

L 2.3: 2450-9 Health Technologists and Technicians



Reprinted from the
Occupational Outlook Handbook, 1994-95 Edition

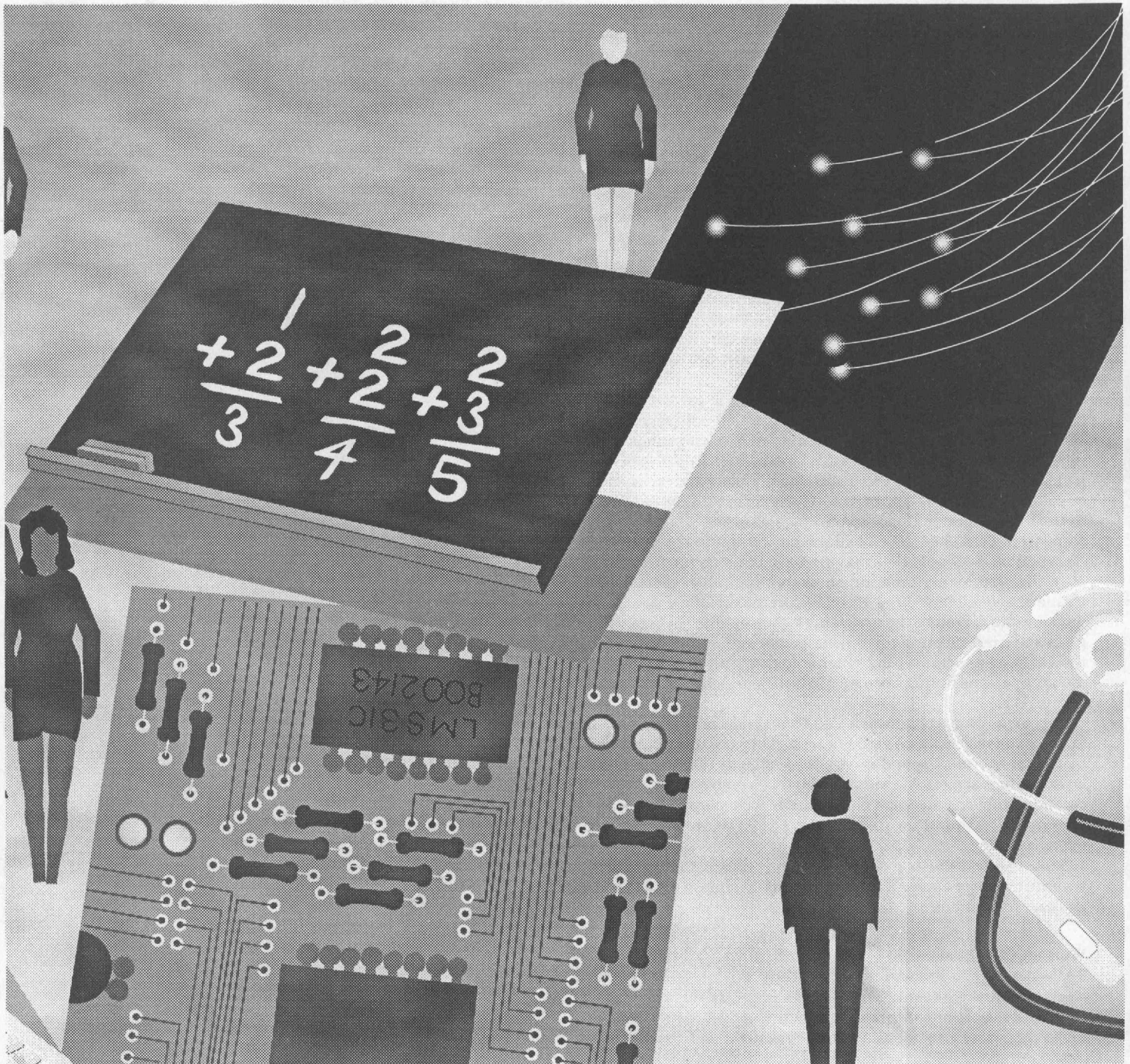
U.S. Department of Labor
Bureau of Labor Statistics

Bulletin 2450-9

ISBN 0-16-043056-9



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P-0745: E.S.J

Cardiovascular Technologists and Technicians

(D.O.T. 078.264-010, .362-018, -030, -050, -062, .364-014, and .367-010)

Nature of the Work

Cardiovascular technologists and technicians assist physicians in diagnosing and treating cardiac (heart) and peripheral vascular (blood vessel) ailments.

Cardiovascular technicians who obtain electro (electrical)-cardio (heart)-grams (record), abbreviated EKG's or ECG's, which trace electrical impulses transmitted by the heart, are known as *electrocardiograph (ECG or EKG) technicians*. To take a "basic" EKG, technicians attach electrodes to the patient's chest, arms, and legs, then manipulate switches on an electrocardiograph machine to obtain the reading. 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.

More skilled EKG technicians perform Holter monitor 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 24-48 hours of normal routine for the patient, they remove a tape from the monitor, place it in a scanner and read it for electrical interference before sending it to a physician.

For a treadmill stress test, EKG technicians take a medical history, explain the procedure, connect the patient to an EKG monitor, and obtain a baseline reading and resting blood pressure. They then monitor the patient's heart while on a treadmill, gradually increasing the speed of the treadmill to observe the effect of increased exertion. Those who do EKG and stress tests are also known as noninvasive technicians.

Cardiovascular technologists who specialize in cardiac catheterization procedures, also known as invasive technology, are called *cardiology technologists*. They assist a physician who winds a small tube, or catheter, through a patient's blood vessel, from a spot on the patient's leg into the heart to determine if a blockage exists and for other diagnostic purposes. In balloon angioplasty, a procedure used to treat blockages of blood vessels, technologists assist physicians who insert a catheter with a balloon on the end to the point of the obstruction. Technologists may prepare patients for these procedures by positioning them on an examining table, then shaving, cleaning, and administering anesthesia to the top of the patient's leg near the groin. During the procedures, they monitor patients' blood gases and heart rate using EKG equipment and notify the physician if something appears wrong. Technologists may also prepare and monitor patients during open heart surgery and the implantation of pacemakers.

Cardiovascular technologists and technicians may also specialize in noninvasive peripheral vascular tests. They use ultrasound equipment that transmits sound waves, then collects the echoes to form an image on a screen. Individuals who focus on blood flows and circulation problems are known as *vascular technologists*, while those who use ultrasound on the heart are referred to as *echocardiographers*.

Some cardiovascular technologists and technicians schedule appointments, type doctor's interpretations, maintain patient's files, and care for equipment.

Working Conditions

Technologists and technicians generally work a 5-day, 40-hour week, which may include Saturdays and Sundays. Those in catheterization labs tend to work longer hours and also may work evenings. They may also be on call during the night and on weekends.

In addition, they spend a lot of time walking and standing. Cardiology technologists may face stressful working conditions during operating procedures and are in contact with patients who have serious heart ailments.

Employment

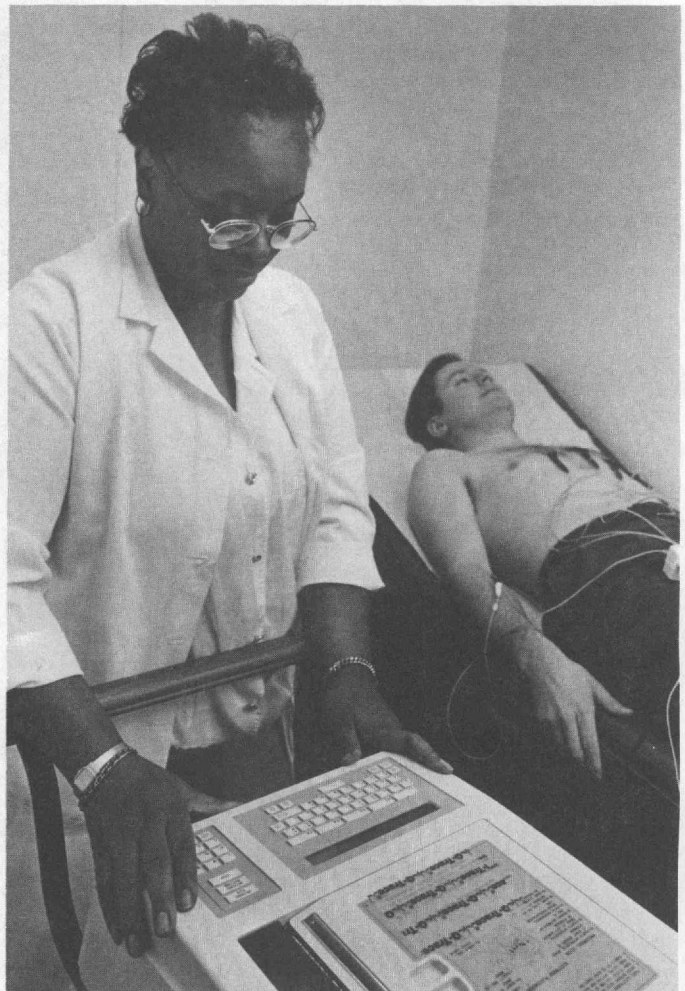
Cardiovascular technologists and technicians held about 31,000 jobs in 1992. Most worked in hospital cardiology departments, while some worked in cardiologists' offices, cardiac rehabilitation centers, or health maintenance organizations. More than half were EKG technicians.

Training, Other Qualifications, and Advancement

For basic EKGs, Holter monitoring, and stress testing, 1-year certificate programs exist, although most EKG technicians are still trained on the job by an EKG supervisor or a cardiologist. On-the-job training usually lasts about 8 to 16 weeks. Applicants must be high school graduates. Most employers prefer to train people already in the health care field, nursing aides, for example.

Most vascular technologists are trained on the job although some have backgrounds in nursing and sonography.

Cardiology technologists need to complete a 2-year junior or community college program. One year is dedicated to core courses followed by a year of specialized instruction in either invasive, noninvasive, or noninvasive peripheral cardiology. Those who are



EKG technicians operate machines that record electrical impulses transmitted by the heart.

qualified in a related allied health profession only need to complete the year of specialized instruction.

Cardiovascular technologists 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.

Job Outlook

Overall employment in this field is expected to grow more slowly than the average for all occupations through the year 2005, but technicians and technologists will experience different patterns of employment change. Employment of EKG technicians is expected to decline. Although the number of cardiac tests and procedures performed is anticipated to grow, demand for EKG technicians is not likely to keep pace because many hospitals are expected to train registered nurses and others to perform basic EKG procedures. Individuals trained in Holter monitoring and stress testing are expected to have more favorable job prospects than those who can only perform a basic EKG. Some openings will occur as EKG technicians transfer to other jobs or leave the labor force.

Employment of cardiology technologists is expected to grow faster than average for all occupations. Growth will occur as the population ages, because older people have a higher incidence of heart problems.

Earnings

According to a University of Texas Medical Branch national survey of hospitals and medical centers, the median annual salary of EKG technicians, based on a 40 hour week and excluding shift and area differentials, was \$17,222 in October 1992. The average minimum salary was \$15,223 and the average maximum was \$21,868.

According to the American Society for Cardiovascular Professionals, the average salary for cardiovascular technologists was \$28,756 in 1991.

Related Occupations

Cardiovascular technologists and technicians operate sophisticated equipment to help physicians and other allied health practitioners diagnose and treat patients, so do radiologic technologists, diagnostic medical sonographers, electroencephalographic technologists, perfusionists, and respiratory therapists.

Sources of Additional Information

Local hospitals can supply information about employment opportunities.

For general information about a career in EKG and cardiovascular technology contact:

☞ American Society for Cardiovascular Professionals, 10500 Wakeman Dr., Fredericksburg, VA 22407.

For a list of accredited programs in cardiovascular technology, contact:

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

For information on vascular technology, contact:

☞ The Society of Vascular Technology, 1101 Connecticut Ave. NW., Suite 700, Washington, DC 20036.

For information on cardiovascular technology, contact:

☞ American College of Cardiology, 9111 Old Georgetown Rd., Bethesda, MD 20814-1699.

Clinical Laboratory Technologists and Technicians

(D.O.T. 078.121-010, .221-010, .261-010, -014, -026, -030, and -038, .281-010, .381-014, .687-010, and 559.361-010)

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 microorganisms; 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 analyze 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 microorganisms; 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 microorganisms 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 independent laboratories that operate continuously, personnel usually work the day, evening, or night shift, and may work weekends and holidays. Laboratory personnel in small facilities may 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 infection control and sterilization are followed, few hazards 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 268,000 jobs in 1992. More than half worked in hospitals. Most



Experienced clinical technologists may advance to supervisory positions.

others worked in medical laboratories and offices and clinics of physicians. Some worked in blood banks, research and testing laboratories, and in the Federal Government—for Department of Veterans Affairs 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, and specialized courses devoted to knowledge and skills used in the clinical laboratory. Many programs also offer or require courses in management, business, and computer applications.

Masters degrees in medical technology and related clinical laboratory sciences provide training for specialized areas of laboratory work or teaching, administration, or research. Two universities offer doctorates in clinical laboratory technology.

Medical laboratory technician training is offered in community and junior colleges, hospitals, vocational and technical schools, and in the Armed Forces. A few technicians learn on the job. Community and junior college programs last 2 years and lead to an associate degree. Others are shorter and lead to a certificate in medical laboratory technology.

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 methods of assuring the skill and competence of workers. 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 most 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 crucial 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 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. A doctorate is needed to become a laboratory director. Technicians can become technologists through additional education and experience.

Job Outlook

As in most occupations, replacement needs will be the main source of job openings. Employment of clinical laboratory workers is expected to grow about as fast as the average for all occupations through the year 2005 creating additional job openings. The rapidly growing older population will spur demand, since older people generally have more medical problems. Technological changes will have two opposite effects on employment. New, more powerful diagnostic tests will encourage more testing and spur employment. However, advances in laboratory automation and simpler tests, which make it possible for each worker to perform more tests, should slow growth. 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 independent 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. Slower growth is expected in hospitals.

Earnings

Median annual earnings of full time, salaried clinical laboratory technologists and technicians were \$26,312 in 1992. Half earned between \$19,136 and \$32,864. The lowest 10 percent earned less than \$14,664 and the top 10 percent more than \$39,000.

According to a University of Texas Medical Branch national survey of hospitals and medical centers, the median annual salary of medical technologists, based on a 40 hour week and excluding shift or area differentials, was \$31,202 in October 1992. The average minimum salary was \$24,888 and the average maximum was \$36,844. For medical laboratory technicians, the median was \$23,340; for histology technicians, the median was \$25,605; for cytotechnologists, the median was \$34,414; and for phlebotomists, the median was \$16,209.

Related Occupations

Clinical laboratory technologists and technicians analyze body fluids, tissue, and other substances using a variety of tests. Similar 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 12277, Chicago, IL 60612.

American Medical Technologists, 710 Higgins Rd., Park Ridge, IL 60068.

National Certification Agency for Medical Laboratory Personnel, 7910 Woodmont Ave., Suite 1301, Bethesda, MD 20814.

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, 7910 Woodmont Ave., Suite 1301, Bethesda, MD 20814.

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

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

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

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

Information about employment opportunities in Department of Veterans Affairs medical centers is available from local medical centers and also from:

Title 38 Employment Division (054D), Department of Veterans Affairs, 810 Vermont Ave. NW., Washington, DC 20420.

Dental Hygienists

(D.O.T. 078.361-010)

Nature of the Work

Dental hygienists provide preventive dental care and teach patients how to practice good oral hygiene.

Hygienists examine patients' teeth and gums, recording the presence of diseases or abnormalities. They remove calculus, stain, and plaque from teeth; apply caries-preventive agents such as fluorides and pit and fissure sealants; take 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, inform patients how to select toothbrushes, and show patients how to floss their teeth. Some hygienists develop and promote community dental health programs which may include teaching how to practice good oral hygiene.

Dental hygienists 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 use 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 and AIDS. 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.



Dental hygienists sometimes administer local anesthetic.

Employment

Dental hygienists held about 108,000 jobs in 1992. 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. Some 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. State or regional testing agencies administer 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 1993, 208 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. Five universities offer master's degree programs in dental hygiene.

An associate degree is sufficient for practice in a private dental office. A bachelor's or master's degree is usually required for 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. 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 include biology, chemistry, 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 and rising real incomes. Additional

job openings will result from the need to replace workers who leave the occupation.

Also, 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 do so. In addition, as dentists' workloads increase, they are expected to hire more hygienists to perform preventive dental care such as cleaning, so they may use their own time more profitably.

Enrollments in dental hygiene programs have been on the rise recently after declining during the 1980's. Unless the number increases sharply, however, 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, dental hygienists who worked 32 hours a week or more averaged \$609 a week in 1991; the average hourly earnings for all dental hygienists was \$18.50.

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, Department of Career Guidance, 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. 712.381-014, -018, -022, -026, -030, -042, -046, and -050)

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 form the metal. Using small hand-held tools, they prepare

the surface of the metal to allow the metal and porcelain to bond. They apply porcelain in layers to arrive at the precise shape and color of a tooth. Technicians place the tooth in a porcelain furnace to bake the porcelain onto the metal framework, then adjust the shape and color with subsequent grinding and addition of porcelain to achieve a sealed finish. The final product is an exact replica of the lost tooth or teeth.

In some laboratories, technicians perform all stages of the work, while in others, each does only a few. 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-lit, 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 48,000 jobs in 1992. 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.

Some dental laboratory technicians worked in dentists' offices. Others worked for hospitals that provide dental services, including Department of Veterans Affairs hospitals. Some technicians work in dental laboratories in their homes, in addition to their regular job. Approximately 1 technician in 7 is self-employed, a higher proportion than in most other occupations.

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



Many dental lab technicians are trained on the job.

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 1993, 42 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.

Graduates of 2-year training programs need additional hands-on experience to become fully qualified. 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.

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 laboratories.

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 reduce the amount of time required to produce dental prosthetics—and, therefore, the demand for dental laboratory technicians.

Earnings

According to the American Dental Association, the average hourly earnings for dental laboratory technicians in independent dental offices was \$13.30 in 1991. According to limited data, trainees in dental laboratories average only a little over minimum wage. However, earnings rise sharply with experience. 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 dentists. 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. 299.361-010 and -014)

Nature of Work

Dispensing opticians fit eyeglasses and contact lenses, following prescriptions written by ophthalmologists or optometrists. (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 recommend eyeglass frames, lenses, and lens coatings after considering the prescription and the customer's occupation, habits, and facial features. Dispensing opticians measure clients for size of eyeglasses including the distance between the centers of the pupils and the distance between the eye surface and the lens. For customers without prescriptions, dispensing opticians may use a lensometer to record the present eyeglass prescription. Dispensing opticians may obtain a customer's previous record, or verify a prescription with the examining optometrist or ophthalmologist.

Dispensing opticians prepare work orders that give ophthalmic laboratory technicians 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 grind and insert lenses themselves. After the glasses are made, dispensing opticians verify that the lenses have been ground to specifications. Then they may reshape or bend the frame, by hand or using pliers, so that the eyeglasses fit the customer properly and comfortably. Dispensing opticians also fix, adjust, and refit broken frames. They instruct clients about adapting to, wearing, or caring for eyeglasses.

Some dispensing opticians specialize in fitting contacts, artificial eyes, cosmetic shells to cover blemished eyes, or low vision aids. To fit contact lenses, dispensing opticians measure eye shape and size, select the type of contact lens material, and prepare work orders specifying the prescription and lens size. Fitting contact lenses requires considerable skill, care, and patience. Dispensing opticians observe customers' eyes, corneas, lids, and contact lenses with special instruments and microscopes. During several visits, opticians show customers how to insert, remove, and care for their contacts, and make sure the fit is correct.

Dispensing opticians keep records on customer prescriptions, work orders, and payments; track inventory and sales; and perform other administrative duties.

Working Conditions

Dispensing opticians work indoors in attractive, well lighted, and well ventilated surroundings. They may work in small stores where customers are served one at a time, or in large 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 also prepare lenses, they need to take precautions against the hazards associated with glass cutting, chemicals, and machinery.

Most dispensing opticians work a 40-hour week, although some work longer hours. Those in retailing may work evenings and weekends. Some work part time.

Employment

Dispensing opticians held about 63,000 jobs in 1992. About half work for ophthalmologists or optometrists who sell glasses directly to patients. Many also work in optical shops, including "superoptical stores." These stores offer one-stop shopping: Customers may have their eyes examined, choose frames, and have glasses made on the spot. Some work in optical departments of drug and department stores.

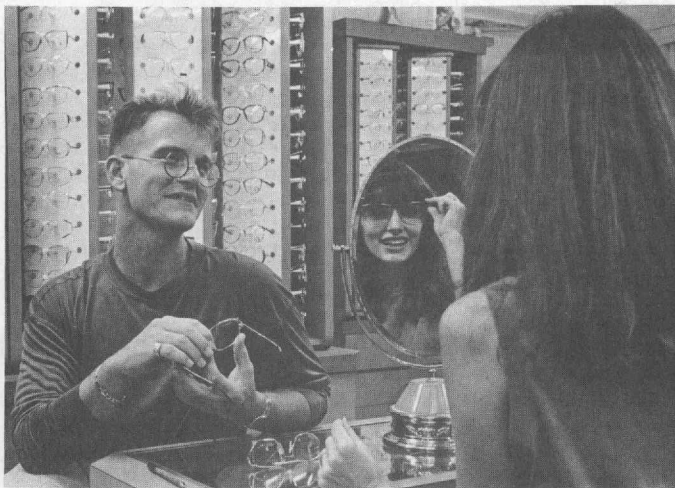
Training, Other Qualifications, and Advancement

Some employers hire individuals with no background in opticianry or those who have worked as ophthalmic laboratory technicians. (See the statement on ophthalmic laboratory technicians elsewhere in the *Handbook*.) Training may be informal, on-the-job or formal apprenticeship. Others seek people with college level training in opticianry.

Knowledge of physics, basic anatomy, algebra, geometry, and mechanical drawing is particularly valuable because 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.

Large employers generally offer structured apprenticeship programs, and small employers provide more informal on-the-job training. In the 21 States that license dispensing opticians, individuals without formal college level training train from 2 to 4 years as apprentices. Apprenticeship or formal traineeship is offered in most of the other States as well.

Apprentices receive technical training and are taught office management and sales. Under the supervision of an experienced optician, optometrist, or ophthalmologist, apprentices work directly



Dispensing opticians help customers select appropriate frames.

with patients, fitting eyeglasses and contact lenses. In States requiring licensure, information about apprenticeships and licensing procedures is available from the State board of occupational licensing.

Formal opticianry training is offered in community colleges and a few colleges and universities. In 1993, there were about 40 programs. Of these, 23 were accredited by the Commission on Opticianry Accreditation and awarded 2-year associate degrees in ophthalmic dispensing or optometric technology. There are also shorter programs, including some under 1 year. 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.

Dispensing opticians may also gain credentials through voluntary certification or registration by the American Board of Opticianry and by the National Contact Lens Examiners. Certification must be renewed every 3 years through continuing education.

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

Job Outlook

Employment in this occupation is expected to increase faster than the average for all occupations through the year 2005 in response to rising demand for corrective lenses. The number of middle-aged and elderly persons is projected to increase rapidly. Middle age is a time when many people use corrective lenses for the first time, and elderly persons require more vision care, on the whole, than others.

Fashion, too, influences demand. Frames come in a growing variety of styles and colors—encouraging people to buy more than one pair. 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. There will be a relatively large number of job openings, both to replace those who leave the occupation and due to growth. This is a young occupation and like many other occupations in retail trade, many people transfer to other occupations.

Earnings

According to the Opticians Association of America, salaries for dispensing opticians in retail stores averaged about \$26,000 in 1992. The beginning average salary for licensed and certified opticians was \$20,971. Those with 3 to 5 years of experience averaged \$21,875; 6 to 9 years, \$25,876; and 10 years or more, \$29,640. Noncertified opticians averaged about \$6,000 less at each level of experience. Beginning apprentices averaged about \$13,000 a year. Some opticians earned well above \$30,000 a year. Those who run their own stores earned more than salaried workers. In addition to base salaries, many employers provide commissions, bonuses, and profit-sharing.

Related Occupations

Other workers who deal with customers and perform delicate work include jewelers, artificial eye makers, ophthalmic laboratory technicians, orthodontic technicians, dental laboratory technicians, prosthetics technicians, camera repairers, and watch repairers.

Sources of Additional Information

For general information about this occupation, contact:

☞ Opticians Association of America, 10341 Democracy Lane, Fairfax, VA 22030-2521.

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) technologist using an EEG 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 "cerebral" death, the absence of brain activity, and to assess the probability of a recovery from a coma.

For basic, "resting" EEG's, technologists take patients' medical histories and help them 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 understand anesthesia's effect on brain waves.

For special procedure EEG's, technologists 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 quantitative 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 dynamics 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 quantitative 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. They may also write technical reports summarizing test results.

Technologists also look for changes in the patient's neurologic, cardiac, and respiratory status, which may indicate an emergency, such as a heart attack, and 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 may also be responsible for the equipment's upkeep.



EEG technologists test for brain and nervous system disorders.

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 do all their work in a single room, or may push equipment to patients' bedsides and obtain recordings there.

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 more than 6,000 jobs in 1992. Most worked in EEG or neurology laboratories of hospitals. Others worked in offices 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. Often, EEG trainees transfer from other hospital jobs, such as licensed practical nurse. Applicants for trainee positions in hospitals need at least a high school diploma, while some hospitals require postsecondary training.

Formal postsecondary training is offered in hospitals and community colleges. In 1992, the Joint Review Committee on Education in Electroneurodiagnostic Technology had approved 13 formal programs. Programs usually last from 1 to 2 years and include laboratory experience as well as classroom instruction in human anatomy and physiology, neurology, neuroanatomy, neurophysiology, medical terminology, computer technology, electronics and instrumentation. Graduates receive associate degrees or certificates.

The American Board of Registration of Electroencephalographic and Evoked Potential Technologists awards the credential "Registered EEG Technologist" to qualified applicants. This board also accredits technologists evoked potentials 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. 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.

Earnings

According to a University of Texas Medical Branch national survey of hospitals and medical centers, the median annual salary of EEG technologists, based on a 40 hour week and excluding shift or area differentials, was \$23,369 in October 1992. The average minimum salary was \$19,695 and the average maximum was \$28,736.

Related Occupations

Other health personnel who operate medical equipment include radiologic technologists, nuclear medicine technologists, perfusionists, and cardiovascular (EKG) 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., 204 W. 7th, Carroll, IA 51401.

For information on work in sleep studies, contact:

☞ Association of Polysomnographic Technology, 1610 14th St. NW., Suite 300, Rochester, MN 55901.

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 of Electroencephalographic and Evoked Potential Technologists, P.O. Box 11434, Norfolk, VA 23517.

EMT-Intermediates, or EMT-I's, have more advanced training and can perform such additional procedures as administer intravenous fluids; and use defibrillators to give lifesaving 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.



Most job openings for EMT's will result from people who leave the field.

Emergency Medical Technicians

(D.O.T. 079.364-026 and .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, give initial care to poison and burn victims, and treat patients with anti-shock trousers, which prevent a person's blood pressure from falling too low.

EMT's employed by fire departments often have about a 50-hour workweek. Those employed by hospitals frequently work between 45 and 58 hours a week and those in private between 48 and 51 hours. Some EMT's, especially those in police and fire departments, are on call for extended periods. Because most emergency services function 24 hours a day, EMT's have irregular working hours that add to job stress.

Employment

In 1992, EMT's held 114,000 jobs. Two-fifths were in private ambulance services, about a third were in municipal fire, police, or rescue squad departments, and a quarter were 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 100 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 EMT basic 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 additional instruction in patient assessment as well as the use of esophageal airways, intravenous fluids, and antishock garments. Training programs for EMT-Paramedics 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.

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

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 required clinical and field internships as well as 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.

All 50 States have some kind of certification procedure. In 29 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.

EMT's should have emotional stability, good dexterity, agility, 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, or 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, physicians, or other health workers.

Job Outlook

Most job openings will occur because of this occupation's substantial replacement needs. Turnover is quite high, reflecting this occupation's stressful working conditions, limited advancement potential, and the modest pay and benefits in the private sector.

Employment of EMT's is expected to grow faster than average for all occupations through the year 2005. Driving the growth will be an expanding population. Also, the number of older people, who are more likely to need emergency services, is increasing rapidly.

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.

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 1993 were \$20,092 for EMT-Ambulance or Basic, \$19,530 for EMT-Intermediate, and \$24,390 for EMT-Paramedic. EMT's working in fire departments command the highest salaries, as the accompanying table shows.

Table 1. Average annual salaries of emergency medical technicians, by type of employer, 1993

| Employer | Paramedic | EMT-I | EMT-Basic |
|---------------------------------|-----------|----------|-----------|
| All employers (mean) | \$28,079 | \$22,682 | \$22,848 |
| Private ambulance services | 25,606 | 20,060 | 19,383 |
| Hospitals | 24,944 | 21,088 | 18,845 |
| Fire departments | 34,994 | 30,914 | 31,141 |

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, air traffic controllers, workers in other health occupations, 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. 079.362-014, -018)

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 their 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, who may also be called medical record technicians, first make sure that the medical chart is complete. They ensure that all forms are present and properly identified and signed, and 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 software 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. 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. *Tumor registrars* compile and maintain records of patients who have cancer to provide information to physicians and for research studies.

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 transcribers while a *medical record administrator* manages the department (see the statement on health services managers elsewhere in the *Handbook*). In small facilities 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 muscle pain.



Medical record technicians may also be referred to as health information technicians.

Employment

Medical record technicians held about 76,000 jobs in 1992. About one half of 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 Health Information Management Association (AHIMA). Hospitals sometimes advance promising medical record clerks to jobs as medical record technicians, although this practice may be less common in the future. Advancement generally requires 2-4 years of job experience and 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 AHIMA. 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 1992, CAHEA accredited 90 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 or in tumor registry.

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 ART credentials may become director or assistant director of a medical record department in a small facility. However, in larger institutions the director is a medical records administrator, with a bachelor's degree in medical record administration. (See the statement on health services managers elsewhere in the *Handbook*.)

Job Outlook

Hospitals will continue to employ the most technicians. Most job openings will occur because of replacement needs. The job prospects for formally trained technicians should be very good. 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.

The need for detailed medical records in offices and clinics of doctors of medicine 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.

Earnings

According to a 1992 survey of AHIMA members, accredited record technicians who worked as coders averaged \$11.30 an hour; unaccredited coders averaged \$9.77 an hour; and accredited record technicians in supervisory positions averaged \$29,599 a year. The average annual salary for medical record technicians in the Federal Government in nonsupervisory, supervisory, and managerial positions was \$22,008 in 1993.

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 transcribers, 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 Health Information Management Association, 919 N. Michigan Ave., Suite 1400, Chicago, IL 60611.

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

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

Nuclear Medicine Technologists

(D.O.T. 078.361-018)

Nature of the Work

In nuclear medicine, radionuclides—unstable atoms that emit radiation spontaneously—are used to diagnose and treat disease. Radionuclides are purified and compounded like other drugs to form radiopharmaceuticals. Nuclear medicine technologists administer these radiopharmaceuticals to patients, then monitor the characteristics and functions of tissues or organs in which they localize. Abnormal areas show higher or lower concentrations of radioactivity than normal.

Nuclear medicine technologists operate cameras that detect and map the radioactive drug in the patient's body to create an image on photographic film. Radiologic technologists also operate diagnostic imaging equipment, but their equipment creates an image by projecting an x ray through the patient. (See the statement on radiologic technologists elsewhere in the *Handbook*.)

Nuclear medicine technologists explain test procedures to patients. They prepare a dosage of the radiopharmaceutical and administer it by mouth, injection, or other means. When preparing radiopharmaceuticals, technologists adhere to safety standards that keep the radiation dose to workers and patients as low as possible.

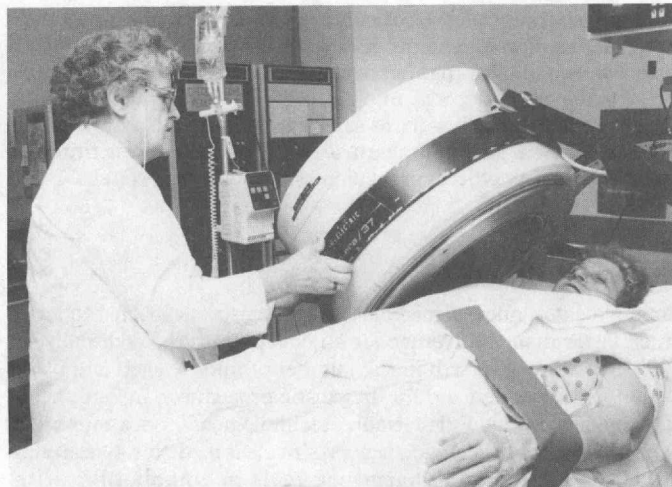
Technologists position patients and start a gamma scintillation camera, or scanner, which creates images of the distribution of a radiopharmaceutical as it passes through or localizes in the patient's body. Technologists produce the images on a computer screen or on film for a physician to interpret. Some nuclear medicine studies, such as cardiac function studies, are processed with the aid of a computer.

Nuclear medicine technologists also perform radioimmunoassay studies which assess the behavior of a radioactive substance inside the body. For example, technologists may add radioactive substances to blood or serum to determine levels of hormones or therapeutic drug content.

Technologists 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



Nuclear medicine technologists must adhere to radiation safety guidelines.

shift work are also available. In addition, technologists in hospitals may be on-call duty on a rotational basis.

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

Although there is potential for radiation exposure in this field, it is kept to a minimum by the use of shielded syringes, gloves, and other protective devices. Technologists also wear badges that measure radiation levels. Because of safety programs, however, badge measurements rarely exceed established safety levels.

Employment

Nuclear medicine technologists held about 12,000 jobs in 1992. 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 lead to a certificate, associate degree, or bachelor's 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, the use of radiopharmaceuticals, imaging techniques, and computer applications. Associate and bachelor's programs also cover liberal arts.

One-year certificate programs are for health professionals, 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. Others interested in the nuclear medicine technology field 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 nuclear medicine technology. In 1992, there were 112 CAHEA-accredited programs.

All nuclear medicine technologists must meet the minimum Federal standards on the administration of radioactive drugs and the operation of radiation detection 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). Most employers prefer to hire certified or registered technologists.

Technologists may advance to supervisor, then to chief technologist, and to department administrator or director. (See statement on health services managers elsewhere in the *Handbook*.) 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 a bachelor's degree or master's in nuclear medicine technology. Others leave the occupation to work as sales or training representatives for health equipment and radiopharmaceutical manufacturing firms, or as radiation safety officers in regulatory agencies or hospitals.

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. 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 pump blood. Wider use of positron emission tomography imaging to observe metabolic and biochemical changes for neurology, cardiology, and oncology procedures, will also spur demand for nuclear medicine technologists.

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

Earnings

According to a University of Texas Medical Branch national survey of hospitals and medical centers, the median annual salary of nuclear medicine technologists, based on a 40 hour week and excluding shift or area differentials, was \$32,843 in October 1992. The average minimum salary was \$26,402 and the average maximum was \$38,840.

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 a list of accredited programs in nuclear medicine technology, write to:

☞ Joint Review Committee on Educational Programs in Nuclear Medicine Technology, 1144 West 3300 South, Salt Lake City, UT 84119.

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; 713.381-010, .681-010; 716.280-010, -014, and -018, .381-014, .382-010, -014, -018, and -022, .462-010, .681-010 and -018, and .682-018)

Nature of the Work

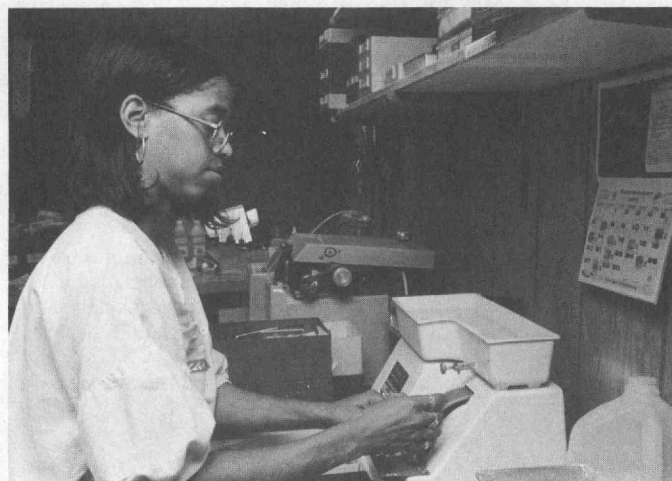
Ophthalmic laboratory technicians—also known as manufacturing opticians, optical mechanics, or optical goods workers—make prescription eyeglass lenses. Some manufacture lenses for other optical instruments, such as telescopes and binoculars. Prescription lenses are curved in such a way that light is 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 and treat 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*.)

Ophthalmic laboratory 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 a 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.



Nearly all ophthalmic laboratory technicians learn their skills on the job.

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 against the hazards associated with cutting glass, handling chemicals, and working near machinery.

Employment

Ophthalmic laboratory technicians held about 19,000 jobs in 1992. About half of these jobs were in retail stores that manufacture and sell prescription glasses—mostly chains of optical goods stores or independent retailers. Most of the rest were in optical laboratories. These laboratories 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 trainee jobs prefer applicants who are high school graduates. Courses in science and mathematics are valuable; manual dexterity and the ability to do precision work is essential.

Technician trainees start on 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.

Some ophthalmic technicians learn their trade in the Armed Forces. Others attend the few 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 about as fast as 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 technicians who transfer to other occupations or leave the labor force.

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 an 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 the Opticians Association of America, the beginning average salary for ophthalmic laboratory technicians in retail optical stores was \$15,040 in 1992. Those with 3 to 5 years of experience averaged \$16,700; 6 to 9 years, \$21,700; and 10 years or more, \$24,370. Trainees may start at the minimum wage.

Related Occupations

Workers in other precision production occupations include biomedical equipment technicians, 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. 078.361-034, .362-026, -046, -054, -058, .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 use of imaging techniques that do not involve x rays, such as ultrasound and magnetic resonance scans, is growing rapidly. The term "diagnostic imaging" embraces these procedures 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, removing articles such as jewelry, through which x rays cannot pass, and positioning 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 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 may 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. They then remove the film and develop it.

Experienced radiographers may perform more complex imaging tests. For fluoroscopies, radiographers prepare a solution of contrast medium for the patient to drink, allowing the radiologist, a physician who interprets x rays, to see soft tissues in the body. Some radiographers operate computed tomography scanners to produce cross-sectional views of patients and may be called CT technologists. Others operate machines using giant magnets and radiowaves rather than radiation to create an image and may be called magnetic resonance imaging (MRI) technologists.

Radiation therapy technologists, also known as radiation therapists, prepare cancer patients for treatment and administer prescribed doses of ionizing radiation to specific body parts. They 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.

They also check the patients reactions for radiation side effects such as nausea, hair loss, and skin irritation. They give instructions and explanations to patients who are likely to be very ill and may be dying. Radiation therapists, in contrast to other radiologic technologists, are likely to see the same patient a number of times during the course of treatment.

Sonographers, also known as ultrasound technologists, use non-ionizing, high frequency sound waves into areas of the patient's body; the equipment then collects reflected echoes to form an image. The image is viewed on a screen and may be recorded on a printout

strip or photograph for 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, and judge if the images are satisfactory for diagnostic purposes. Sonographers may specialize in neurosonography (the brain), vascular (blood flows), echocardiography (the heart), abdominal (the liver, kidneys, spleen, and pancreas), obstetrics/gynecology (the female reproductive system), and ophthalmology (the eye).

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

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 a radiology department.

Working Conditions

Most full-time radiologic technologists work about 40 hours a week; they may have evening and weekend or on-call hours.

Technologists are on their feet for long periods and may lift or turn disabled patients. They work at radiologic machines but may also do some procedures at patients' bedsides. Some radiologic technologists travel to patients in large vans equipped with sophisticated diagnostic equipment.

Radiation therapists are prone to emotional "burn out" since they regularly treat extremely ill and dying patients on a daily basis. Although potential radiation hazards exist in this occupation, 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.

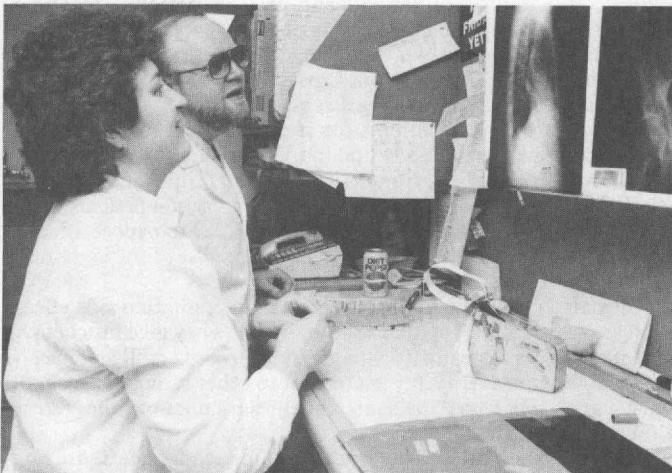
Employment

Radiologic technologists held about 162,000 jobs in 1992. Most technologists were radiographers. Some were sonographers and radiation therapists. About 1 radiologic technologist in 5 worked part-time.

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 profession 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.



Radiologic technologists may be on their feet for extended periods of time.

Formal training is offered in radiography, radiation therapy, 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 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 687 radiography programs, 120 radiation therapy programs, and 52 diagnostic medical sonography programs in 1992.

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. Some programs consider applicants with liberal arts backgrounds, however, as well as high school graduates with courses in math and science.

Radiographers and radiation therapists 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 ensuring 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 1992, 26 States required radiographers to be licensed, and 23 required radiation therapists 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. The American Registry of Diagnostic Medical Sonographers (ARDMS) certifies the competence of sonographers. To become registered, technologists must be graduates of a CAHEA-accredited program or meet other prerequisites and have passed an examination. Many employers prefer to hire registered technologists.

With experience and additional training, staff technologists may become specialists, performing CT scanning, ultrasound, angiography, and magnetic resonance imaging. Experienced technologists may also be promoted to supervisor, chief radiologic technologist, and—ultimately—department administrator or director. Depending on the institution, courses or a master's degree in business or health administration may be necessary for the director's position. Some technologists progress by 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 as 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 radiologic technologists is expected to grow much faster than the average for all occupations through 2005, as the health care industries grow, and 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 and be used more widely. Since ultrasound is non-invasive, it is also less risky and uncomfortable for the patient than exploratory surgery.

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.

Although physicians are enthusiastic about the clinical benefits of new technologies, the extent to which they are adopted depends largely on cost and reimbursement considerations. Some promising new technologies may not come into widespread use because they are too expensive and third-party payers may not be willing to pay for their use. But on the whole, it appears that radiologic procedures will be used more widely.

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. Some jobs will also come from the need to replace technologists who leave the occupation.

Earnings

In 1992, the median annual earnings for radiologic technologists who worked year round full time were \$28,236. The middle 50 percent earned between \$22,932 and \$33,748 a week; 10 percent earned less than \$19,708 a week; and 10 percent earned more than \$40,456.

According to a University of Texas Medical Branch national survey of hospitals and medical centers, the median annual salary for radiation technologists, based on a 40 hour week and excluding shift or area differentials, was \$25,615 in October 1992. The average minimum salary was \$22,250 and the average maximum was \$32,553. For radiation therapy technologists the median was \$34,278 and for ultrasound technologists, \$32,219.

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, cardiovascular technologists and technicians, 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 87123-3917.

☞ Society of Diagnostic Medical Sonographers, 12770 Coit Rd., Suite 508, Dallas, TX 75251.

☞ American Healthcare Radiology Administrators, 111 Boston Post Rd., Suite 215, P.O. Box 334, Sudbury, MA 01776.

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 Heights, 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 assemble, adjust, and check nonsterile equipment to ensure that it is in working order. Technologists also "prep" (prepare) patients for surgery by washing, shaving, and disinfecting incision sites. They transport patients to the operating room, help position them on the operating table, and cover them with sterile surgical "drapes." Technologists also observe patients' vital signs, check charts, and help the surgical team scrub and put on gloves, gowns, and masks.

During surgery, technologists pass instruments and other sterile supplies to surgeons and surgeon 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. Technologists may also maintain specified supplies of fluids such as plasma and blood.

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

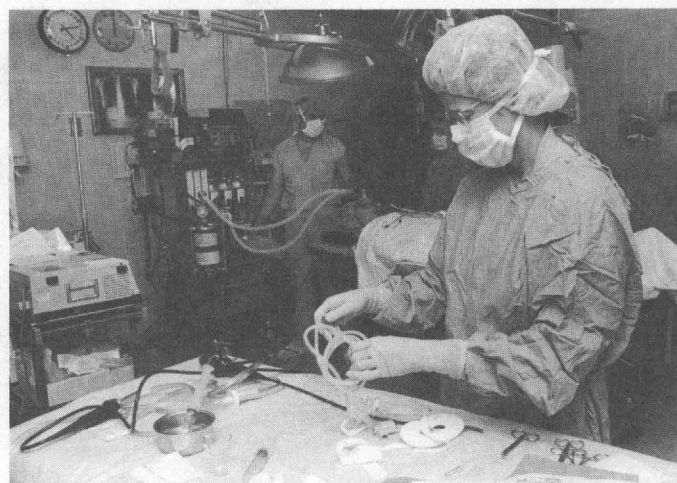
Working Conditions

Surgical technologists work in clean, well-lighted, cool environments. They must stand for long periods of time and remain alert during operations.

Most surgical technologists work a regular 40-hour week, 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 44,000 jobs in 1992. Most surgical technologists are employed by hospitals. Others are employed in clinics and surgicenters, and in the offices of physicians and dentists who perform outpatient surgery. A few, known as private scrubs, are employed directly by surgeons who have special surgical teams like those for liver transplants.



Surgical technologists set up the operating room with surgical instruments and equipment.

Training, Other Qualifications, and Advancement

Surgical technologists receive their training in formal programs offered by community and junior colleges, vocational schools, universities, hospitals, and the military. In 1993, the Committee on Allied Health Education and Accreditation (CAHEA) of the American Medical Association recognized 130 accredited programs. High school graduation normally is required for admission. Programs last 9 to 24 months and lead to a certificate, diploma, 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 procedures. Students also learn to sterilize instruments; prevent and control infection; and handle special drugs, solutions, supplies, and equipment.

Technologists may obtain voluntary professional certification from the Liaison Council on Certification for the Surgical Technologist by graduating from a formal program and passing a national certification examination. Continuing education or reexamination is required to maintain certification, which must be renewed every 6 years. Some employers prefer to hire certified technologists.

Surgical technologists need manual dexterity to handle instruments quickly. They also must be conscientious, orderly, and emotionally stable to handle the demands of surgeons. Technologists must respond quickly and know procedures well so that they may have instruments ready for surgeons without having to be told. They are expected to keep abreast of new developments in the field. Recommended high school courses include health, biology, chemistry, and mathematics.

Technologists may advance by specializing in a particular area of surgery, such as neurosurgery or open heart surgery. 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" persons during the procedure; interviews the patient before surgery; keeps a written account of the surgical procedure; and answers the surgeon's questions about the patient during the surgery. With additional training, some technologists advance to first assistants, who help with retracting, sponging, suturing, cauterizing bleeders, and closing and treating wounds. Surgical technologists may manage central supply departments in hospitals, or take positions with insurance companies, sterile supply services, and operating equipment firms.

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.

Some employers may seek to substitute surgical technologists for operating room nurses to reduce costs. However, because some facilities and States limit the work that surgical technologists can do, widespread displacement of operating room nurses is not likely to occur.

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

According to a University of Texas Medical Branch survey of hospitals and medical centers, the median annual salary of surgical technologists, based on a 40 hour week and excluding shift or area differentials, was \$21,741 in October 1992. The average minimum salary was \$18,087 and the average maximum was \$26,480.

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

For additional information on a career as a surgical technologist and a list of CAHEA-accredited programs, contact:

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

For information on certification, contact:

☞ Liaison Council on Certification for the Surgical Technologist, 7108-C S. Alton Way, Englewood, CO 80112.

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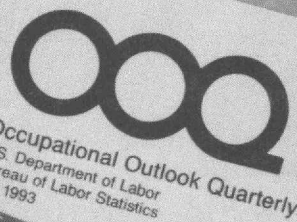
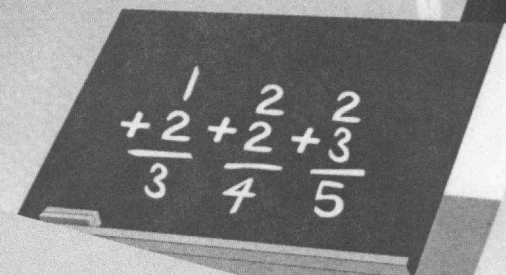
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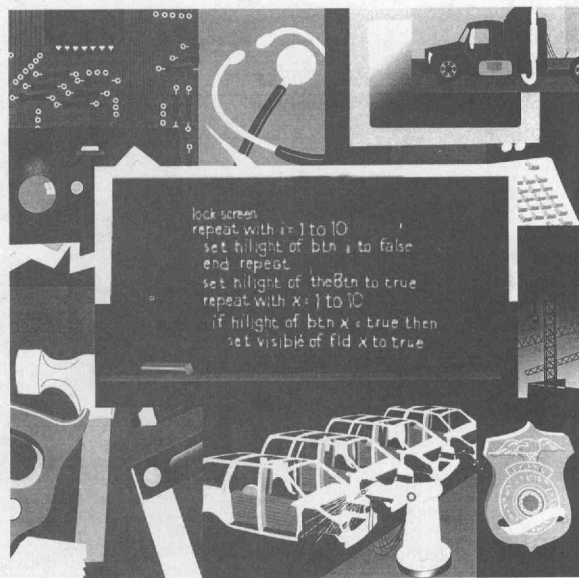
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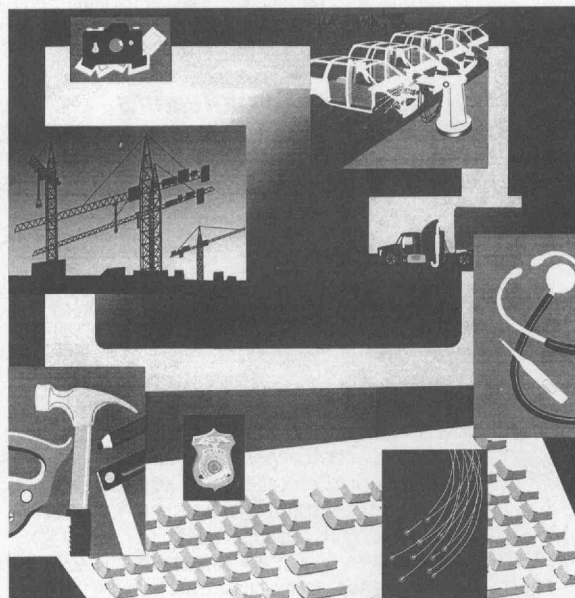
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April 1994

BLS Bulletin 2451

Occupational Projections and Training Data, 1994 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.

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.

BLS Bulletin 2452

The American Work Force: 1992-2005

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.

Bureau of Labor Statistics Regional Offices

| | | |
|---------------|---|-------------------------|
| Boston | 1 Congress St., 10th Floor Boston, MA 02114-2023 | Phone (617) 565-2327 |
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