vascular specialty exams available); Must pass Ultrasound Physics and Abdominal exam to enter profession; many add OB and Small Parts exams to be fully registered for General Sonography practice. See ARRT website for a list of accredited programs.

Pass ARDMS or ARRT board exams. Candidates are allowed three attempts to pass an exam, and they must complete the three attempts within a three year period that begins with the initial ARRT examination window start date. Must document completion of the Vascular Sonography Clinical Experience Requirements.

VASCULAR SONOGRAPHER

Vascular Sonography is an ultrasound specialty wich focuses on the anatomy and function of the blood vessels. Registered Vascular Technologists (or RVT's) may be certified in Vascular Technology as a primary modality; but most add this as an additional certification over and above General Medical Sonography certification. RVT's who do not have General Sonography certifications have a limiteld practice, and generally reduced work environment potential and reduced earning potential.

INTERVENTIONAL RADIOLOGIST PATHWAY



RADIATION THERAPIST PATHWAY

DIAGNOSTIC MEDICAL RADIOGRAPHY

Radiologic technologists, also known medical radiographers create images of the inside of the body that are used to diagnose medical problems.

2 Year AS Degree; Some BS degrees exist.

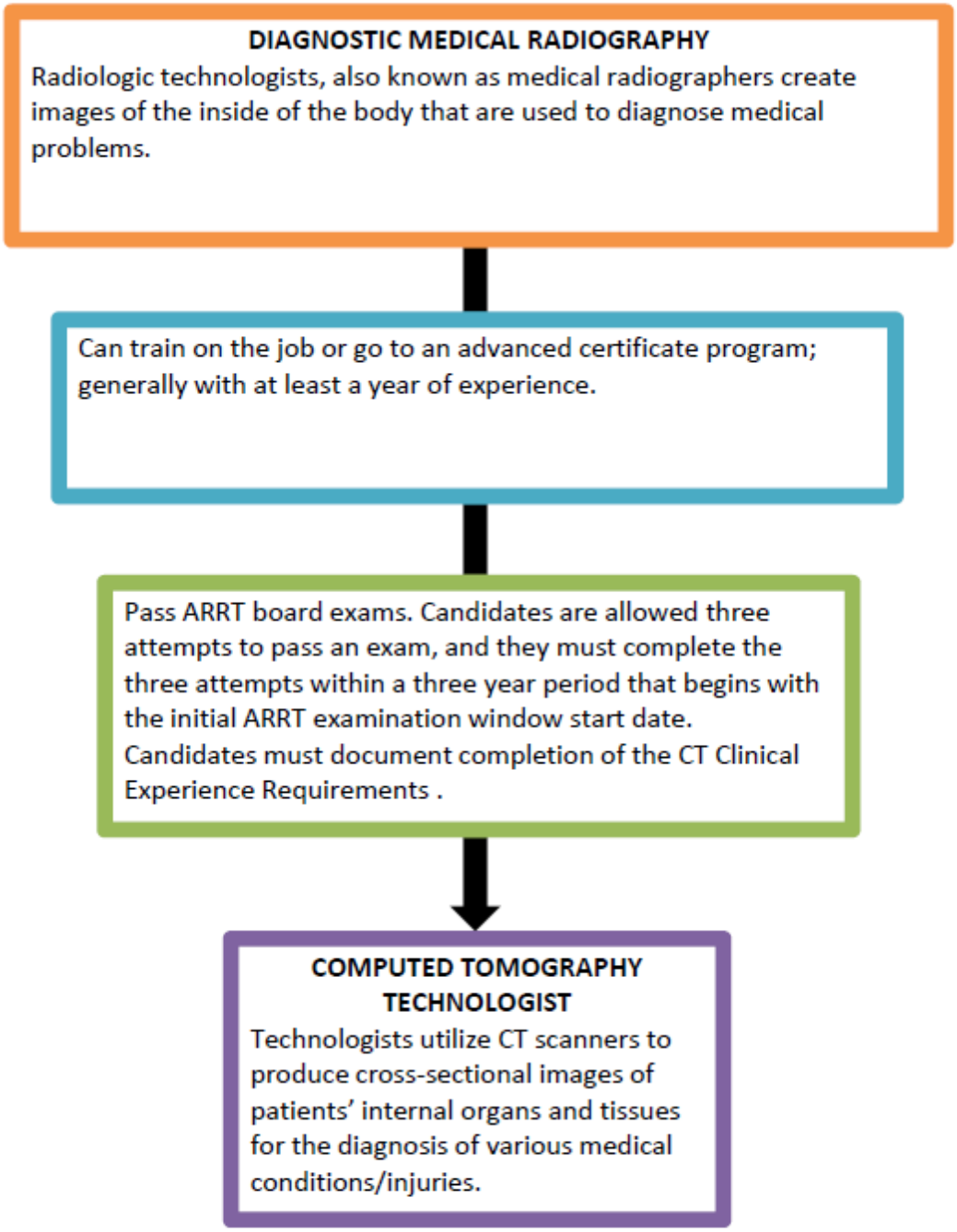
Go to an advanced certificate program. See the ARRT website for a list of accedited programs.

Pass ARRT board exams. Radiation Therapy certification candidates must have within the past five years successfully completed a Radiation Therapy educational program that is accredited by a mechanism acceptable to the ARRT. Candidates are allowed three attempts to pass an exam, and they must complete the three attempts within a three year period that begins with the initial ARRT examination window start date.

RADIATION THERAPIST

Radiation therapists use ionizing-radiation producing equipment to administer therapeutic doses of radiation as prescribed by physicians for treatment of disease. 2-4 year Radiation Therapy programs are most common, but it is possible to go to an advanced program and add certification if you are a registered Radiologic Technologist.

COMPUTED TOMOGRAPHY PATHWAY



General Occupation Background[1]

Diagnostic Radiography (X-ray)

Job Description: Radiologic technologists, also known as radiologic technicians and radiographers, provide information that is used to diagnose medical problems. They create images of the inside of the body. Technologists receive instructions from doctors about which areas of the body they need images of. Doctors also tell technicians which procedure to use. The main types of procedures are x-ray, fluoroscopy, and sonogram. Technologists prepare patients for these procedures. They explain these procedures to patients and answer their questions. Next, technologists position patients on an examining table near the imaging equipment. For some procedures, such as x-rays, technologists must make sure that the patient is protected during the test. When giving any of these procedures, technologists adjust the controls of the equipment. When conducting fluoroscopies and sonograms, they monitor images on video screens. Technologists monitor patients' during the procedures and report problems to doctors. Radiologic technologists analyze the images and consult with doctors about what the images might mean. The images help doctors to identify and treat medical problems. Radiologic technologists may oversee and train other radiologic staff members and maintain patient records. They may also be in charge of maintaining special equipment and doing inventory of medical supplies.

Education: Formal training programs in radiography lead to a certificate, an associate degree, or a bachelor's degree. An associate degree is the most prevalent form of educational attainment among radiologic technologists and technicians. Some may receive a certificate. Certificate programs typically last around 21-24 months. Most states require licensure for practicing radiologic technologists. Licensing requirements vary by state.

Pathways: If you have experience in another health care field, you can become a radiologic technologist by completing a one-year certification program. With experience and additional training, staff technologists may become specialists, performing CT scanning, MR, mammography, or bone densitometry. Technologists also may advance, with additional education and certification, to become a radiologist assistant. The ARRT offers specialty certification in many radiologic specialties as well as a credentialing for radiologist assistants. Experienced technologists also may be promoted to supervisor, chief radiologic technologist, and, ultimately, department administrator or director. Depending on the institution, courses or a master's degree in business or health administration may be necessary for the director's position. Some technologists progress by specializing in the occupation to become instructors or directors in radiologic technology educational programs; others take jobs as sales representatives or instructors with equipment manufacturers. There are many opportunities for advancement for radiologic technologists. Those who continue their education and stay up to date on technological changes are most likely to advance.

Outlook/wages: Employment is projected to grow faster than average. Those with knowledge of more than one diagnostic imaging procedure—such as CT, MR, and mammography—will have the best employment opportunities. In addition to job growth, job openings also will arise from the need to replace technologists who leave the occupation. Median hourly wage: $34.38 Median Annual salary: $71,510

[1] Information drawn from BLS, MassCIS, credentialing board web sites

Bone Density

Bone Densitometry Technologists use a special type of x-ray equipment to measure bone mineral density at a specific anatomical site (usually the wrist, heel, spine or hip) or to calculate total body bone mineral content. Results can be used by physicians to estimate the amount of bone loss due to osteoporosis. Bone densitometry technologists are radiology professionals who are specifically responsible for measuring bone mass and determining patients' bone health, especially for the purpose of diagnosing osteoporosis and other bone diseases. The first task in a typical bone density scan is to make certain that equipment is functioning properly. The bone densitometry technologist then explains the procedure to patients and ensures that they are positioned correctly. Next, the technologist activates the radiological imaging equipment to take measurements of the patient's bone mass. After the scan is complete, bone densitometry technologists may be responsible for analyzing the scans they have completed. Technologists may also be responsible for maintaining a variety of procedural records. Bone density technologists may work in many different settings, such as physicians' offices, medical services agencies or hospitals.

Education: Bone Density Technologists usually receive on the job training. There are limited program options. Candidates pursuing certification in bone densitometry must already be certified in Radiography Nuclear Medicine Technology or Radiation Therapy. In addition, candidates must document completion of the Bone Densitometry Clinical Experience Requirements. Certification in densitometry establishes standards and ensures that technologists running and interpreting DXA (bone density) scans offer the patients the best diagnosis and treatments possible. The International Society for Clinical Densitometry provides three certifications for technologists: Certified Bone Density Technologist (CBDT) which is a professional certification in the field of bone densitometry for technologists who *perform* densitometry scans; Certified Clinical Densitometrist (CCD) is a professional designation awarded to individuals for the *interpretation* of bone densitometry and Certified Densitometry Technologist (CDT) which is a professional designation awarded to individuals who are *performing* central DXAs.

Mammography

The mammographer is a registered radiologic technologist who produces radiographic images of the breast. Duties include: obtaining a thorough patient history, providing a specific explanation of the mammographic procedure, providing information and/or demonstrating the procedure of self breast examination, positioning of the patient to obtain proper projection and a quality mammographic image, making exposure factor selections, processing the image, storing and retrieving images, performing quality assurance tests. Mammogram technicians use advanced medical imaging technology to examine breast tissue for tumors, cysts, lesions and other disease causing abnormalities. A mammogram technician is responsible for creating a clear readable image that can be used by a radiologist, oncologist or other doctor to make an informed diagnosis. Even a routine mammogram can be a cause of great stress for patients. A mammogram technician should be able to develop an excellent rapport with patients and make the process as comfortable as possible. Depending on the position, some mammogram technicians are required to service and repair imaging equipment as needed. With advancements in medical technology, many mammogram technicians are called upon to test new devices and report on their effectiveness. Additional duties may include filing and processing confidential patient records, arranging for proper billing, consulting with physicians and surgeons and more. The ideal mammogram technician will have the communications skills to clearly explain all procedures to patients and reassure them during the process. Attention to detail is a major part of

this position, as many scans and mammograms must be repeated if the developed film doesn't provide a clear view from which the doctor can basis his or her findings.

Education: Mammogram technicians generally complete an associate's degree program in Radiology, Sonography or Ultrasound Technology. In these programs, students can expect to study the physics and science behind radiologic medical tests, human anatomy, medical terminology, health care ethics, pathology and more. Other alternative vocational training programs are available but vary from state to state. Depending on state laws and the policies of a prospective employer, some mammogram technicians may need to obtain a professional license from an organization like the ARRT. Candidates pursuing certification in mammography must be registered with the ARRT in Radiography and must document completion of the Mammography Clinical Experience Requirements.

At Bunker Hill Community College the Mammography Certificate Program is designed for experienced medical imaging professionals seeking to enter the field of mammography

Outlook: Employment is projected to grow faster than average for Radiologic Techs. Those with knowledge of more than one diagnostic imaging procedure—such as CT, MR, and mammography—will have the best employment opportunities. Employment of radiologic technologists is expected to increase by about 17 percent from 2008 to 2018, faster than the average for all occupations.

Magnetic Resonance Imaging (MRI)

MRI technologists use magnetic resonance imaging (MRI) to take pictures of the interior of the body. Technologists meet with patients before performing the MRI scan. They answer questions about MR imaging and instruct patients on what they need to do during the exam. Technologists ask patients if they have any serious health problems and what surgeries they have undergone. The answers to these questions and others help technologists determine if the procedure will be safe for the patient. Some MRI exams require patients to swallow contrast material or receive an injection into the bloodstream prior to the exam. Technologists administer those materials if they are needed. The MRI system scans the patient's body point by point. It builds a 2-D or 3-D map of tissue types as it scans. The scanner can also image flowing blood. This allows the technologist to view the arterial system in the body, but not the tissue around it. Technologists follow instructions from the patient's primary care doctor regarding which part of the body to focus on. They help patients deal with any emotional or physical discomfort during the scan. Technologists monitor patients' safety during testing and make sure equipment is working properly. When the exam is complete, technologists ask patients to wait while they check the images. If no additional images are needed, technologists help patients off of the table and escort them out of the room. MRI technologists most often work in hospitals and diagnostic imaging centers.

Education: Most technologists have an associate degree. They earn their degree by completing a two-year program in medical imaging technology. Professional-technical schools and two-year colleges, universities, and hospitals all offer these programs. Common classes are anatomy and physiology, patient care procedures, and medical terminology. Radiation physics, radiation protection, and principles of imaging are other topics studied.

Upon graduation from a medical imaging technology program, you must complete one to two years of specific training in MRI technology, including clinical experience. In some cases, this training will be provided by an employer. Another option is to take courses offered by medical education companies. In this situation, you must still find a medical center where you can complete your clinical experience. Many employers prefer to hire certified MRI technologists. Certification is optional and can be obtained through the American Registry of Radiologic Technicians or the American Registry of Magnetic Resonance Imaging Technologists. Technologists must be strong because they help position patients on the table. Most employers require two years of experience in MRI technology.

Pathways: Most MRI technologists are radiologic technologists first. If you have experience as a radiologic technologist, you can become an MRI technologist by receiving on-the-job training.

Positron Emission Tomography (Nuclear Medicine/PET)

Nuclear medicine technologists give patients radioactive drugs or radiation treatments. Before they give patients the drugs, technologists review the patient's medical history and explain the procedure. Using a computer, they calculate how much radiation or radioactive drug the treatment will require. They prepare the proper dosage and give it to the patient by mouth, injection, or other means. Technologists use cameras that detect radioactive drugs as they move through patients' bodies. To track the movement of drugs, technologists arrange patients and the equipment in the proper position. Then they start the camera, also known as a scanner. The scanner monitors the path of the radioactive drug in the body. This path appears as images on a computer screen or on film. Technologists print out the pictures for doctors to interpret. In addition, they monitor patients during procedures and enter test results into patients' records. The procedure for giving radiation treatments is similar. Technologists position patients and equipment properly. Then they program computers so that patients receive the correct amount of radiation. After the tests or treatments are given, technologists record the results. Nuclear medicine technologists may perform studies to assess how radioactive materials act inside the body. For example, they add materials to a blood sample and observe the changes. They may also run tests on cardiac function. They also develop procedures for treatment programs. In addition, technologists maintain and adjust laboratory equipment. Following safety procedures, they dispose of and store radioactive materials. They keep track of the amount and type of radiation disposed of and used. They may also purchase materials. In addition, they may train and supervise other technologists and those studying in nuclear medicine programs.

Education: Nuclear medicine technology programs range in length from one to four years. One-year programs grant a certificate. These programs are for health care professionals, such as nurses or radiation therapists, who wish to specialize in nuclear medicine. Hospitals usually offer certificate programs. Two-year programs in nuclear medicine grant a certificate or associate degree. Associate degrees are the most common training for this occupation. Four-year programs award a bachelor's degree. All nuclear medicine technologists must meet minimum federal standards on giving radioactive drugs and operating radiation detection equipment. In addition, about half of all states require technologists to be licensed. Licensing requirements vary by state.

Pathways: Experienced nuclear medicine technologists who have good people skills may become supervisors. With training in administrative procedures, they may advance to chief technologist or department director. Some may specialize in areas such as nuclear cardiology or computer analysis. Others may leave patient care to take jobs in research labs.

Outlook/Wages: The median hourly wage is in Massachusetts is $36.03. The yearly median income is Massachusetts is $74,930.

The demand for nuclear medicine technologists will grow as the number of older people increases. Also, new uses of nuclear medicine are being discovered. Competition for jobs will be strong. This is because the number of qualified applicants is greater than the number of job openings. Currently in MA the number of annual openings is very few and the growth is at around 11% compared with 6.3% for all other occupations.

Interventional Radiology (IR)

Interventional radiology (IR) is a medical specialty that performs minimally invasive treatments, using radiologic imaging for guiding the procedure. Interventional radiology treatments have become the primary method of care for a variety of conditions, offering less risk, less pain and less recovery time, compared to open surgery. Interventional radiology is a medical field that combines tiny specialized instruments and devices with systems that form images of the body, to enable doctors to perform image-guided procedures. These minimally-invasive procedures treat a wide variety of medical conditions that in the past would have required open surgery to perform. Interventional radiology is now used to treat blockages inside arteries and veins, to block off blood vessels that nourish tumors, destroy malignant tumors using focused heat and freezing, drain blocked organ systems such as the liver, gallbladder and kidney, and perform biopsies that would otherwise require surgical exploration.

Education: Interventional radiologists are board-certified and fellowship trained physicians whose area of expertise is minimally invasive, targeted treatments. They are experts at reading x-rays, ultrasounds, CTs, MRIs, and other forms of medical imaging. They offer the most comprehensive knowledge of the least invasive treatments available coupled with diagnostic and clinical experience. They have had extensive training and must show expertise in radiation safety, radiation physics, the biological effects of radiation and injury prevention.

Cardiac Interventional Radiology (CIR)

The cardiovascular-interventional technologist works alongside interventional radiologists and nurses. A cardiovascular-interventional technologist assists the interventional radiologist with diagnostic angiographic procedures, complex vascular and nonvascular interventional and therapeutic procedures. Cardiovascular-interventional technologists are required to have a combination of technical, radiologic and clinical skill. Cardiovascular-interventional technologists perform many duties during an interventional procedure. The technologist is responsible for obtaining all equipment needed for a procedure, positioning and imaging patients, resolving equipment issues, and demonstrating knowledge of human anatomy, radiation safety, interventional supplies and equipment operation.

Education: Cardiovascular-interventional technologists must complete an accredited two-year certificate, associate degree or four-year baccalaureate program in radiologic technology. The Joint Review Committee of Education in Radiologic Technology (JRCERT) is the accrediting organization. Cardiovascular-interventional technologists must be certified by the American Registry of Radiologic Technologists (ARRT) and complete an additional advanced-level cardiovascular-interventional technology examination. In order to maintain ARRT certification and stay abreast of advances in cardiovascular technology (CV), cardiovascular-interventional technologists must complete 24 hours of continuing education courses every two years. The licensing examination is a difficult, high-level examination which is not meant for individuals with little, limited or no interventional radiology coding experience or training.

There is an overwhelming need for experts in the Interventional Radiology Cardiovascular specialty

Cardiac Sonography (Cardiac Echocardiolography)

Technologists who specialize in echocardiography or vascular technology perform noninvasive tests. Tests are called “noninvasive” if they do not require the insertion of probes or other instruments into the patient's body. For example, procedures such as Doppler ultrasound transmit high-frequency sound waves into areas of the patient's body and then processes reflected echoes of the sound waves to form an image. Technologists view the ultrasound image on a screen and may record the image on videotape or photograph it for interpretation and diagnosis by a physician. Technologists who use ultrasound to examine the heart chambers, valves, and vessels are referred to as cardiac sonographers, or echocardiographers. They use ultrasound instrumentation to create images called echocardiograms. An echocardiogram may be performed while the patient is either resting or physically active. Technologists may administer medication to physically active patients to assess their heart function. Cardiac sonographers also may assist physicians who perform other procedures.

Cardiovascular technologists and technicians spend a lot of time walking and standing. Heavy lifting may be involved to move equipment or transfer patients. Those who work in catheterization laboratories may face stressful working conditions because they are in close contact with patients with serious heart ailment. Cardiovascular technologists and technicians must be reliable, have mechanical aptitude, and be able to follow detailed instructions. A pleasant, relaxed manner for putting patients at ease is an asset. They must be articulate as they must communicate technically with physicians and also explain procedures simply to patients.

Education: The majority of cardiovascular technologists, vascular technologists, and cardiac sonographers complete a 2-year community college program resulting in an associate degree. However, 4-year programs are increasingly available. Credentialing for cardiovascular technologists is available from Cardiovascular Credentialing International (CCI) and the American Registry of Diagnostic Medical Sonographers (ARDMS). Most credentials require that technologists complete an accredited education program to qualify to sit for credentialing examination.

Pathways: Technologists can advance to higher levels of the profession as many institutions structure the occupation with multiple levels, each having an increasing amount of responsibility. Advancement may occur through multiple credentialing in more than one cardiovascular specialty or through work experience. Technologists may also advance into supervisory or management positions. Other possibilities include working in an educational setting or conducting laboratory work.

Outlook/Wages: Employment is expected to grow much faster than the average; technologists and technicians with multiple professional credentials, trained to perform a wide range of procedures, will have the best prospects. Employment of cardiovascular technologists and technicians is expected to increase 24 percent through the year 2018, much faster than the average for all occupations. Demand will stem from the prevalence of heart disease and the aging population. Growth is projected at 21.6% in MA.

The hourly average wage in Massachusetts is $31.45. The average annual salary in Massachusetts is $65,420.

Computed Tomography

A computed tomography (CT) scan uses X-rays to make detailed pictures of structures inside of the body. CT technologists utilize computerized tomography (CT) scanners to produce cross-section images of patients' internal organs and tissues for the diagnosis of medical issues. A CT scan technician must be able to accurately interpret a physician's scanning instructions, administer contrast materials, prepare and operate the CT scan equipment and position the patient to capture the appropriate images. Generally speaking, a CT technologist should be in good health, because maneuvering equipment and patients who are disabled may pose physical challenges. In addition to conducting scans, CT technicians prepare patients for these diagnostic procedures by explaining the process and positioning patients to correctly capture the images requested by a physician. CT scanners emit radiation, which can be harmful for the technologist and patient if proper safety procedures are not followed. CT scan technician jobs are most often located in hospitals and diagnostic imaging centers.

Education: Candidates pursuing certification in computed tomography (CT) must be registered with the ARRT in Radiography, Nuclear Medicine Technology (registration with NMTCB is also accepted), or Radiation Therapy. In addition, candidates must document completion of the CT Clinical Experience Requirements

Wages: In today's job market, a CT scan technologist can expect an average yearly salary between $48,000 and $52,000. For CT scan technicians with advanced certification or experience, the average salary will fall into the upper end of the pay scale, which is currently at a median salary of approximately $55,000

LMI Resources for healthcare occupations

- ☐ Mass CIS: http://www.masscis.intocareers.org/
- ☐ My Skills My future: http://www.myskillsmyfuture.org/
- ☐ Bureau of Labor Statistics: http://www.bls.gov/ro1/
- ☐ Career OneStop: http://www.careeronestop.org/
- ☐ MA Labor and Workforce Development: http://www.mass.gov/lwd/
- ☐ Health Career Center: http://www.healthcareercenter.org/
- ☐ Mass Pulse: http://www.masspulse.org/students.html
- ☐ Career Pathways: http://www.mypathcareers.org/
- ☐ American Registry of Radiologic Technicians (ARRT): https://www.arrt.org/
- ☐ American Registry of Diagnostic Medical Sonographers (ARDMS): http://ardms.org/
- ☐ International Society for Clinical Densitometry: http://www.iscd.org/