Health Technologists and Technicians

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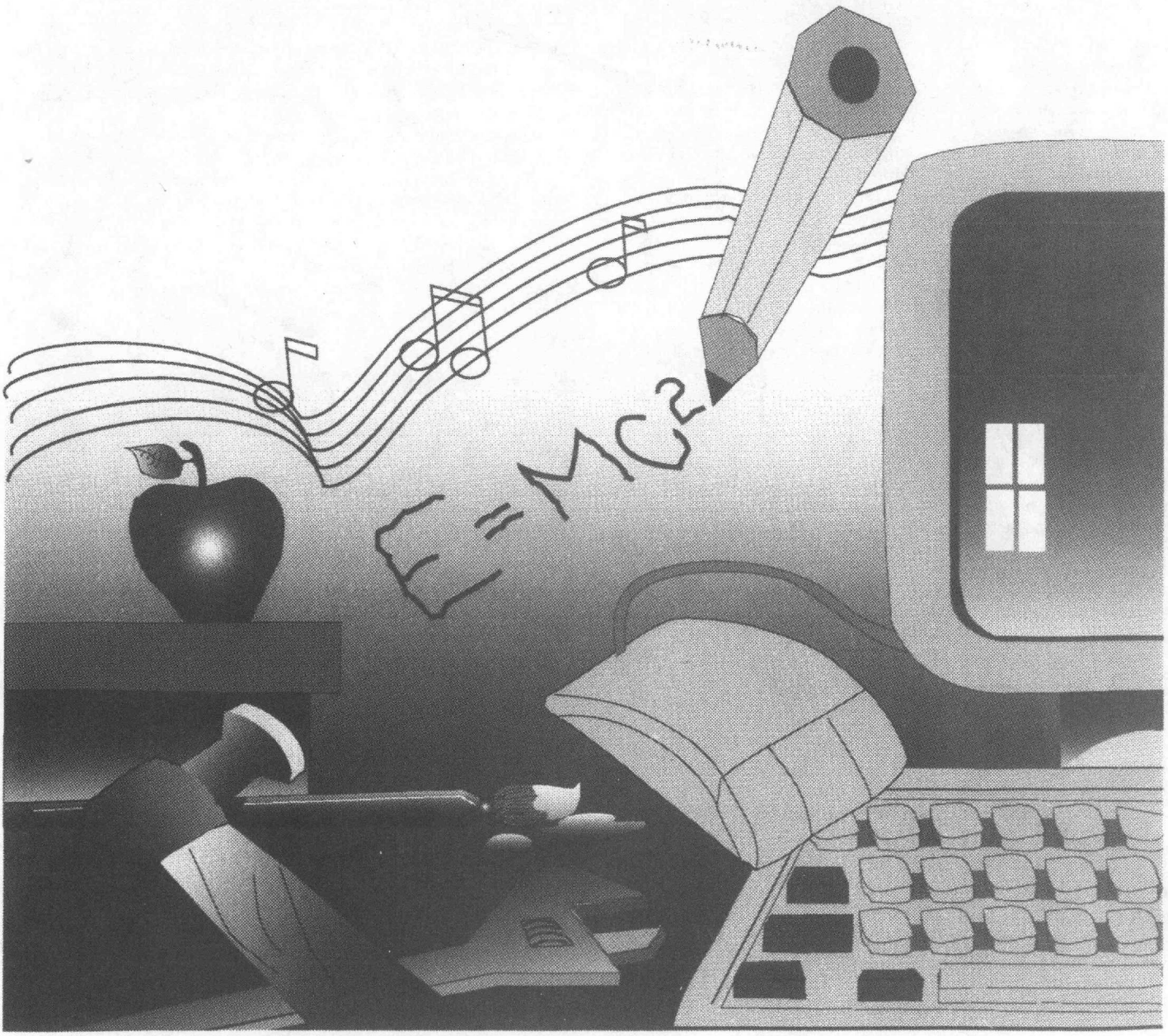

Clinical Laboratory Technologists and Technicians

(D.O.T. 078.121-010, .161-010, .221-010, .261-010 and -014, .281-010, .361-014 and -030, .381-010 and -014, .687-010, and 079.364-022)

Nature of the Work

Clinical laboratory testing plays a crucial role in the detection, diagnosis, and treatment of disease. Clinical laboratory technologists and technicians, also known as medical technologists and technicians, perform most of these tests.

Clinical laboratory personnel examine and analyze body fluids, tissues, and cells. They look for bacteria, parasites, or other micro-organisms; analyze the chemical content of fluids; match blood for transfusions, and test for drug levels in the blood to show how a patient is responding to treatment. They also prepare specimens for examination, count cells, and look for abnormal cells. They use automated equipment and instruments that perform a number of tests simultaneously, as well as microscopes, cell counters, and other kinds of sophisticated laboratory equipment to perform tests. Then they interpret the results and relay them to physicians.

The complexity of tests performed, the level of judgment needed, and the amount of responsibility workers assume depend largely on the amount of education and experience they have.

Medical technologists generally have a bachelor's degree in medical technology or in one of the life sciences, or have a combination of formal training and work experience. They perform complex chemical, biological, hematological, immunologic, microscopic, and bacteriological tests. Technologists microscopically examine blood, tissue, and other body substances; make cultures of body fluid or tissue samples to determine the presence of bacteria, fungi, parasites, or other micro-organisms; analyze samples for chemical content or reaction; and determine blood glucose or cholesterol levels. They also type and cross-match blood samples for transfusions.

They may evaluate the effects a patient's condition has on test results, develop and modify procedures, and establish and monitor programs to insure the accuracy of tests. Some medical technologists supervise medical laboratory technicians.

Technologists in small laboratories perform many types of tests, while those in specialty laboratories or large laboratories generally specialize. Technologists who prepare specimens and analyze the chemical and hormonal contents of body fluids are *clinical chemistry technologists*. Those who examine and identify bacteria and other micro-organisms are *microbiology technologists*. *Blood bank technologists* collect, type, and prepare blood and its components for transfusions; *immunology technologists* examine elements and responses of the human immune system to foreign bodies. *Cytotechnologists*, who have specialized training, prepare slides of body cells and microscopically examine these cells for abnormalities which may signal the beginning of a cancerous growth.

Medical laboratory technicians generally have an associate degree from a community or junior college, or a diploma or certificate from a vocational or technical school. They perform routine tests and laboratory procedures. Technicians may prepare specimens and operate automatic analyzers, for example, or they may perform manual tests following detailed instructions. Like technologists, they may work in several areas of the clinical laboratory or specialize in just one. *Histology technicians* cut and stain tissue specimens for microscopic examination by pathologists and *phlebotomists* draw and test blood. They usually work under the supervision of medical technologists or laboratory managers.

Working Conditions

Hours and other working conditions vary according to the size and type of employment setting. In large hospitals or in commercial laboratories that operate continuously, personnel usually work the day, evening, or night shift, and may work weekends and holidays. Laboratory personnel in small facilities are likely to work on rotating shifts rather than on a regular shift. In some facilities, laboratory personnel are on call (available in case of emergency) several nights a week or on weekends.

Clinical laboratory personnel are trained to work with infectious specimens. When proper methods of control and sterilization are followed, few hazards of infection exist.

Laboratories generally are well lighted and clean; however, specimens, solutions, and reagents used in the laboratory sometimes produce odors. Laboratory workers may spend a great deal of time on their feet.

Employment

Clinical laboratory technologists and technicians held about 258,000 jobs in 1990. About 3 out of 5 worked in hospitals. Most others worked in offices and clinics of physicians and in medical laboratories. Some worked in blood banks, research institutions, and in the Federal Government—for Veterans Administration hospitals and the U.S. Public Health Service.

About 1 laboratory worker in 6 worked part-time.

Training, Other Qualifications, and Advancement

The usual requirement for an entry level position as a medical technologist is a bachelor's degree with a major in medical technology or in one of the life sciences. Universities and hospitals offer medical technology programs. It is also possible to qualify through a combination of on-the-job and specialized training.

Bachelor's degree programs in medical technology include courses in chemistry, biological sciences, microbiology, and mathematics, with the final component of course work devoted to knowledge and skills used in the clinical laboratory. Many programs also offer or require courses in management, business, and computer applications.

Many universities offer masters degrees in medical technology and related clinical laboratory sciences for technologists who plan to specialize in a certain area of laboratory work or in teaching, administra-

Cytotechnologists prepare slides of body cells and microscopically examine these cells for abnormalities.

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tion, or research. Two universities offer doctorates in clinical laboratory technology.

Medical laboratory technicians acquire their training in community and junior colleges, hospitals, vocational and technical schools, or in the Armed Forces. A few learn it through on-the-job training. Many programs last 2 years and lead to an associate degree. Others are shorter and lead to a certificate in medical laboratory technology.

Persons interested in a clinical laboratory career should be careful about selecting an educational program. Prospective employers—hospitals and independent laboratories—may have preferences as to program accreditation. (Accreditation indicates that an educational program meets established standards.) Educational programs should be able to provide information about the kinds of jobs obtained by graduates, the length of time the program has been in operation, instructional facilities, and faculty qualifications.

Nationally recognized accrediting agencies in the allied health field include the American Medical Association's Committee on Allied Health Education and Accreditation (CAHEA), and the Accrediting Bureau of Health Education Schools (ABHES). CAHEA accredits over 800 programs that provide education for medical technologists, cytotechnologists, histologic technicians, specialists in blood bank technology, and medical laboratory technicians. ABHES accredits training programs for medical laboratory technicians.

Licensure and certification are well established in the health field as methods of assuring the skill and competence of personnel. Licensure refers to the process by which a government agency authorizes individuals to engage in a given occupation and use a particular job title. Some States require laboratory personnel to be licensed or registered. (Information on licensure is available from State departments of health, boards of occupational licensing, or occupational information coordinating committees.)

Certification is a voluntary process by which a nongovernmental organization such as a professional society or certifying agency grants recognition to an individual whose professional competence meets prescribed standards. Widely accepted by employers in the health industry, certification is a prerequisite for some jobs and often is necessary for advancement. Agencies that certify medical laboratory technologists and technicians include the Board of Registry of the American Society of Clinical Pathologists, the American Medical Technologists, the National Certification Agency for Medical Laboratory Personnel, and the Credentialing Commission of the International Society for Clinical Laboratory Technology. These agencies have different requirements for certification and different organizational sponsors.

Clinical laboratory personnel need analytical judgment and the ability to work under pressure. Close attention to detail is essential because small differences or changes in test substances or numerical readouts can be critical for patient care. Manual dexterity and normal color vision are highly desirable. With the widespread use of automated laboratory equipment, computer skills are important. In addition, technologists in particular are expected to be good at problem solving and to have strong interpersonal and communications skills.

Technologists may advance to supervisory positions in laboratory work or become chief medical technologists or laboratory managers in large hospitals. Manufacturers of home diagnostic testing kits and laboratory equipment and supplies seek experienced technologists to work in product development, marketing, and sales. Graduate education in medical technology, one of the biological sciences, chemistry, management, or education usually speeds advancement. Technicians can become technologists through additional education and experience.

Job Outlook

The number of new graduates entering the field in recent years has dropped off—prompting reports of shortages. Until the supply situation improves, qualified clinical laboratory personnel will be in strong demand and should enjoy very favorable employment prospects.

Employment of clinical laboratory workers is expected to grow about as fast as the average for all occupations through the year 2005. New government regulations and changes in technology will affect future employment. The Federal Government will implement new guidelines for those who perform certain tests after 1992. At the time of this writing the exact guidelines are not known. However, they are expected to increase the level of training that some medical laboratory personnel need. If medical assistants are not allowed to perform as many tests in physicians' offices, more technologists and technicians will be needed to perform them in private laboratories.

Technological changes will have two diverse effects on employment. The probability of new, more powerful diagnostic tests is certain. Advances in biotechnology have already changed testing methods through the use of monoclonal antibodies and other advanced technologies that permit rapid, simple, and accurate testing. As further advances occur, they are likely to spur additional testing. Also, research laboratories are working to find the cause, treatment, and cure for AIDS and other diseases.

Employment would grow faster were it not for advances in laboratory automation, which make it possible for each worker to perform more tests. Research and development efforts are targeted at simplifying routine testing procedures so that nonlaboratory personnel—physicians and patients in particular—can perform tests now done in laboratories. Also, robots may prepare specimens, a job now done by technologists and technicians.

Fastest growth is expected in medical laboratories, as hospitals continue to send them a greater share of their testing. Rapid growth is also expected in offices and clinics of physicians. Little growth is expected in hospitals.

As in most occupations, replacement needs will be the main sources of job openings.

Earnings

In January 1991 medical technologists employed full-time in private hospitals averaged $14.71 an hour, excluding premium pay for overtime and for work on weekends, holidays, and late shifts. Average hourly earnings ranged from $12.94 in Fort Worth-Arlington to $20.17 in San Francisco. Those working part-time averaged $14.84 an hour. Medical laboratory technicians employed full-time averaged $11.33 an hour.

In the Federal Government, medical technologists earned an average of $32,023 a year in 1991; technicians, $21,664.

Related Occupations

Clinical laboratory technologists and technicians analyze body fluids, tissue, and other substances using a variety of tests. Similiar or related procedures are performed by analytical, water purification, and other chemists; science technicians; crime laboratory analysts; food testers; and veterinary laboratory technicians.

Sources of Additional Information

Career and certification information is available from:

- American Society of Clinical Pathologists, Board of Registry, P.O. Box 12270, Chicago, IL 60612.
- American Medical Technologists, 710 Higgins Rd., Park Ridge, IL 60068.
- National Certification Agency for Medical Laboratory Personnel, 2021 L St. NW., Suite 400, Washington, DC 20036.
- International Society for Clinical Laboratory Technology, 818 Olive St., Suite 918, St. Louis, MO 63101.

For more career information, write to:

- American Association of Blood Banks, 1117 N. 19th St., Suite 600, Arlington, VA 22209.
- American Society of Cytology, 1015 Chestnut St., Suite 1518, Philadelphia, PA 19107.
- American Society for Medical Technology, 2021 L St. NW., Suite 400, Washington, DC 20036.

For a list of CAHEA-accredited educational programs for clinical laboratory personnel, write:

- Committee on Allied Health Education and Accreditation, 515 North St., Chicago, IL 60610.

For a list of training programs for medical laboratory technicians accredited by the Accrediting Bureau of Health Education Schools, write:

- Secretary-ABHES, 29089 U.S. 20 West, Elkhart, IN 46514.

For information about employment opportunities in a Veterans Administration medical center, contact the personnel office of that center.

Dental Hygienists

(D.O.T. 078.361-010)

Nature of the Work

Who works on your teeth? It may be a dental hygienist. Dental hygienists provide preventive dental care and teach patients how to practice good oral hygiene.

Depending on State legal restrictions, dental hygienists provide a wide range of services. They examine the patient's teeth and mouth, recording the presence of diseases or abnormalities. They remove calculus, stain, and plaque from above and below the gumline; apply caries-preventive agents such as fluorides and pit and fissure sealants; expose and develop dental X-rays; place temporary fillings and periodontal dressings; remove sutures; and polish and recontour amalgam restorations. In some States, hygienists administer local anesthetics and nitrous oxide/oxygen analgesia, and place and carve filling materials.

Dental hygienists also help patients develop and maintain good oral health. For example, they may explain the relationship between diet and oral health, teach patients how to select toothbrushes, and show patients how to floss their teeth. Some hygienists develop and promote community dental health programs. This may include teaching groups of people how to practice good oral hygiene.

Dental hygienists use a variety of instruments in the course of their work. They use hand and rotary instruments to clean teeth, X-ray machines to take dental pictures, syringes with needles to administer local anesthetics, and models of teeth to explain oral hygiene.

Working Conditions

Flexible scheduling is a distinctive feature of this job. Full-time, part-time, evening, and weekend work is widely available. Dentists frequently hire hygienists to work only 2 or 3 days a week, so hygienists may hold jobs in more than one dental office.

Dental hygienists work in clean, well-lighted offices. Important health safeguards include strict adherence to proper radiological procedures, compliance with recommended aseptic technique, and utilization of appropriate protective devices when administering nitrous oxide/oxygen analgesia. Dental hygienists also wear safety glasses, surgical masks and gloves to protect themselves from infectious diseases such as hepatitis. The occupation is one of several covered by the Consumer-Patient Radiation Health and Safety Act of 1981, which encourages the States to adopt uniform standards for the training and certification of individuals who perform medical and dental radiological procedures.

Employment

Dental hygienists held about 97,000 jobs in 1990. Because multiple jobholding is common in this field, the number of jobs greatly exceeds the number of hygienists. About half of all dental hygienists usually worked part time—less than 35 hours a week.

Almost all dental hygienists work in private dental offices. Others work in public health agencies, school systems, hospitals, and clinics.

Training, Other Qualifications, and Advancement

Dental hygienists must be licensed by the State in which they practice. To qualify for licensure, a candidate must graduate from an accredited dental hygiene school and pass both a written and a clinical examination. The American Dental Association Joint Commission on National Dental Examinations administers the written examination that is accepted by all States and the District of Columbia. The individual State or regional testing agency administers the clinical examination. In addition, examinations on legal aspects of dental hygiene practice are required by most States. Alabama also allows candidates to take its examination if they have been trained through a State-regulated on-the-job program in a dentist's office.

In 1991, 205 programs in dental hygiene were accredited by the Commission on Dental Accreditation. Although some programs lead to a bachelor's degree, most grant an associate degree. A few institutions offer both types of programs. Six universities offer master's degree programs in dental hygiene.

Dental hygienists often work flexible hours.

Completion of an associate degree program is sufficient for practice in a private dental office. A bachelor's or master's degree is usually required for positions that involve research, teaching, or clinical practice in public or school health programs.

About half of the dental hygiene programs prefer applicants who have completed at least 1 year of college. Some of the bachelor's degree programs require applicants to have completed 2 years. However, requirements vary from school to school. These schools offer laboratory, clinical, and classroom instruction in subjects such as anatomy, physiology, chemistry, microbiology, pharmacology, nutrition, radiography, histology (the study of tissue structure), periodontology (the study of gum diseases), pathology, dental materials, clinical dental hygiene, and social and behavioral sciences.

Dental hygienists should work well with others, particularly patients who may be under stress. Personal neatness, cleanliness, and good health are important qualities. Dental hygienists must have manual dexterity because they use dental instruments with little room for error within a patient's mouth. Recommended high school courses for aspiring dental hygienists are biology, health, chemistry, psychology, speech, and mathematics.

Job Outlook

Employment of dental hygienists is expected to grow much faster than the average for all occupations through the year 2005 in response to increasing demand for dental care. Demand will be stimulated by population growth, greater retention of natural teeth by middle-aged and elderly people, rising real incomes, and greater availability of dental insurance. Additional job openings will result from the need to replace workers who leave the occupation.

Also, in the future, dentists are likely to employ more hygienists, for several reasons. Older dentists, who are less likely to employ dental hygienists, will leave and be replaced by recent graduates, who are more likely to employ a hygienist part time, or even full time. In addition, as the surplus of dentists abates, dentists' workloads will increase. As this happens, they are expected to hire more hygienists to perform preventive dental care such as cleaning, so they may use their own time for more profitable procedures like surgery.

Enrollments in dental hygiene programs declined during the 1980's, reducing the number of new graduates entering the field. Unless the number increases sharply, opportunities are expected to remain very good.

Earnings

Earnings of dental hygienists are affected by geographic location, employment setting, and education and experience. Dental hygienists who work in private dental offices may be paid on an hourly, daily, salary, or commission basis.

According to the American Dental Association, the average hourly salary for dental hygienists was $17.50 in 1989. The average starting salary was $15.20 an hour.

Fringe benefits vary substantially by practice setting, and may be contingent upon full-time employment. Dental hygienists who work for school systems, public health agencies, the Federal Government, or State agencies usually have substantial benefits.

Related Occupations

Workers in other occupations supporting health practitioners in an office setting include dental assistants, ophthalmic medical assistants, podiatric assistants, office nurses, medical assistants, and physician assistants.

Sources of Additional Information

For information on a career in dental hygiene and the educational requirements to enter this occupation, contact:

☛ Division of Professional Development, American Dental Hygienists' Association, 444 N. Michigan Ave., Suite 3400, Chicago, IL 60611.

☛ SELECT, American Dental Association/American Association of Dental Schools, 211 E. Chicago Ave., Suite 1804, Chicago, IL 60611.

For information about accredited programs and educational requirements, contact:

☛ Commission on Dental Accreditation, American Dental Association, 211 E. Chicago Ave., Suite 1814, Chicago, IL 60611.

The State Board of Dental Examiners in each State can supply information on licensing requirements.

Dental Laboratory Technicians

(D.O.T. 712.281-010 and .381-014, -018, -022, -026 and -030)

Nature of the Work

Dental laboratory technicians are like pharmacists: They fill prescriptions. But their prescriptions come from dentists, and their orders are for crowns, bridges, dentures, and other dental prosthetics. Dentists send a specification of the item to be fabricated along with an impression (mold) of the patient's mouth or teeth to the technicians. Then dental laboratory technicians, also called dental technicians, create a model of the patient's mouth by pouring plaster into the impression and allowing it to set. They place the model on an apparatus which mimics the bite and movement of the patient's jaw. The model serves as the basis of the prosthetic device. Technicians examine the model, noting the size and shape of the adjacent teeth or gaps within the gumline. Based upon these observations and the dentist's specifications, technicians build and shape a wax tooth or teeth using small hand instruments called wax spatulas and wax carvers. They use this wax model to cast the metal framework for the prosthetic device.

Once the wax tooth has been formed, dental technicians pour the cast and make the metal. Using small hand-held tools, they prepare the surface in the base to allow the metal and porcelain to bond. They apply porcelain in layers to arrive at the precise shape and color of a tooth. After the application of each layer of porcelain, technicians place the tooth in a porcelain furnace to bake the porcelain onto the metal framework. Then they adjust the shape and color with subsequent grinding and addition of porcelain to achieve a lacquered finish. The final product is an exact replica of the tooth or teeth lost.

In some laboratories, technicians perform all stages of the work, while in others, technicians may have specific duties. Dental laboratory technicians also may specialize in one of five areas: Orthodontic appliances, crown and bridge, complete dentures, partial dentures, or ceramics. Job titles may reflect specialization in these areas. For example, technicians who make porcelain and acrylic restorations are called *dental ceramists*.

Working Conditions

Dental laboratory technicians generally work in clean, well-lighted, and well-ventilated areas. Technicians usually have their own workbenches, which may be equipped with Bunsen burners, grinding and polishing equipment, and hand instruments, such as wax spatulas and wax carvers.

The work is extremely delicate and quite time consuming. Salaried technicians usually work 40 hours a week, but self-employed technicians frequently work longer hours.

Employment

Dental laboratory technicians held about 57,000 jobs in 1990. Most jobs were in commercial dental laboratories, which usually are small, privately owned businesses with fewer than five employees. However, some laboratories are larger; a few employ over 50 technicians.

About 6,300 dental laboratory technicians worked in dentists' offices. Others worked for hospitals that provide dental services, including Veterans Administration hospitals and clinics.

Approximately 1 technician in 5 is self-employed, a higher proportion than in most other occupations. Some technicians work in dental laboratories in their homes, in addition to their regular job.

Training, Other Qualifications, and Advancement

Most dental laboratory technicians learn their craft on the job. They begin with simple tasks, such as pouring plaster into an impression, and progress to more complex procedures, such as making porcelain crowns and bridges. Becoming a fully trained technician requires an average of 3 to 4 years depending upon the individual's aptitude and ambition, but it may take a few more years to be recognized as an accomplished technician.

Training in dental laboratory technology is also available through community and junior colleges, vocational-technical institutes, and the Armed Forces. Formal training programs vary greatly both in length and the level of skill they impart.

In 1989, 50 programs in dental laboratory technology were approved (accredited) by the Commission on Dental Accreditation in conjunction with the American Dental Association (ADA). These programs provide classroom instruction in dental materials science, oral anatomy, fabrication procedures, ethics, and related subjects. In addition, each student is given supervised practical experience in the school or an associated dental laboratory. Accredited programs generally take 2 years to complete and lead to an associate degree.

About 1 out of 5 dental laboratory technicians is self-employed.

Even graduates of 2-year training programs need to gain additional hands-on experience to become fully qualified in the craft. Each dental laboratory owner operates in a different way, and classroom instruction does not necessarily expose students to techniques and procedures favored by individual laboratory owners. Students who have taken enough courses to learn the basics of the craft generally are considered good candidates for training, regardless of whether they have completed the formal program. Many employers will train someone without any classroom experience.

Certification, which is voluntary, is offered by the National Board for Certification in five specialty areas: Crown and bridge, ceramics, partial dentures, complete dentures, and orthodontic appliances.

In larger dental laboratories, technicians may become supervisors or managers. Experienced technicians may teach or take jobs with dental suppliers in such areas as product development, marketing, or sales. Still, for most technicians, opening one's own laboratory is the way toward advancement and higher earnings in this field.

A high degree of manual dexterity, good vision, and the ability to recognize very fine color shadings and variations in shape are necessary. An inclination for detailed and precise work also is important. Useful high school courses are art, metal and wood shop, drafting, and sciences. Courses in management and business may help those wishing to operate their own businesses.

Job Outlook

Job opportunities for dental laboratory technicians should be favorable despite little growth in the occupation. Employers have difficulty filling trainee positions, probably because of relatively low entry level salaries and lack of familiarity with the occupation. Also, experienced technicians who have built up a favorable reputation with dentists should have good opportunities for establishing laboratories of their own.

Although job opportunities are favorable, employment of dental laboratory technicians is not expected to grow through the year 2005, due to changes in dental care. The fluoridation of drinking water, which has reduced the incidence of dental caries, and greater emphasis on preventive dental care since the early 1960's have improved the overall dental health of the population. As a result, people are keeping their teeth longer. Instead of full or partial dentures, most people will need a bridge or crown. This means less work for the dental laboratory technician, who may need to fabricate only three or four teeth rather than a whole set of false teeth.

Office-based, computer-aided equipment—designed to measure a patient's mouth and fabricate the required prosthetic device—is currently under development and testing in Europe. While not replacing the technicians completely, such equipment, when and if it comes into widespread use in this country, could considerably reduce the amount of time required to produce dental prosthetics—and, therefore, the demand for dental laboratory technicians.

Earnings

Experience makes a big difference in wages. According to a National Association of Dental Laboratories' survey, in 1988 the average wage of a trainee was $5.30 an hour. For a recent graduate of a 2-year program, it was $6.50 an hour. Technicians with 2 to 5 years of experience averaged $7.90 an hour, and those with 5 to 10 years, $9.70 an hour. Technicians with 10 or more years of experience averaged $14.40 an hour. In general, earnings of self-employed technicians exceed those of salaried workers.

Related Occupations

Dental laboratory technicians fabricate artificial teeth, crowns and bridges, and orthodontic appliances following the specifications and instructions provided by the dentist. Other workers who make medical devices include arch-support technicians, orthotics technicians (braces and surgical supports), prosthetics technicians (artificial limbs and appliances), opticians, and ophthalmic laboratory technicians.

Sources of Additional Information

For information about training and a list of approved schools, contact:

☛ Commission on Dental Accreditation, American Dental Association, 211 E. Chicago Ave., Chicago, IL 60611.

General information on grants and scholarships is available from dental technology schools.

For information on career opportunities in commercial laboratories, contact:

☛ National Association of Dental Laboratories, 3801 Mt. Vernon Ave., Alexandria, VA 22305.

For information on requirements for certification, contact:

☛ National Board for Certification in Dental Technology, 3801 Mt. Vernon Ave., Alexandria, VA 22305.

Dispensing Opticians

(D.O.T. 299.474-010; 713.361-010, -014)

Nature of Work

Dispensing opticians fit eyeglasses and contact lenses. After an eye exam by an ophthalmologist or an optometrist, people needing corrective lenses ordinarily visit a dispensing optician to have the prescription filled. Optometrists generally fill prescriptions in-house. They may do their own dispensing, or employ an optician to do it. (The work of optometrists is described in a statement elsewhere in the *Handbook*. See the statement on physicians for information about ophthalmologists.)

Dispensing opticians help customers select appropriate frames, order the necessary ophthalmic laboratory work, and adjust the finished eyeglasses. In some States, they fit contact lenses under the supervision of an optometrist or ophthalmologist.

Dispensing opticians examine written prescriptions to determine lens specifications. They help the customer select from various styles and colors of eyeglass frames and lenses. When choosing frames, important considerations include the customer's occupation, habits, hairstyle, facial features, and the weight and thickness of the corrective lenses. The dispensing optician takes a number of measurements, including the distance between the centers of the pupils of the eyes to determine where the lens centers should be placed in relation to them, and the distance between the eye surface and the lens. For the customer without a prescription, dispensing opticians may use a lensometer to record the customer's present eyeglass prescription. Dispensing opticians may obtain a customer's previous record, or verify a prescription with the examining optometrist or ophthamologist. They also determine the lens material, and whether lenses will be tinted or protectively coated.

The dispensing optician then prepares a work order that gives the ophthalmic laboratory information needed to grind and insert lenses into a frame. The work order includes lens prescriptions and information on lens size, material, color, and style. Some dispensing opticians do their own laboratory work, preparing the lenses themselves. After the glasses are made, the dispensing optician checks the optical center, power, and surface quality of the lenses with special instruments, then adjusts the frame to the contours of the customer's face and head so that it fits properly and comfortably. Adjustments are made with handtools, such as optical pliers, files, and screwdrivers. Dispensing opticians may also fix broken frames, then adjust and refit them.

Most dispensing opticians fit eyeglasses. Some specialize in fitting contacts, artificial eyes, cosmetic shells to cover blemished eyes, or low vision aids. In fitting contact lenses, dispensing opticians measure eye shape and size, select the type of contact lens material, and then prepare work orders specifying the prescription and lens size. Fitting contact lenses requires considerably more skill, care, and patience than fitting eyeglasses. It may take several visits, during which the optician shows the customer how to insert, remove, and care for the contacts, and makes sure the fit is correct. During the visits, the dispensing optician observes the customer's eyes, corneas, lids, and contact lenses with special instruments and microscopes. The dispensing optician refers customers to their ophthalmologist or optometrist if the fit seems improper. While dispensing opticians may

make minor adjustments, major changes must be done in a prescription laboratory.

Dispensing opticians also keep records on customer prescriptions, work orders, and payments, and may also track inventory and sales.

Working Conditions

Dispensing opticians work indoors in pleasant surroundings that are well lighted and well ventilated. They may work in small shops where customers are served one at a time, or in large chain stores where several dispensing opticians serve a number of customers at once. Opticians deal with customers most of the time and spend much time on their feet. If they work in a laboratory where eyeglasses are made, they need to take precautions to guard against the hazards associated with cutting glass, handling chemical solutions, and working near machines with moving parts.

Dispensing opticians generally work a 40-hour week, although longer hours are not uncommon. Those employed in retail shops may work in the evenings and on weekends. Some work part-time.

Employment

Dispensing opticians held about 64,000 jobs in 1990. Almost half work for ophthalmologists or optometrists who sell glasses directly to patients. Many also work in optical shops or for department stores, drug stores, and other retail outlets, including the so-called "superoptical stores." These stores offer one-stop shopping: Customers may have their eyes examined, choose frames, and have glasses made on the spot.

Training, Other Qualifications, and Advancement

There are several ways of becoming a dispensing optician. Some firms hire individuals with no background in opticianry and train them on the job; others seek trainees who have taken courses in opticianry, completed a formal training program, or have worked as ophthalmic laboratory technicians.

Solid math and science skills are important. Knowledge of physics, basic anatomy, algebra, geometry, and mechanical drawing is particularly valuable since training usually includes instruction in optical mathematics, optical physics, and the use of precision measuring instruments and other machinery and tools. Because dispensing opticians deal directly with the public, they should be tactful and pleasant and communicate well.

In the 22 States that license dispensing opticians, individuals who are trained on the job must register with the State as apprentices and train from 2 to 4 years. Some form of apprenticeship or formal traineeship is offered in most of the other States as well. Large chain stores, for example, generally offer structured apprenticeship programs, while small companies provide more informal on-the-job training.

There are several ways to become an optician.

In addition to receiving technical training, apprentices are taught office management and sales and, under the supervision of an experienced optician, optometrist, or ophthamologist, may work directly with patients in fitting eyeglasses and contact lenses. In States requiring licensure, information about apprenticeships is available from the State agency responsible for occupational licensing.

Formal training in opticianry is offered in community colleges and a few colleges and universities. In 1991, there were about 40 programs. Of these, 20 were accredited by the Commission on Opticianry Accreditation and awarded 2-year associate degrees in ophthalmic dispensing. Some States that license dispensing opticians allow graduates to take the licensure exam immediately upon graduation. Others require a few months to a year of experience.

Some dispensing opticians start as optical laboratory workers. (See the statement on ophthalmic laboratory technicians elsewhere in the *Handbook*.) They generally learn laboratory skills in vocational-technical institutes, trade schools, or programs offered by manufacturers. Such programs last from a few weeks to a year.

Credentials for dispensing opticians are gained through voluntary certification or registration. Certification is offered by the American Board of Opticianry and by the National Contact Lens Examiners, and must be renewed every 3 years through continuing education. In most States that require a license to dispense eyeglasses, continuing education is necessary for relicensure. For specific information about licensing procedures, consult the State board of occupational licensing.

Many experienced dispensing opticians go into business for themselves. Others become managers of retail optical stores or sales representatives for wholesalers or manufacturers of eyeglasses or lenses.

Job Outlook

Employment in this occupation is expected to increase much faster than the average for all occupations through the year 2005 in response to rising demand for corrective lenses, a result of demographic trends. Not only is the population growing, but the number of middle-aged and elderly persons is projected to increase. Middle age is a time when many persons begin using corrective lenses for the first time, and elderly persons require more vision care, on the whole, than others.

Vision screening programs and other efforts to increase public awareness of eye care are likely to stimulate demand as well. Nowadays, there is considerably less stigma attached to wearing eyeglasses than in the past. Industrial safety precautions may require more safety goggles and glasses. Fashion, too, influences demand. The growing variety of frame styles and colors—as well as the increasing popularity of contact lenses—encourages people to buy more than one pair of corrective lenses. Finally, demand is expected to grow in response to products such as special lens treatments; photochromic lenses (glasses that become sunglasses in sunlight), now available in plastic as well as glass; tinted lenses; and bifocal, extended wear, and disposable contact lenses.

This occupation is vulnerable to changes in the business cycle, with employment falling somewhat during downturns and rising during periods of economic recovery. As is generally the case, however, many openings will arise from the need to replace experienced workers who change occupations or stop working.

Employment opportunities in opticianry should be excellent for entry level workers as well as for those with experience. Graduates of formal training programs will continue to be in demand, and applicants with the requisite aptitude for math and science should have little difficulty securing positions as apprentices or trainees.

Earnings

The earnings of dispensing opticians vary considerably; those who work in States that require licensure, and those who run their own stores, often earn more. According to limited information, dispensing opticians averaged about $25,000 a year in 1991, and their salaries ranged from about $18,000 to $35,000 annually.

Related Occupations

Other workers who deal with customers and perform delicate work include jewelers, ocularists, calibrators, ophthalmic laboratory technicians, orthodontic technicians, prosthetics technicians, and watch repairers.

Sources of Additional Information

For general information about this occupation, contact:

☛ Opticians Association of America, 10341 Democracy Lane, P.O. Box 10110, Fairfax, VA 22030.

For a list of accredited training programs, contact:

☛ Commission on Opticianry Accreditation, 10111 Martin Luther King, Jr. Hwy., Suite 100, Bowie, MD 20720-4299.

For general information on opticianry; and a list of home-study programs, seminars, and review materials, contact:

☛ National Academy of Opticianry, 10111 Martin Luther King, Jr. Hwy., Suite 112, Bowie, MD 20720-4299.

EEG Technologists

(D.O.T. 078.362-022)

Nature of the Work

"Brain waves" are electrical impulses which can be recorded by an electroencephalograph (EEG) machine. EEG technologists operate this machine. Since technologists often perform other related tests as well, they may also be called electroneurodiagnostic or neurophysiologic technologists. The tests performed by these technologists help neurologists—physicians who study the brain—to diagnose brain tumors, strokes, toxic/metabolic disorders, and epilepsy; to measure the effects of infectious diseases on the brain; and to determine whether individuals with mental or behavioral problems have an organic impairment such as Alzheimer's disease. They are also used to determine "clinical" death, the absence of brain activity, and to assess the probability of a recovery from a coma.

For basic, "resting" EEG's, technologists take a patient's medical history and help him or her to relax. Then they apply electrodes to designated spots on the patient's head and choose the most appropriate combination of instrument controls and electrodes to produce the kind of record needed. Technologists correct for electrical or mechanical events that come from somewhere other than the brain, such as eye movement or interference from electrical sources.

Increasingly, technologists perform EEG's in the operating room, which requires that they be well versed in anesthesia and its effect on brain waves.

For special procedure EEG's, technologists attach electrodes to a patient's body parts other than the head. They may secure electrodes to the chest, arm, leg, or spinal column to record activity from both the central and peripheral nervous systems.

In ambulatory monitoring, EEG technologists monitor the brain, and sometimes the heart, while patients carry out normal activities over a 24-hour period. Then they remove the small recorder carried by the patients and obtain a readout. Technologists review the readouts, a process which can take several hours, selecting sections for the physician to examine.

Using "evoked potential" testing, technologists measure sensory and physical responses to specific stimuli. After the electrodes have been attached, technologists set the instrument for the type and intensity of the stimulus, increase the intensity until the patient reacts, and note the sensation level. The tests may take from 1 to 4 hours.

For nerve conduction tests, used to diagnose muscle and nerve problems, technologists place electrodes on the patient's skin over a nerve and over the muscle. Then they stimulate the nerve with an electrical current and record how long it takes the nerve impulse to reach the muscle.

Specialized electroneurodiagnostic technologists also administer sleep studies and perform quantative EEG's (sometimes called "brain wave mapping"). For sleep studies, technologists monitor respiration and heart activity in addition to brain wave activity. They must know the various stages of sleep and the characteristic functioning of the neurologic and cardiopulmonary systems during each stage. Technologists coordinate readings from several organ systems, separating them according to the stages of sleep, and relay them to the physician. For quantative EEG's, technologists decide which sections of the EEG should be transformed into color-coded pictures of brain wave frequency and intensity, for interpretation by a physician.

Technologists look for changes in the patient's neurologic, cardiac, and respiratory status, which may indicate an emergency, such as a heart attack, and must provide emergency care until help arrives.

EEG technologists may have supervisory or administrative responsibilities. They may manage an EEG laboratory, arrange work schedules, keep records, schedule appointments, order supplies, and provide instruction in EEG techniques. Technologists also are responsible for the equipment's upkeep.

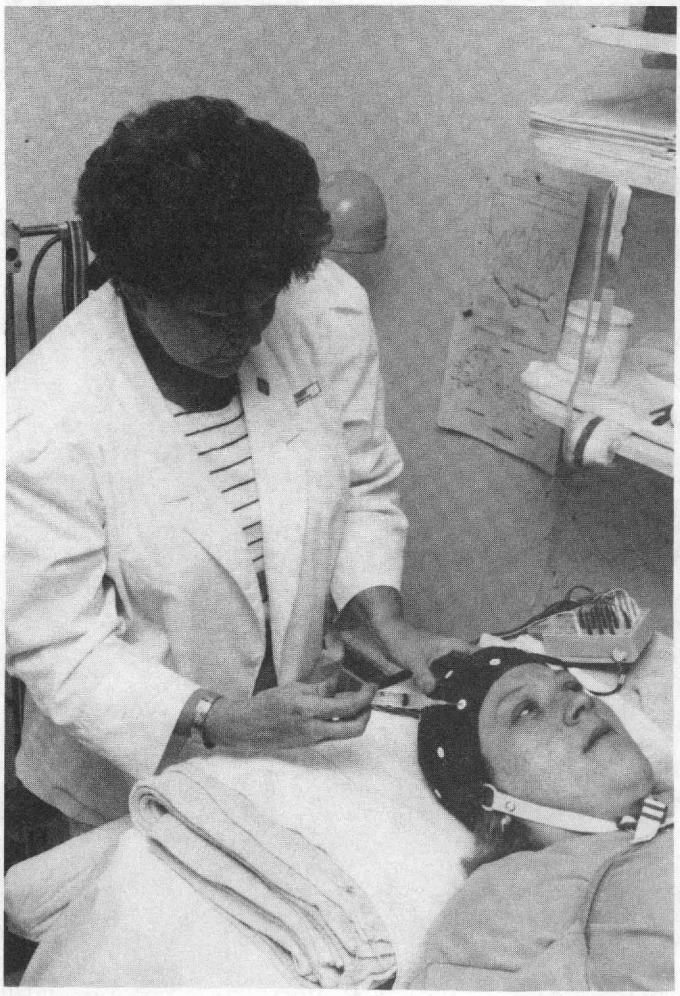
Working Conditions

EEG technologists usually work in clean, well-lighted surroundings, and spend about half of their time on their feet. Bending and lifting are necessary since they may work with patients who are very ill and require assistance. EEG technologists in hospitals may push equipment to the patients' bedsides to obtain recordings.

Most technologists work a standard workweek, although those in hospitals may be "on call" (ready to report to work at a moment's notice) evenings, weekends, and holidays. Those performing sleep studies may work evenings and nights.

Employment

EEG technologists held nearly 6,700 jobs in 1990. Most worked in EEG or neurology laboratories of hospitals. Others worked in offices



Most EEG technologists work in hospitals.

and clinics of neurologists and neurosurgeons, health maintenance organizations, and psychiatric facilities.

Training, Other Qualifications, and Advancement

EEG technologists generally learn their skills on the job, although some complete formal training programs. Applicants for trainee positions in hospitals need a high school diploma. Often, EEG trainees transfer from other hospital jobs, such as licensed practical nurse.

Formal postsecondary training is offered in hospitals and community colleges. In 1990, the Joint Review Committee on Education in Electroneurodiagnostic Technology had approved 14 formal programs. Programs usually last from 1 to 2 years and include laboratory experience as well as classroom instruction in neurology, anatomy, neuroanatomy, physiology, neurophysiology, electronics and instrumentation. Graduates receive associate degrees or certificates.

The American Board of Registration of Electroencephalographic Technologists awards the credential "Registered EEG Technologist" to qualified applicants. This board also accredits technologists in the subspecialty of evoked potential as "Registered Evoked Potential Technologist." Although not generally required for staff level jobs, registration indicates professional competence, and usually is necessary for supervisory or teaching jobs.

Technologists should have manual dexterity, good vision, writing skills, an aptitude for working with electronic equipment, and the ability to work with patients as well as with other health personnel. High school courses in health, biology, and mathematics are useful.

EEG technologists in large hospitals can advance to jobs performing more difficult tests and then to chief EEG technologist, who manages the EEG laboratory. Chief EEG technologists generally are supervised by a physician—an electroencephalographer, neurologist, or neurosurgeon. Technologists may also teach or go into research.

Job Outlook

Employment of EEG technologists is expected to grow much faster than the average for all occupations through the year 2005, reflecting the increased numbers of neurodiagnostic tests performed. There will be more testing as new tests and procedures are developed, and as the older population, which requires more medical care, grows rapidly. Nonetheless, most job openings will result from the need to replace workers who transfer to other occupations or leave the labor force.

Most jobs will still be found in hospitals; however, growth will be fastest in offices and clinics of neurologists. Opportunities for formally trained technologists should be excellent.

Earnings

In January 1991, EEG technologists employed full-time in private hospitals averaged $10.70 an hour, excluding premium pay for overtime and for work on weekends. Average hourly earnings ranged from $9.43 in Dallas to $13.67 in Boston. Those working part-time averaged $11.35 an hour. EEG laboratory supervisors and EEG training program directors generally earn higher salaries.

Related Occupations

Other health personnel who operate medical equipment include EKG technicians, radiologic technologists, nuclear medicine technologist, perfusionists, and cardiovascular technologists.

Sources of Additional Information

Local hospitals can supply information about employment opportunities.

For general information about a career in electroencephalography as well as a list of accredited training programs, contact:

☛ Executive Office, American Society of Electroneurodiagnostic Technologists Inc., Sixth at Quint, Carroll, IA 51401.

Information about specific accredited training programs is also available from:

☛ Joint Review Committee on Electroneurodiagnostic Technology, P.O. Box 11434, Norfolk, VA 23517.

Information on becoming a registered EEG technologist is available from:

☛ American Board of Registration for Electroencephalgraphic Technologists, P.O. Box 11434, Norfolk, VA 23517.

EKG Technicians

(D.O.T. 078.264-010 and 078.362-018)

Nature of the Work

An electro (electrical)- cardio (heart)- gram (record), abbreviated as EKG or ECG, traces electrical impulses transmitted by the heart. EKG technicians operate electrocardiograph machines, which record electrocardiograms.

EKG's help physicians diagnose heart disease, monitor the effect of drug therapy, and analyze changes in a patient's heart over time. The test is done before most kinds of surgery and as part of a routine physical examination for persons who have passed a certain age.

For basic "resting" EKG tests, technicians first explain the procedure to the patient. Then they attach 10 electrodes to the patient's chest, arms, and legs. Technicians apply a gel or cream between the electrodes and the patient's skin to facilitate the passage of the electrical impulses. They manipulate switches on the electrocardiograph or enter information into a computer. Technicians look for and correct technical errors, such as crossed leads, incorrect lead placement, or electrical interference, that prevent an accurate reading. Technicians prepare electrocardiograms for analysis by a physician, usually a cardiologist, noting any abnormal readings.

More skilled EKG technicians perform ambulatory monitoring (also called Holter monitoring, after the physician who developed the equipment) and stress testing. For a Holter monitoring, technicians place electrodes on the patient's chest and attach a portable EKG monitor to the patient's belt. After patients wear the monitor for 24-48 hours while pursuing a normal routine, technicians remove the electrodes and tape, place the tape in a scanner, and read it for electrical interference before sending it to a physician. Sometimes they prepare a report for the physician, noting any significant abnormalities.

For a treadmill stress test, technicians take a medical history, explain the procedure, connect the patient to an EKG monitor, and obtain a baseline reading and resting blood pressure. Then, under supervision of a physician or nurse, they have the patient walk on a treadmill whose speed is gradually increased.

Some EKG technicians schedule appointments, type doctors' interpretations, maintain patients' EKG files, and care for equipment.

Working Conditions

Technicians generally work a 5-day, 40-hour week, which may include Saturdays and Sundays. Those in hospitals and clinics also may work evenings. Technicians spend a lot of time walking and standing.

Employment

Electrocardiograph technicians held about 16,000 jobs in 1990. Most worked in hospital cardiology departments. Some EKG technicians had jobs in cardiologists' offices, cardiac rehabilitation centers, or health maintenance organizations.

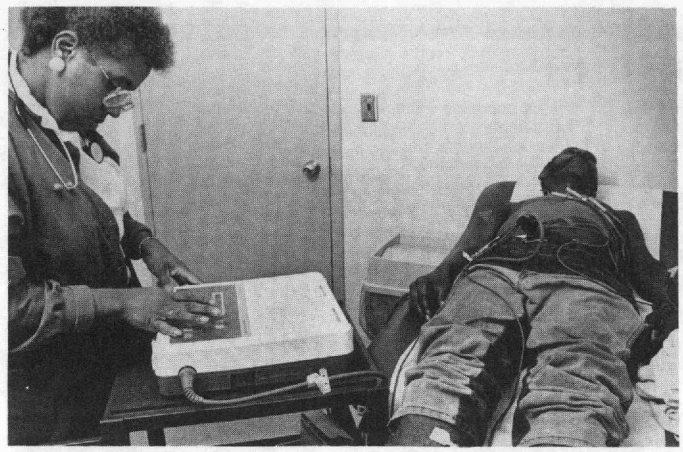
Training, Other Qualifications, and Advancement

Most EKG technicians are trained on the job. Training usually is conducted by an EKG supervisor or a cardiologist and lasts no more than 4 to 6 weeks for the basic "resting" EKG. Learning to handle critically ill patients, interpret graphs, and write reports for a physician takes 4 or 5 months. Specialized EKG tests (ambulatory monitoring and stress tests) require an additional 4 months of training.

Applicants must be high school graduates. Most employers prefer to train people already in the health care field, nursing aides, for example. Applicants for EKG training 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.

For those who want to learn basic EKG's, Holter monitoring, and stress testing, 1-year certificate programs exist. This is becoming a more common way to enter the field.

There are no licensing requirements for basic EKG technicians. Voluntary certification for Holter monitoring and stress testing is



Most EKG technicians are trained on the job.

available through the Cardiovascular Credentialing International/ National Board of Cardiovascular Testing. The Council for the Advancement of Ambulatory Monitoring certifies people who perform Holter monitoring on a consulting basis.

Opportunities for EKG technicians to advance are limited, unless they get additional in-school training. Cardiology technologists, who perform more sophisticated cardiac tests or assist in heart surgery and patient care, generally need to take 2-year junior and community college programs.

Job Outlook

Employment of EKG technicians is expected to decline through the year 2005. Although the number of cardiac tests and procedures performed anticipated to grow, demand for EKG technicians is not likely to keep pace. Many hospitals are reducing EKG technicians' employment by training registered nurses, respiratory therapists, and others to perform EKG procedures. A small but growing number of jobs will be available in offices and clinics of cardiologists. Some job openings, mostly in hospitals, will result from the need to replace technicians who transfer to other jobs or leave the labor force.

Technicians with training in Holter monitoring and stress testing are expected to have more favorable job prospects than those who can only perform a basic EKG.

Earnings

In January 1991, EKG technicians employed full-time in private hospitals averaged $8.66 an hour, excluding premium pay for overtime and for work on weekends. Average hourly earnings ranged from $6.93 in Fort Worth-Arlington to $12.03 in New York City. Those working part-time averaged $8.92 an hour. EKG technicians who perform Holter monitoring and stress testing are paid the most.

Related Occupations

Many other workers perform cardiac tests. Cardiac ultrasound technologists (also known as cardiac sonographers and echocardiographers) perform echocardiograms. Peripheral vascular technicians conduct a variety of imaging tests, including sonographic (sound wave) tests on the arteries and veins. Cardiac catheterization technologists, cardiopulmonary function technologists, and cardiology technologists also assist physicians in diagnosing heart ailments.

Sources of Additional Information

Local hospitals can supply information about employment opportunities.

For a list of training programs in cardiovascular and cardiopulmonary technology, contact:

☛ National Society of Cardiovascular Technology/National Society of Pulmonary Technology (NSCT/NSPT), 1101 14th St. NW., Suite 1100, Washington, DC 20005.

For information about acquiring credentials in cardiovascular and cardiopulmonary technology, contact:

☛ Cardiovascular Credentialing International and National Board of Cardiovascular Testing (CCI/NBVT), P.O. Box 611, Wright Brothers Station, Dayton, OH 45419-0611.

For information on Holter monitoring consulting, contact:

☛ Council for the Advancement of Ambulatory Monitoring, P.O. Box 611, Wright Brothers Station, Dayton, OH 45419-0611.

Emergency Medical Technicians

(D.O.T. 079.374-010)

Nature of the Work

Automobile accident injuries, heart attacks, near drownings, unscheduled childbirths, poisonings, and gunshot wounds all demand urgent medical attention. Emergency medical technicians (EMT's) give immediate care and then transport the sick or injured to medical facilities.

Following instructions from a dispatcher, EMT's—who usually work in teams of two—drive specially equipped emergency vehicles to the scene of emergencies. If necessary, they request additional help from police, fire, or electric company personnel, or they may enlist bystanders to direct traffic or remove debris. They determine the nature and extent of the patient's injuries or illness while also trying to determine whether the patient has epilepsy, diabetes, or other preexisting medical conditions. EMT's then give appropriate emergency care following strict guidelines for which procedures they may perform. All EMT's, including those with basic skills, the EMT-Basic, may open airways, restore breathing, control bleeding, treat for shock, administer oxygen, immobilize fractures, bandage wounds, assist in childbirth, manage emotionally disturbed patients, treat and assist heart attack victims, and give initial care to poison and burn victims.

EMT-Intermediates, or EMT-I's, have more advanced training and can perform such addtional procedures as administer intravenous fluids; treat patients with anti-shock trousers, which prevent a person's blood pressure from falling too low; or use a defibrillator to give life-saving shocks to a stopped heart.

EMT-Paramedics provide the most extensive prehospital care. In addition to the procedures already described, paramedics may administer drugs orally and intravenously, interpret EKG's, perform endotracheal intubations, and use monitors and other complex equipment.

Some conditions are simple enough to be handled following general rules and guidelines. More complicated problems can only be carried out under the step-by-step direction of medical personnel with whom the EMT's are in radio contact.

When victims are trapped, as in the case of an automobile accident, cave-in, or building collapse, EMT's free them or provide emergency care while others free them.

When transporting patients to a medical facility, EMT's may use special equipment such as backboards to immobilize them before placing them on stretchers and securing them in the ambulance. While one EMT drives, the other monitors the patient's vital signs and gives additional care as needed. Some EMT's work for hospital trauma centers or jurisdictions which use helicopters to transport critically ill or injured patients.

At a medical facility, EMT's transfer patients to the emergency department, report to the staff their observations and the care they provided, and may help provide emergency treatment.

After each run, EMT's replace used supplies and check equipment. If patients have had a contagious disease, EMT's decontaminate the interior of the ambulance and report cases to the proper authorities.

Working Conditions

EMT's work both indoors and outdoors, in all kinds of weather. Much of their time is spent standing, kneeling, bending, and lifting. They may risk noise-induced hearing loss from ambulance sirens and back injuries from lifting patients. EMT's may be exposed to diseases such as Hepatitis-B and AIDS, as well as violence from drug overdose victims. The work is not only physically strenuous, but stressful—not surprising in a job that involves life-or-death situations. However, many people find the work exciting and challenging.

EMT's employed by fire departments often have about a 52-hour workweek. Those employed by hospitals often work between 42 and 45 hours a week while those in private firms often work between 53 and 56 hours. Some EMT's, especially those in police and fire departments, are on call for extended periods. Because most ambulance services function 24 hours a day, EMT's have irregular working hours that add to job stress.

Employment

In 1990, there were 89,000 paid EMT's. Two-fifths worked in private ambulance services, about a third worked in municipal fire, police, or rescue squad departments, and a quarter worked in hospitals. In addition, there are many volunteer EMT's.

Most paid EMT's work in metropolitan areas. In many smaller cities, towns, and rural areas, there are no paid EMT jobs. All services are provided by volunteers.

Training, Other Qualifications, and Advancement

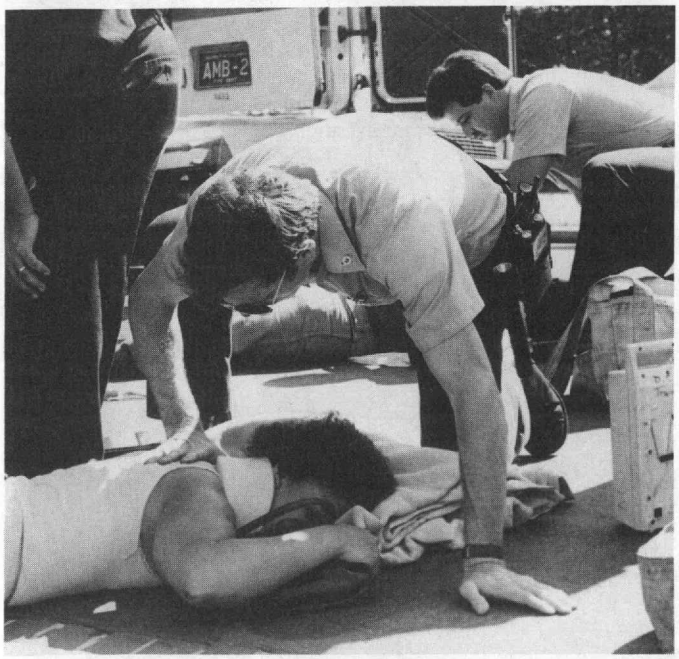
Formal training is needed to become an EMT. EMT-Basic training is 80 to 120 hours of classroom work plus 10 hours of internship in a hospital emergency room. Training is available in 50 States and the District of Columbia, and is offered by police, fire, and health departments; in hospitals; and as a nondegree course in colleges and universities.

The 80- to 120-hour program provides instruction and practice in dealing with bleeding, fractures, airway obstruction, cardiac arrest, and emergency childbirth. Students learn to use and care for common emergency equipment, such as backboards, suction devices, splints, oxygen delivery systems, and stretchers.

EMT-Intermediate training varies from State to State, but includes 35-55 hours of further instruction in patient assessment as well as the use of esophageal airways, intravenous fluids, and antishock garments. Training programs for EMT-Paramedics, of which there were about 540 in 1990, generally last between 750 and 2,000 hours. Refresher courses and continuing education are available for EMT's at all levels.

Applicants to an EMT training course generally must be at least 18 years old and have a high school diploma or the equivalent and a driver's license. Recommended high school subjects for prospective EMT's are driver education, health, and science. Training in the Armed Forces as a "medic" is also good preparation.

Graduates of approved EMT-Basic training programs who pass a written and practical examination administered by the State certifying agency or the National Registry of Emergency Medical Technicians earn the title of Registered EMT-Basic. Prerequisites for taking the EMT-Intermediate examination include registration as an EMT-Basic, required classroom work, and a specified amount of clinical experience and field internship. Registration for EMT-Paramedics by the National Registry of Emergency Medical Technicians or a state emergency medical services agency requires current registration or State certification as an EMT-Basic, completion of an EMT-Paramedic training program, and passing of a written and practical examination. Although not a general requirement for employment, registration acknowledges an EMT's qualifications and may make higher paying jobs easier to obtain.



EMT's learn skills in formal training programs.

All 50 States have some kind of certification procedure. In 30 States and the District of Columbia, registration with the National Registry is required at some or all levels of certification. Other States require their own certification examination or provide the option of taking the National Registry examination.

To maintain their certification, all EMT's must reregister, usually every 2 years. In order to reregister, an individual must be working as an EMT and meet a continuing education requirement.

In addition to EMT training, EMT's in fire and police departments must be qualified as firefighters or police officers.

EMT's should have emotional stability, good dexterity, and physical coordination and be able to lift and carry heavy loads. EMT's need good eyesight (corrective lenses may be used) with accurate color vision.

Advancement beyond the EMT-Paramedic level usually means leaving fieldwork. An EMT-Paramedic can become a supervisor, operations manager, administrative director, or executive director of emergency services. Some EMT's become EMT instructors, firefighters, dispatchers, or police officers. Still others move into sales or marketing of emergency medical equipment. Finally, some become EMT's to assess their interest in health care and then decide to return to school and become R.N.'s or physicians.

Job Outlook

Employment of EMT's is expected to grow about as fast as the average for all occupations through the year 2005. Driving the growth will be a growing population. Also, the number of older people, who are more likely to need emergency services, is growing rapidly. However, slow growth in government spending should constrain growth of EMT employment.

Opportunities for EMT's are expected to be excellent in hospitals and private ambulance services, where pay and benefits usually are low. Competition for jobs will be keen in fire, police, and rescue squad departments because of attractive pay and benefits and good job security.

While new job openings will result from expansion of emergency medical services, most openings will occur because of this occupation's substantial replacement needs. Turnover is quite high, reflecting this occupation's high-stress working conditions, limited advancement potential, and the modest pay and benefits in the private sector.

Earnings

Earnings of EMT's depend on the employment setting and geographic location as well as the individual's training and experience. According to a survey conducted by the *Journal of Emergency Medical Services (JEMS)*, average starting salaries in 1991 were $20,637 for EMT-Ambulance or Basic, $19,220 for EMT-Intermediate, and $23,385 for EMT-Paramedic. EMT's working in fire departments command the highest average annual salaries, as the accompanying table shows.

Table 1. Average annual salaries of emergency medical technicians, by type of employer, 1991

Employer	*Paramedic*	*EMT-1*	*EMT-Basic*
Mean, all employers	$27,320	$23,108	$21,650
Private ambulance services	24,223	19,097	17,227
Hospitals	24,518	18,134	16,401
Fire departments	33,108	32,176	28,029

SOURCE: *Journal of Emergency Medical Services*

Those in emergency medical services which are part of fire or police departments receive the same benefits as firefighters or police officers.

Related Occupations
Other workers in occupations that require quick and level-headed reactions to life-or-death situations are police officers, firefighters, registered nurses, and members of the Armed Forces.

Sources of Additional Information
Information concerning training courses, registration, and job opportunities for EMT's can be obtained by writing to the State Emergency Medical Service Director.

General information about EMT's is available from:
☛ National Association of Emergency Medical Technicians, 9140 Ward Pky., Kansas City, MO 64114.

Medical Record Technicians

(D.O.T. 079.367-014)

Nature of the Work
When you enter a hospital, you see a whirl of white coats of physicians, nurses, radiologic technologists, and others. Every time these health care personnel treat a patient, they record what they observed and did to the patient. This record includes information the patient provides about his or her symptoms and medical history, and also the results of examinations, reports of X-ray and laboratory tests, and diagnoses and treatment plans. Medical record technicians organize and evaluate these records for completeness and accuracy.

When assembling a patient's medical record, technicians first make sure that the medical chart is complete. They ensure that all forms are present and properly identified and signed, or that all necessary information is on a computer file. Sometimes, they talk to physicians or others to clarify diagnoses or get additional information.

Technicians assign a code to each diagnosis and procedure. They consult a classification manual and rely, too, on their knowledge of disease processes. Technicians may then use a packaged computer program to assign the patient to one of several hundred "diagnosis-related groups" or DRG's. The DRG determines the amount the hospital will be reimbursed if the patient is covered by Medicare or other insurance programs that use the DRG system. In large hospitals, technicians who specialize in coding are called medical record coders, coder/abstractors, or coding specialists.

Technicians may also tabulate and analyze data to help improve patient care, to control costs, to be used in legal actions, or to respond to surveys. Technicians known as registrars maintain registries showing occurrences of certain diseases, such as cancer.

Medical record technicians' duties vary with the size of the facility. In large to medium facilities, technicians may specialize in one aspect of medical records or supervise medical record clerks and transcriptionists while a *medical record administrator* manages the department (see the statement on health services managers elsewhere in the *Handbook*). In small hospitals and many nursing homes, an accredited record technician may manage the department.

Working Conditions
Medical record technicians generally work a 40-hour week. Some overtime may be required. In hospitals where medical record departments are open 18-24 hours a day, 7 days a week, they may work on day, evening, and night shifts.

They work in pleasant and comfortable offices. Medical record technician is one of the few health occupations in which there is little or no contact with patients. Accuracy is essential, and this demands concentration and close attention to detail. Medical record technicians who work at video display terminals for prolonged periods may experience eyestrain and musculoskeletal pain.

Employment
Medical record technicians held about 52,000 jobs in 1990. Three out of five jobs were in hospitals. Most of the remainder were in nursing homes, medical group practices, health maintenance organizations, and clinics.

In addition, insurance, accounting, and law firms that deal in health matters employ medical record technicians to tabulate and analyze data from medical records. Public health departments hire technicians to supervise data collection from health care institutions and to assist in research.

Some self-employed medical record technicians are consultants to nursing homes and physicians' offices.

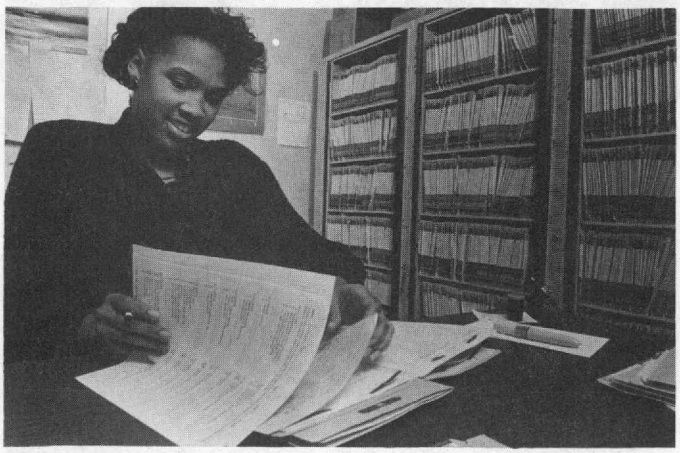
Training, Other Qualifications, and Advancement
Medical record technicians entering the field usually have formal training in a 2-year associate degree program offered at community and junior colleges. Courses include medical terminology and diseases, anatomy and physiology, legal aspects of medical records, coding and abstraction of data, statistics, databases, quality assurance methods, and computers as well as general education.

Technicians may also gain training through an Independent Study Program in Medical Record Technology offered by the American Medical Record Association (AMRA). Hospitals sometimes advance promising medical record clerks to jobs as medical record technicians, although this practice is becoming less common. Advancement generally requires 2-4 years of job experience and successful completion of the hospital's in-house training program.

Most employers prefer to hire Accredited Record Technicians (ART). Accreditation is obtained by passing a written examination offered by the American Medical Record Association. To take the examination, a person must be a graduate of a 2-year associate degree program accredited by the Committee on Allied Health Education and Accreditation (CAHEA) of the American Medical Association, or a graduate of the Independent Study Program in Medical Record Technology who has also obtained 30 semester hours of academic credit in prescribed areas. Technicians who have received training in non-CAHEA accredited programs or on the job are not eligible to take the examination. In 1989, CAHEA accredited 99 programs for medical record technicians.

Experienced medical record technicians generally advance in one of two ways—by specializing or managing. Many senior medical record technicians specialize in coding, particularly Medicare coding. Tumor registry is another specialty area.

In large medical record departments, experienced technicians may become section supervisors, overseeing the work of the coding, correspondence, or discharge sections, for example. Senior technicians with Accredited Record Technician credentials may become director or assistant director of a medical record department in a small facility. However, in larger institutions, they probably will need a bachelor's degree in medical record administration.



Medical record technicians make sure that the medical chart is complete.

Job Outlook

The job prospects for formally trained technicians should be excellent. Employment of medical record technicians is expected to grow much faster than the average for all occupations through the year 2005 due to rapid growth in the number of medical tests, treatments, and procedures and because medical records will be increasingly scrutinized by third-party payers, courts, and consumers.

A change in Medicare reimbursement policies starting January 1990 has increased the need for detailed medical records in offices and clinics of doctors of medicine. This should translate into rapid growth in employment opportunities for medical record technicians in large group practices and offices of specialists. Rapid growth is also expected in health maintenance organizations, nursing homes, and home health agencies. Nonetheless, hospitals will continue to employ the most technicians, and most job openings will occur because of replacement needs.

Earnings

In January 1991, medical record technicians employed full-time in private hospitals earned an average of $9.70, excluding premium pay for overtime and for work on weekends. Average hourly earnings ranged from $8.70 in the Fort Worth-Arlington area to $13.08 in San Francisco. In 1991, medical record technicians employed by the Federal Government averaged $19,660. According to a 1989 survey by the American Medical Record Association, Accredited Record Technicans averaged $22,462.

Related Occupations

Medical record technicians need a strong clinical background to analyze the contents of medical records. Other occupations that require a knowledge of medical terminology, anatomy, and physiology without directly touching the patient are medical secretaries, medical transcriptionists, tumor registrars, medical writers, and medical illustrators.

Sources of Additional Information

Information on careers in medical record technology, including the Independent Study Program, is available from:

☛ American Medical Record Association, 919 N. Michigan Ave., Suite 1400, Chicago, IL 60611.

A list of CAHEA-approved programs for medical record technicians is available from:

☛ American Medical Association, Division of Allied Health Education and Accreditation, 535 N. Dearborn St., Chicago, IL 60610.

Nuclear Medicine Technologists

(D.O.T. 078.161-018 and .361-018)

Nature of the Work

Nuclear medicine is the branch of radiology that uses radionuclides—unstable atoms that emit radiation spontaneously—to diagnosis and treat disease. Radionuclides are purified and compounded like other drugs to form radiopharmaceuticals. Radiopharmaceuticals are administered to patients and then monitored to show the characteristics or functioning of those tissues or organs in which they localize. Abnormal areas show up as higher or lower concentrations of radioactivity than normal.

Nuclear medicine technologists perform these radioactive tests and procedures under the supervision of physicians, who in turn interpret the results. Like radiologic technologists, nuclear medicine technologists operate diagnostic imaging equipment. However, the equipment used in these two specialties relies on different principles, and job duties reflect this. Radiologic technologists create an image by shooting a beam of radiation, commonly called an X-ray, through the patient. (See the statement on radiologic technologists elsewhere in the *Handbook*.) Nuclear medicine technologists prepare and administer radiopharmaceuticals, then operate cameras that detect and map the radioactive drug in the patient's body to create an image.

Technologists first explain test procedures to patients and try to relieve any anxiety. Then nuclear medicine technologists calculate and prepare the correct dosage of the radiopharmaceutical and administer it by mouth, injection, or other means. In preparing radiopharmaceuticals, technologists apply laboratory skills while adhering to safety precautions to keep the radiation dose to workers and patients as low as possible.

Technologists position the patient and start the gamma scintillation camera, or scanner, which creates images of the distribution of the radiopharmaceutical as it passes through or localizes in the patient's body. Technologists produce the images on a computer screen or on film for the physician, who interprets the nuclear medicine study. Some studies, such as cardiac function studies, are processed with the aid of a computer. Technologists who specialize in computer processing may be called "nuclear medicine technology computer specialists."

Nuclear medicine technologists also perform clinical laboratory procedures called radioimmunoassay studies to assess the behavior of the radioactive substance inside the body instead of using a diagnostic image. For example, technologists may add radioactive substances to blood or serum to determine levels of hormones or therapeutic drug content.

Technologists insure that radiation safety procedures are carefully followed by all workers in the nuclear medicine laboratory and that complete and accurate records are kept. They keep patient records and record the amount and type of radionuclides received, used, and disposed of.

Working Conditions

Nuclear medicine technologists generally work a 40-hour week. This may include evening or weekend hours in departments which operate on an extended schedule. Opportunities for part-time and shift work are also available. In addition, technologists in hospitals may be on-call duty on a rotational basis.

Technologists are on their feet much of the day, and may lift or turn disabled patients. Therefore, physical stamina is important.

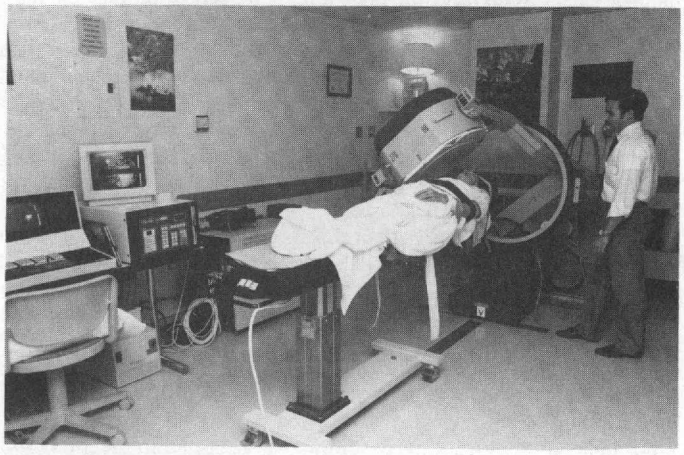
Although there is potential for radiation exposure in this field, exposure is kept to a minimum by the use of shielded syringes, gloves, and other protective devices. Technologists also wear badges that measure radiation levels while they are in the radiation area. The badge measurement rarely approaches or exceeds established safety levels because of safety programs and built-in safety devices.

Employment

Nuclear medicine technologists held about 10,000 jobs in 1990. About 9 out of 10 jobs were in hospitals. The rest were in physicians' offices and clinics, including imaging centers.

Training, Other Qualifications, and Advancement

Nuclear medicine technology programs range in length from 1 to 4 years and may lead to a certificate, associate degree, or bachelor's



Nuclear medicine technologists are on their feet much of the day.

degree. Generally, certificate programs are offered in hospitals; associate programs in community colleges; and baccalaureate programs in 4 year-colleges and in universities. Courses cover physical sciences, the biological effects of radiation exposure, radiation protection and procedures, radiopharmaceuticals and their use with patients, imaging techniques, and computer applications. Associate and bachelor's programs also cover liberal arts.

One-year certificate programs are for health professionals or individuals with a previous science background, especially radiologic technologists and ultrasound technologists wishing to specialize in nuclear medicine. They also attract medical technologists, registered nurses, and others who wish to change fields or specialize.

People not already trained in one of the health occupations have three options: a 2-year certificate program, a 2-year associate program, or a 4-year baccalaureate program.

The Committee on Allied Health Education and Accreditation (CAHEA) accredits most formal training programs in this field. In 1990, there were 107 CAHEA-accredited programs in nuclear medicine technology.

All nuclear medicine technologists must meet the minimum Federal standards on the administration of radioactive drugs and the operation of radiologic equipment. In addition, about half of all States require technologists to be licensed. Technologists also may obtain voluntary professional certification or registration. Registration or certification is available from the American Registry of Radiologic Technologists (ARRT) and from the Nuclear Medicine Technology Certification Board (NMTCB). Many employers prefer to hire certified or registered technologists.

Technologists may advance to supervisor, then to chief technologist, and finally to department administrator or director. Some technologists specialize in a clinical area such as nuclear cardiology or computer analysis or leave patient care to take positions in research laboratories. Some become instructors or directors in nuclear medicine technology programs, a step that usually requires an associate or bachelor's degree in nuclear medicine technology. Others leave the occupation to work as sales or training representatives with health equipment or radiopharmaceutical manufacturing firms, or as radiation safety officers in regulatory agencies or hospitals, positions which build upon their background and experience.

Job Outlook

Employment of nuclear medicine technologists is expected to grow much faster than the average for all occupations through the year 2005. Substantial growth in the number of middle-aged and older persons will spur demand for diagnostic procedures, including nuclear medicine tests. Nuclear medicine is especially beneficial for bone, heart, and brain scans.

Furthermore, technological innovations seem likely to increase the diagnostic uses of nuclear medicine. One example is the use of radiopharmaceuticals in combination with monoclonal antibodies to detect cancer at far earlier stages than is customary today, and without resorting to surgery. Another is the use of radionuclides to examine the heart's ability to meet the body's need for blood. Some technologies are still on the drawing board. Presently large research institutes are using positron emission tomography (PET) imaging to observe metabolic and biochemical changes for neurology, cardiology and oncology procedures. However, the radiopharmaceuticals used in PET imaging have very short half-lives and have to be made on the premises in expensive machines called cyclotrons. Radiopharmaceutical companies are now researching ways for hospitals without cyclotrons to perfrom PET imaging.

Cost considerations will affect the speed with which new applications of nuclear medicine grow. Some promising nuclear medicine procedures, such as PET, are extremely costly, and hospitals contemplating them will have to consider equipment costs, reimbursement policies, and the number of potential users.

Employment prospects are excellent at present; reports of shortages are widespread. The long-run outlook is favorable, inasmuch as the supply of new graduates may not keep pace with demand. Enrollment in accredited training programs has declined in recent years. Unless enrollments increase, shortages should persist.

Earnings

According to a national survey by the University of Texas Medical Branch, the median salary for nuclear medicine technologists in hospitals and medical schools was $28,506 in 1990; the average minimum salary was $23,925, and the average maximum salary was $34,247.

Related Occupations

Nuclear medical technologists operate sophisticated equipment to help physicians and other health practitioners diagnose and treat patients, so do radiologic technologists, diagnostic medical sonographers, cardiology technologists, electroencephalographic technologists, clinical laboratory technologists, perfusionists, and respiratory therapists.

Sources of Additional Information

Additional information on a career as a nuclear medicine technologist is available from:

☛ The Society of Nuclear Medicine-Technologist Section, 136 Madison Ave., New York, NY 10016.

☛ American Society of Radiologic Technologists, 15000 Central Ave., Albuquerque, NM 87123.

For the current list of accredited programs in nuclear medicine technology, write to:

☛ Division of Allied Health Education and Accreditation, American Medical Association, 515 N. State St., Chicago, IL 60610.

Information on certification is available from:

☛ Nuclear Medicine Technology Certification Board, 2970 Clairmont Rd., Suite 610, Atlanta, GA 30329.

☛ The American Registry of Radiologic Technologists, 1255 Northland Dr., Mendota Heights, MN 55120.

Ophthalmic Laboratory Technicians

(D.O.T. 711.381-010; 713.261-010 and -014, .381-010, .681-010; 716.280-008, -010, and -014, .381-014, .382-010, -014, -018, and -022, .462-010, .681-010, and -018, and .682-018)

Nature of the Work

Ophthalmic laboratory technicians—also known as manufacturing opticians, optical mechanics, or optical goods workers—make prescription eyeglass lenses. Some manufacture lenses for other optical instruments, such as telescopes and binoculars. Prescription lenses are curved in such a way that light is correctly focused onto the retina of the patient's eye, improving vision. Ophthalmic laboratory technicians cut, grind, edge, and finish lenses according to specifications provided by dispensing opticians, optometrists, or ophthalmologists, and then assemble the lenses with frames to produce finished glasses.

Ophthalmic laboratory technicians should not be confused with workers in other vision care occupations. Ophthalmologists and optometrists are "eye doctors" who examine eyes, diagnose vision problems, and prescribe corrective lenses. Ophthalmologists also perform eye surgery. Dispensing opticians, who may also do work described here, help patients select frames and lenses, and adjust finished eyeglasses. (See the statement on physicians, which includes ophthalmologists, and the statements on optometrists and dispensing opticians elsewhere in the *Handbook*.)

Technicians read prescription specifications, then select standard glass or plastic lens blanks and mark them to indicate where the curves specified on the prescription should be ground. They place the lens into the lens grinder, set the dials for the prescribed curvature, and start the machine. After a minute or so, the lens is ready to be "finished" by a process in which an oscillating machine rotates the lens against a fine abrasive to grind the lens and smooth out rough edges. The lens is then placed in a polishing machine, with an even finer abrasive, to polish the lens to a smooth, bright finish.

Next, the technician examines the lens through a lensometer, an instrument similar in shape to a microscope, and makes sure the degree and placement of the curve is correct. The technician then cuts the

lenses and bevels the edges to fit the frame, dips each lens into dye if the prescription calls for tinted or coated lenses, polishes the edges, and assembles the lenses and frame parts into a finished pair of glasses.

In small laboratories, technicians generally handle every phase of the operation. In large ones, technicians may specialize in one or more steps, assembly-line style.

Working Conditions

Ophthalmic laboratory technicians work in relatively clean and well-lighted laboratories and have limited contact with the public. Surroundings are relatively quiet despite the humming of machines. At times, technicians may need to wear goggles to protect their eyes, and may spend a great deal of time standing.

Most ophthalmic laboratory technicians work a 5-day, 40-hour week, which may include weekends, evenings or occasionally some overtime. Some work part time.

Ophthalmic laboratory technicians need to take precautions to guard against the hazards associated with cutting glass, handling chemical solutions, and working near machines with moving parts.

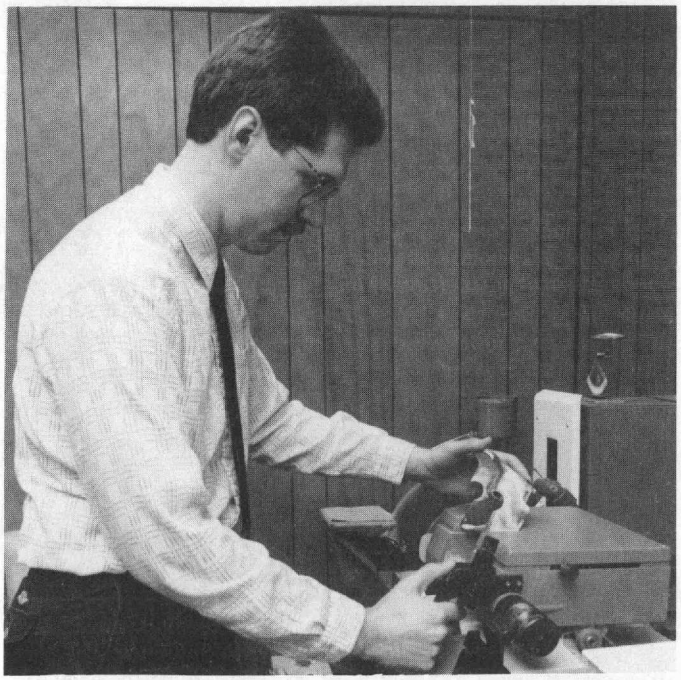
Employment

Ophthalmic laboratory technicians held about 19,000 jobs in 1990. About half of these jobs were in retail stores that manufacture prescription glasses and sell them to their customers—mostly optical goods store chains or independent retailers. Most of the rest were in optical laboratories, that manufacture eyewear for dispensing by retail stores that sell but do not fabricate prescription glasses, and by ophthalmologists and optometrists. A few work for optometrists or ophthalmologists who dispense glasses directly to patients.

Training, Other Qualifications, and Advancement

Nearly all ophthalmic laboratory technicians learn their skills on the job. Employers filling entry level trainee jobs prefer applicants who are high school graduates. Courses in science and mathematics are valuable, while manual dexterity and the ability to do precision work is essential.

Technician trainees first perform simple tasks such as marking or blocking lenses for grinding, then progress to lens grinding, lens cutting, edging, beveling, and eyeglass assembly. Depending on the individual's aptitude, it may take 6 to 18 months to become proficient in all phases of the work.



Ophthalmic laboratory technicians make prescription eyeglasses.

Some ophthalmic technicians learn their trade in the Armed Forces. Others attend one of the small number of programs in optical technology offered by vocational-technical institutes or trade schools. These programs have classes in optical theory, surfacing and lens finishing, and the reading and applying of prescriptions. Programs vary in length from 6 months to 1 year, and award certificates or diplomas.

Ophthalmic laboratory technicians can become supervisors and managers. Some technicians become dispensing opticians, although further education or training may be required.

Job Outlook

Employment of ophthalmic laboratory technicians is expected to increase faster than the average for all occupations through the year 2005 due to rising demand for corrective lenses. Nonetheless, most job openings will come from the need to replace experienced technicians who retire or leave the job for other reasons.

Demographic trends make it likely that many more Americans will wear glasses in the years ahead. Not only will the population grow, but the number of middle-aged and older adults will grow particularly rapidly. Middle age is a time when many people use corrective lenses for the first time, and older persons require appreciably more vision care than the rest of the population.

The public's heightened awareness of vision care should also increase demand for corrective lenses. The emergence of eyewear as a fashion item—eyewear now comes in a assortment of attractive shapes and colors—has been enticing many people to purchase two or three pair of glasses rather than just one. Most new jobs for ophthalmic laboratory technicians will be in retail optical chains that manufacture prescription glasses on the premises and provide fast service.

Earnings

According to limited information, most ophthalmic laboratory technicians earned between $12,000 and $17,000 a year in 1991. Trainees may start at the minimum wage.

Related Occupations

Workers in other precision production occupations include biomedical equipment technicians, calibrators, dental laboratory technicians, orthodontic technicians, orthotics technicians, prosthetics technicians, and instrument repairers.

Sources of Additional Information

For general information about a career as an ophthalmic laboratory technician and for a list of accredited programs in ophthalmic laboratory technology, contact:

☛ Commission on Opticianry Accreditation, 10111 Martin Luther King, Jr. Hwy., Suite 100, Bowie, MD 20720-4299.

Radiologic Technologists

(D.O.T. 078.162-010, .361-034, .362-026 and .364-010)

Nature of the Work

Perhaps the most familiar use of the X-ray is the diagnosis of broken bones. However, medical uses of radiation go far beyond that. Radiation is used not only to produce images of the interior of the body, but to treat cancer as well. At the same time, the rapidly growing use of imaging techniques that do not involve X-rays is transforming the field, and the term "diagnostic imaging" embraces procedures such as ultrasound and magnetic resonance scans as well as the familiar X-ray.

Radiographers produce X-ray films (radiographs) of parts of the human body for use in diagnosing medical problems. They prepare patients for radiologic examinations by explaining the procedure, by removing any articles, such as jewelry, through which X-rays cannot pass, and by positioning the patients so that the correct parts of the body can be radiographed. To prevent unnecessary radiation exposure, technologists surround the exposed area with radiation protection devices, such as lead shields, or in some way limit the size of the

X-ray beam. Radiographers position radiographic equipment at the correct angle and height over the appropriate area of a patient's body. Using instruments similar to a measuring tape, technologists measure the thickness of the section to be radiographed and set controls on the machine to produce radiographs of the appropriate density, detail, and contrast. They place the X-ray film under the part of the patient's body to be examined and make the exposure. Afterward, technologists remove the film and develop it.

Experienced radiographers may perform more complex imaging tests. For fluoroscopies, radiographers may prepare a solution of contrast medium for the patient to drink, allowing the radiologist, the physician who interprets X-rays, to see soft tissues in the body. For computed tomography scans (CTs), radiographers use a computer to enhance the X-ray. For magnetic resonance imaging (MRI), technologists use giant magnets and radio-waves rather than radiation to create an image.

Radiation therapy technologists prepare cancer patients for treatment and administer prescribed doses of ionizing radiation to specific body parts. Technologists operate many kinds of equipment, including high-energy linear accelerators with electron capabilities. They position patients under the equipment with absolute accuracy in order to expose affected body parts to treatment while protecting the rest of the body from radiation.

Technologists also check the patients reactions for radiation side effects such as nausea, hair loss, and skin irritation. They need to give clear instructions and explanations to patients who are likely to be very ill and may be dying. Radiation therapy technologists, in contrast to other areas in radiology, are likely to see the same patient on a daily basis throughout the course of treatment.

Sonographers, also known as ultrasound technologists, use nonionizing, ultrasound equipment to transmit high frequency sound waves into areas of the patient's body, then collect reflected echoes to form an image. The image is viewed on a screen and may be recorded on a printout strip or photographed for use in interpretation and diagnosis by physicians. Sonographers explain the procedure, record additional medical history, and then position the patient for testing. Viewing the screen as the scan takes place, sonographers look for subtle differences between healthy and pathological areas, check for factors such as position, obstruction, or change of shape, and judge if the images are satisfactory for diagnostic purposes. Sonographers may specialize in neurosonography (the brain), vascular sonography, echocardiography (the heart), abdominal (the liver, kidneys, spleen, and pancreas), obstetrics/gynecology, and opthalmology (the eye).

Radiologic technologists must precisely follow physicians' instructions and regulations concerning use of radiation to insure that they, patients, and co-workers are protected from its dangers.

In addition to preparing patients and operating equipment, radiologic technologists keep patient records and adjust and maintain equipment. They may also prepare work schedules, evaluate equipment purchases, or manage their department.

Working Conditions

Radiologic technologists generally work a 40-hour week that may include evening and weekend or on-call hours. Part-time work is widely available.

Technologists are on their feet for long periods and may lift or turn disabled patients. They work close to the machines. Some technologists travel in mobile imaging vans; however, most work in hospitals, physicians' offices, or imaging centers.

Radiation therapy technologists are prone to emotional "burn out" since they treat extremely ill and dying patients on a daily basis.

Although potential radiation hazards exist in this field, they have been minimized by the use of lead aprons, gloves, and other shielding devices, as well as by instruments that measure radiation exposure. Technologists wear badges that measure radiation levels in the radiation area, and detailed records are kept on their cumulative lifetime dose.

Employment

Radiologic technologists held about 149,000 jobs in 1990. Most technologists were radiographers. A small proportion were sonographers and radiation therapy technologists.

About 3 out of 5 jobs are in hospitals. The rest are in physicians' offices and clinics, including diagnostic imaging centers.

Training, Other Qualifications, and Advancement

Preparation for this field is offered in hospitals, colleges and universities, vocational-technical institutes, and the Armed Forces. Hospitals, which employ most radiologic technologists, prefer to hire those with formal training.

Formal training is offered in radiography, radiation therapy technology, and diagnostic medical sonography (ultrasound). Programs range in length from 1 to 4 years and lead to a certificate, associate degree, or bachelor's degree. Two-year programs are most prevalent.

Some 1-year certificate programs are for individuals from other health occupations such as medical technologists and registered nurses who want to change fields or experienced radiographers who want to specialize in radiation therapy technology or learn sonography. A bachelor's or master's degree in one of the radiologic technologies is desirable for supervisory, administrative, or teaching positions.

The Committee on Allied Health Education and Accreditation (CAHEA) accredits most formal training programs for this field. CAHEA accredited 672 radiography programs, 104 radiation therapy technology programs, and 38 diagnostic medical sonography programs in 1990.

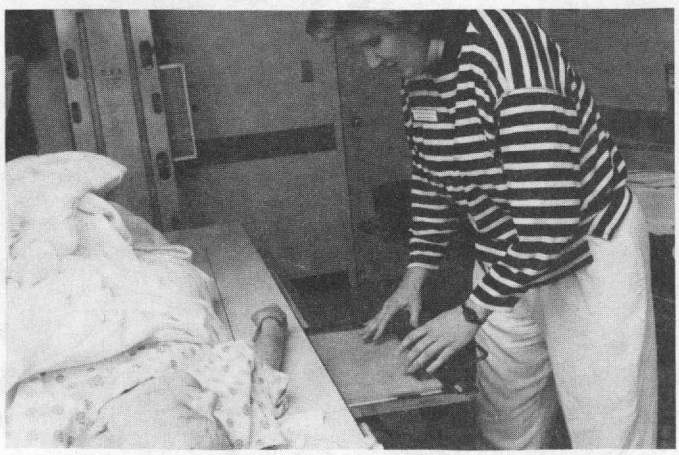
Radiography programs require, at a minimum, a high school diploma or the equivalent. High school courses in mathematics, physics, chemistry, and biology are helpful. The programs provide both classroom and clinical instruction in anatomy and physiology, patient care procedures, radiation physics, radiation protection, principles of imaging, medical terminology, positioning of patients, medical ethics, radiobiology, and pathology.

For training programs in radiation therapy and diagnostic medical sonography, applicants with a background in science, or experience in one of the health professions, generally are preferred. Most programs consider applicants with liberal arts backgrounds, however, as well as high school graduates with courses in math and science.

Radiographers and radiation therapy technologists are covered by provisions of the Consumer Patient Radiation Health and Safety Act of 1981, which aims to protect the public from the hazards of unnecessary exposure to medical and dental radiation by making sure that operators of radiologic equipment are properly trained. The act requires the Federal Government to set standards that the States, in turn, may use for accrediting training programs and certifying individuals who engage in medical or dental radiography.

By 1990, 23 States required radiographers to be licensed, and 20 required radiation therapy technologists to be licensed. (Puerto Rico requires a license for the practice of either specialty.) One State, Utah, licenses diagnostic medical sonographers.

Voluntary registration is offered by the American Registry of Radiologic Technologists (ARRT) in both radiography and radiation therapy technology. The American Registry of Diagnostic Medical



Radiographers place X-ray film under the part of the patient's body to be examined and make the exposure.

Sonographers (ARDMS) certifies the competence of sonographers. To become registered, technologists must be graduated from a CAHEA-accredited school or meet other prerequisites and have passed an examination. Many employers prefer to hire registered technologists.

With experience and additional training, staff technologists in large radiography departments may be promoted to clinical jobs performing special procedures including CT scanning, ultrasound, angiography, and magnetic resonance imaging. Experienced technologists may also be promoted to supervisory positions such as supervisor, chief technologist, and—ultimately—department administrator or director. Depending on the institution, courses in business or a master's degree in health administration may be necessary for the director's position. Some technologists progress by becoming instructors or directors in radiologic technology programs; others take jobs as sales representatives or instructors with equipment manufacturers.

With additional education, available at major cancer centers, radiation therapy technologists can specialize and become medical radiation dosimetrists. Dosimetrists work with health physicists and oncologists (physicians who specialize in the study and treatment of tumors) to develop treatment plans.

Job Outlook

Employment in the field of radiologic technology is expected to grow much faster than the average for all occupations through 2005 because of the vast clinical potential of diagnostic imaging and therapeutic technology. Current as well as new uses of imaging equipment are virtually certain to sharply increase demand for radiologic technologists.

Technology will continue to evolve. New generations of diagnostic imaging equipment are expected to give even better information to physicians. Since it is non-invasive, it will be less risky and uncomfortable for the patient than the exploratory surgery of today. Computed tomography, magnetic resonance imaging, arteriography, and digital vascular imaging have taken hold very quickly. Applications of diagnostic ultrasound—already in wide use in cardiology and obstetrics/gynecology—are expected to grow.

In the treatment area, radiation therapy will continue to be used—alone or in combination with surgery or chemotherapy—to treat cancer. More treatment of cancer is anticipated due to the aging of the population, educational efforts aimed at early detection, and improved ability to detect malignancies through radiologic procedures such as mammography.

However, the speed with which institutions adopt new technologies depends largely on cost and reimbursement considerations. Although physicians are enthusiastic about the clinical benefits, the willingness of third-party payers (insurers) to pay for a particular procedure governs the facilitities' decision to adopt costly technology. Some promising new technologies may not come into widespread use because they are too expensive, but on the whole, it appears that the benefits to physicians and patients are so great that new uses of radiologic procedures will continue to grow.

Hospitals will remain the principal employer of radiologic technologists. However, employment is expected to grow most rapidly in offices and clinics of physicians, including diagnostic imaging centers. Health facilities such as these are expected to grow very rapidly through 2005 due to the strong shift toward outpatient care, encouraged by third party payers and made possible by technological advances that permit more procedures to be performed outside the hospital.

Technologists are even working on the road. In response to rural needs, radiologic technologists travel in large vans equipped with sophisticated diagnostic equipment. This trend is likely to continue.

Most jobs will come from the need to replace technologists who leave the occupation. Turnover is relatively high in radiation therapy technology, because of the stress in treating patients who may be close to death.

Currently there are reports of a shortage of technologists, especially radiation therapy technologists. However, efforts by employers to fill vacancies—raising salaries and improving working conditions—could attract more people to radiology and eventually create a balance between jobseekers and openings.

Earnings

In January 1991, radiologic technologists working full-time in private hospitals averaged $12.75 an hour, excluding premium pay for overtime and for work on weekends, holidays, and late shifts. Average hourly earnings ranged from $11.83 in the Fort Worth-Arlington area to $19.11 in San Francisco. Radiologic technologists working part-time averaged $12.76 an hour. Diagnostic medical sonographers working full-time averaged $14.47 an hour; their average hourly earnings ranged from $13.38 in Denver to $18.06 in San Francisco. Those working part-time averaged $15.18 an hour.

According to a University of Texas Medical Branch survey of hospitals and medical schools, the median salary for radiation therapy technologists was $29,162 in 1990; the average minimum salary was $24,699, and the average maximum salary was $35,811.

Related Occupations

Radiologic technologists operate sophisticated equipment to help physicians, dentists, and other health practitioners diagnose and treat patients. Workers in related occupations include nuclear medicine technologists, cardiology technologists, cardiovascular technologists, perfusionists, respiratory therapists, clinical laboratory technologists, and electroencephalographic technologists.

Sources of Additional Information

For career information, enclose a stamped, self-addressed business-size envelope with your request to:

☛ American Society of Radiologic Technologists, 15000 Central Ave. SE., Albuquerque, NM 87123.

☛ Society of Diagnostic Medical Sonographers, 12225 Greenville Ave., Suite 434, Dallas, TX 75231.

Information about a career in radiation therapy technology is also available from your local chapter of the American Cancer Society.

For the current list of accredited education programs in radiography, radiation therapy technology, or diagnostic medical sonography, write to:

☛ Division of Allied Health Education and Accreditation, American Medical Association, 515 N. State St., Chicago, IL 60610.

For information on certification in radiologic technology, contact:

☛ American Registry of Radiologic Technologists, 1255 Northland Dr., Mendota, MN 55120.

For information on certification in sonography, contact:

☛ American Registry of Diagnostic Medical Sonographers, 2368 Victory Pky., Suite 510, Cincinnati, OH 45206.

Surgical Technologists

(D.O.T. 079.374-022)

Nature of the Work

Surgical technologists, also called operating room technicians, assist in operations under the supervision of surgeons or registered nurses. Before an operation, surgical technologists help set up the operating room with surgical instruments, equipment, sterile linens, and fluids such as saline (a salt solution), or glucose (a sugar solution). They also may "prep" (prepare) patients for surgery by washing, shaving, and disinfecting body areas where surgeons will operate. They transport patients to the operating room. cover them with special surgical "drapes," and help position them on the operating table.

During surgery, technologists pass instruments and other sterile supplies to surgeons and surgeons' assistants. They may hold retractors, cut sutures, and help count sponges, needles, supplies, and instruments. Surgical technologists help prepare, care for, and dispose of specimens taken for laboratory analysis and may help apply dressings. They may operate sterilizers, lights, or suction machines, and help operate diagnostic equipment.

After an operation, surgical technologists may help transfer patients to the recovery room and clean and restock the operating room.

Working Conditions

Surgical technologists work in clean, well-lighted, cool environments. They need stamina to be on their feet and must be alert and able to concentrate throughout operations that may last several hours.

Most surgery is performed during the day, but some workplaces, such as emergency surgical units, require 24-hour coverage. A 40-hour workweek is normal for surgical technologists, although they may be "on call" (available to work on short notice for emergencies) during weekends and evenings on a rotating basis.

Employment

Surgical technologists held about 38,000 jobs in 1990. Most surgical technologists are employed by hospitals. Others are employed in offices and clinics of physicians that have operating, delivery, and emergency room facilities. A few, known as private scrubs, are employed directly by surgeons who have special surgical teams like those for liver transplants.

Training, Other Qualifications, and Advancement

Surgical technologists receive their training in formal programs offered by community and junior colleges, vocational and technical institutes, or hospitals. In 1991, the Committee on Allied Health Education and Accreditation (CAHEA) of the American Medical Association recognized 117 accredited programs. High school graduation normally is required for admission. Programs last 1 to 2 years and lead to a certificate or associate degree.

Programs provide classroom education and supervised clinical experience. Required study includes anatomy, physiology, microbiology, pharmacology, and medical terminology. Other studies cover care and safety of patients during surgery, aseptic techniques, and surgical care procedures. Students also learn to sterilize instruments; prevent and control infection; and handle special drugs, solutions, supplies, and equipment.

Hospital-based programs last from 6 months to 1 year. The shorter programs are for licensed practical nurses, who already have some medical background. Some surgical technologists are trained in the Armed Forces. Surgical technologists are expected to keep abreast of new developments in the field.

Idaho is the only State that requires surgical technologists to be licensed. But technologists may obtain voluntary professional certification from the Liaison Council on Certification by passing a national certification examination. Technologists wishing to become certified after 1993 must also have been graduated from a formal program. Continuing education or reexamination is required to maintain certification, which must be renewed every 6 years. Many employers prefer to hire certified technologists.

Surgical technologists need manual dexterity because they must handle instruments quickly. They also must be conscientious, orderly, and emotionally stable to handle the demands of surgeons. Technologists must respond quickly and have a knowledge of procedures so that they may have instruments ready for surgeons without having to be told. Recommended high school courses include health, biology, chemistry, and mathematics.

Career advancement for surgical technologists is limited. Technologists may work as scrub technologists, cleaning and handing instruments to surgeons . They may also work as circulating technologists. A circulating technologist is the "unsterile" member of the surgical team who prepares patients; helps with anesthesia; gets, opens, and holds packages for the "sterile" person during the procedure; interviews the patient before surgery; and answers the surgeon's questions about the patient during the surgery. Some technologists advance to first assistants, who help with retracting, sponging, suturing, cauterizing bleeders, and assisting in closing and treating wounds. With additional training, they can work with lasers and assist in the more complex procedures such as open heart surgery. However, other health personnel like surgeons' assistants may perform the first assistant functions instead of technologists. Surgical technologists may leave the operating room to manage central supply departments. Some technologists leave health facilities to take positions with insurance companies, sterile supply services, or operating equipment firms. Others become instructors in surgical technology training programs.

Surgical technologists pass instruments and other sterile supplies to surgeons and surgeons' assistants.

Job Outlook

Employment of surgical technologists is expected to grow much faster than the average for all occupations through the year 2005, as the volume of surgery increases and operating room staffing patterns change.

The number of surgical procedures is expected to rise as the population grows and ages. Older people require more surgical procedures. Technological advances, such as fiber optics and laser technology, will also permit new surgical procedures.

In addition, operating room staffing patterns are changing. Some employers are substituting technologists for operating room nurses to reduce costs and because in some areas they have difficulty hiring operating room nurses. However, some facilities and States limit the work that surgical technologists can do, so surgical technologists will never totally replace operating room nurses.

Hospitals will continue to be the primary employer of surgical technologists. Nonetheless, the shift to outpatient or ambulatory surgery will create faster growth for technologists in offices and clinics of physicians, including "surgicenters."

Earnings

In January 1991, surgical technologists working full-time in private hospitals averaged $10.03 an hour, excluding premiums for overtime and for work on weekends, holidays, and late shifts. Average hourly earnings ranged from $9.46 in St. Louis to $13.03 in San Francisco.

Related Occupations

Other health occupations requiring approximately 1 year of training after high school are licensed practical nurses, respiratory therapy technicians, medical laboratory assistants, medical assistants, dental assistants, optometric assistants, and physical therapy aides.

Sources of Additional Information

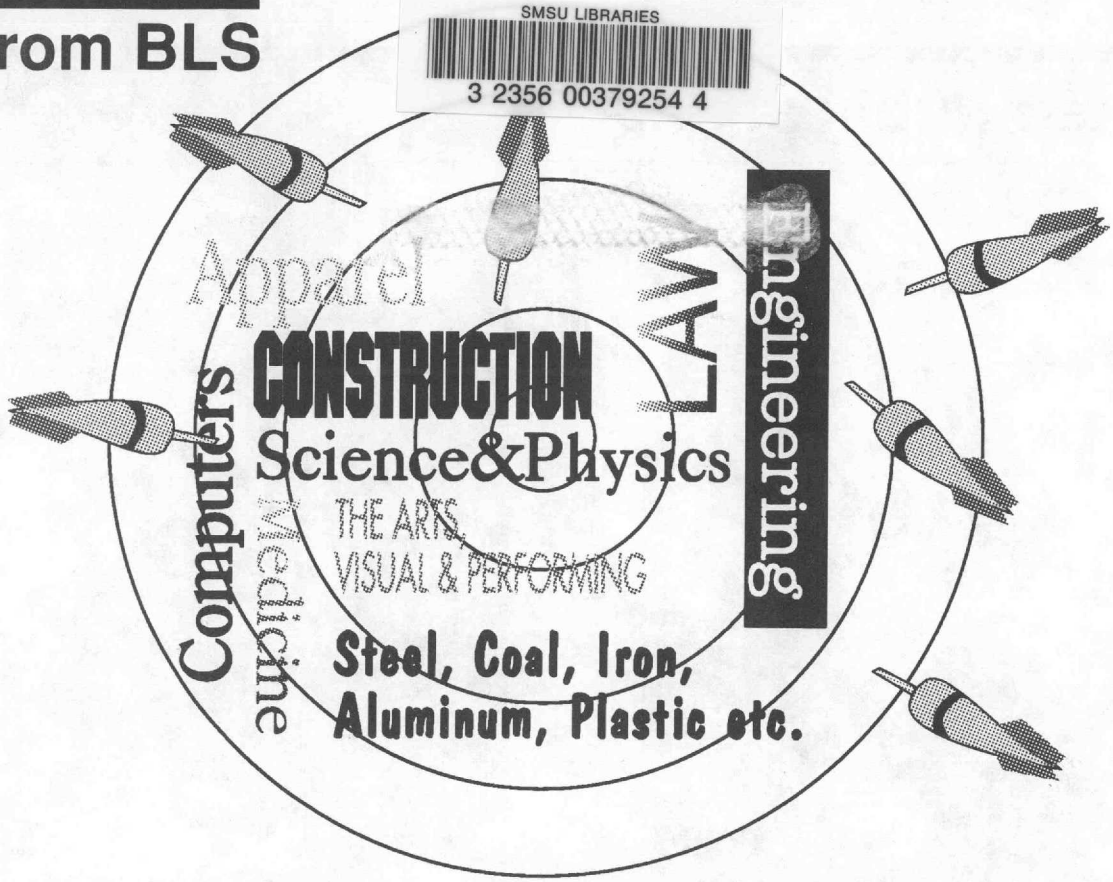
Additional information on a career as a surgical technologist and on certification is available from:

☛ Association of Surgical Technologists, 7108-C S. Alton Way, Englewood, CO 80112.

For a list of CAHEA accredited programs, contact:

☛ American Medical Association, Division of Allied Health Education and Accreditation, 515 North State St., Chicago, IL 60610.

New from BLS



Do you want to know more about work in industries?

- Number of jobs
- Geographic areas having the most jobs
- Size of establishments
- Goods and services produced
- Kinds of workers employed—what types of work is done
- Common working conditions and hazards
- Jobs that can be entered from high school; from college
- Jobs that do not require specialized education or training
- Opportunities for acquiring skills
- Prospects for upward mobility
- Long-term employment outlook
- Reasons for changing staffing patterns
- Earnings of key occupations

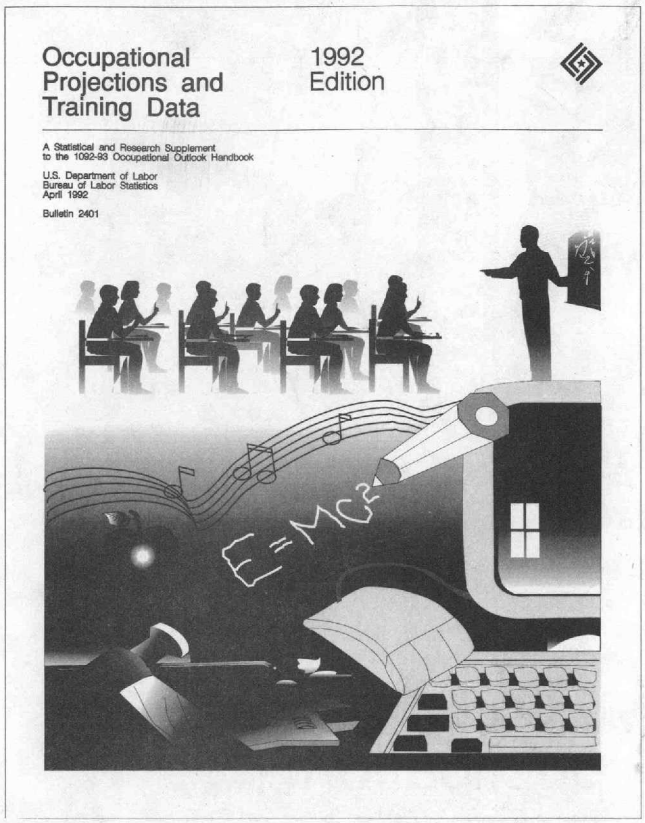
Then, don't miss this new publication!

Career Guide to Industries

Career Guide to Industries, BLS Bulletin 2403, was produced by the same staff that prepares the *Occupational Outlook Handbook*—the Federal Goverment's premier career guidance publication. This new book is a must for guidance counselors, individuals planning their careers, job seekers, and others who want the latest word on career information from an industry perspective.

Note: At press time, the price for this publication was not available. Contact any of the Bureau of Labor Statistics Regional Offices listed on the inside front cover, or the Division of Occupational Outlook, Bureau of Labor Statistics, Washington, DC 20212.

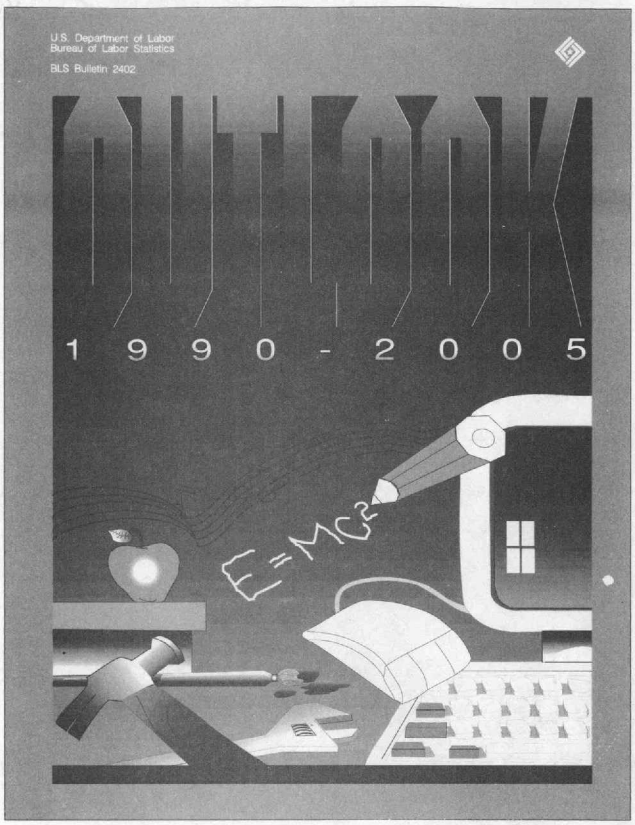
Related Publications



BLS Bulletin 2401

Occupational Projections and Training Data, 1992 Edition

This supplement to the *Occupational Outlook Handbook* provides the statistical and technical data supporting the information presented in the *Handbook*. Education and training planners, career counselors, and jobseekers can find valuable information that ranks occupations by employment growth, earnings, susceptibility to unemployment, separation rates, and part-time work.



BLS Bulletin 2402

Outlook 1990-2005

Every 2 years, the Bureau of Labor Statistics produces detailed projections of the U.S. economy and labor force. This bulletin presents the Bureau's latest analyses of economic and industrial growth, the labor force, and trends in occupational employment into the 21st century. An overview article focuses on important issues raised by these projections.

Note:
At press time, prices for these publications were not available. For prices and ordering information, contact any of the Bureau of Labor Statistics Regional Offices listed on the inside of the front cover, or the Division of Occupational Outlook, Bureau of Labor Statistics, Washington, DC 20212.