R E P O R T R E S U M E S

ED 018 614 VT 003 221

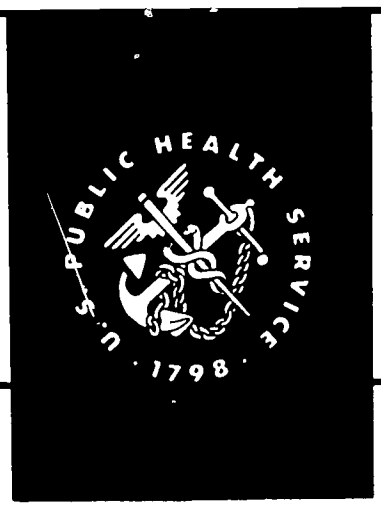
HEALTH RESOURCES STATISTICS, HEALTH MANPOWER, 1965.
PUBLIC HEALTH SERVICE (DHEW), WASHINGTON, D.C.
REPORT NUMBER PHS-PUB-1509 PUB DATE 65
EDRS PRICE MF-$0.75 HC NOT AVAILABLE FROM EDRS. 188P.

DESCRIPTORS- *HEALTH OCCUPATIONS, OCCUPATIONAL SURVEYS, EMPLOYMENT STATISTICS, *HEALTH OCCUPATIONS EDUCATION, GRADUATES, GOVERNMENT EMPLOYEES, PUBLIC HEALTH, PROFESSIONAL PERSONNEL, SUBPROFESSIONALS, LABOR FORCE, OCCUPATIONAL INFORMATION, *PROFESSIONAL EDUCATION, *HEALTH SERVICES, STUDENT ENROLLMENT, DEGREES (TITLES), STATISTICAL DATA,

ONE HUNDRED AND FORTY HEALTH PROFESSIONAL AND SUBPROFESSIONAL OCCUPATIONS ARE CLASSIFIED UNDER 35 BROADER OCCUPATIONAL CATEGORIES. ALTHOUGH SOME GAPS WERE UNAVOIDABLE, THE GOAL FOR ALL CATEGORIES WAS TO PRESENT STATISTICAL INFORMATION ON (1) THE NUMBERS OF HEALTH PERSONNEL AND THEIR LOCATION BY STATE, (2) GROWTH IN EMPLOYMENT SINCE 1950, (3) DISTRIBUTION BY TYPE OF PRACTICE, FUNCTION, AND SPECIALTY, (4) TRENDS IN NUMBERS OF TRAINING PROGRAMS AND GRADUATES SINCE 1950, AND (5) THE LOCATION OF INSTITUTIONS THAT NOW OFFER TRAINING PROGRAMS, WITH THE NUMBER OF STUDENTS AND GRADUATES IN THE ACADEMIC YEAR 1964-65. ALSO INCLUDED ARE (1) COMPARISONS OF THE NUMBERS OF INDIVIDUALS IN THE TOTAL CIVILIAN WORK FORCE WITH THE NUMBERS OF THOSE IN THE HEALTH SERVICES ACCORDING TO OCCUPATION, (2) COMPARISONS OF THE NUMBERS OF WHITE COLLAR EMPLOYEES OF ALL FEDERAL AGENCIES WITH THOSE OF EMPLOYEES OF THE PUBLIC HEALTH SERVICE ACCORDING TO OCCUPATION, AND (3) DATA REGARDING THE LOCATION, OWNERSHIP, AND NUMBER OF GRADUATES OF SCHOOLS OF PUBLIC HEALTH, AND PROFESSIONAL CATEGORIES OF GRADUATES OF SCHOOLS OF PUBLIC HEALTH BY GEOGRAPHIC SOURCES AND RECEIPT OF U.S. PUBLIC HEALTH SERVICE TRAINEESHIPS. THIS DOCUMENT IS AVAILABLE AS FS2.123--965 FOR $1.25 FROM GOVERNMENT PRINTING OFFICE, NORTH CAPITOL AND H STREETS, N.W., WASHINGTON, D.C., 20401. (JK)

Health Resources Statistics

U.S. DEPARTMENT OF
HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
NATIONAL CENTER FOR HEALTH STATISTICS



PUBLIC HEALTH SERVICE PUBLICATION NO. 1509

Library of Congress Catalog Card Number 66-62580

Health Resources Statistics

Health Manpower, 1965

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
NATIONAL CENTER FOR HEALTH STATISTICS
WASHINGTON, D.C.

This first edition of HEALTH RESOURCES STATISTICS, 1965 contains health manpower data. Subsequent editions are planned to be more comprehensive, including statistics on manpower, facilities, and other resources in the health field.

PUBLIC HEALTH SERVICE PUBLICATION NO. 1509

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price $1.25

PREFACE

Health manpower programs of the Public Health Service demand comprehensive information on health manpower resources, requirements, utilization, education and training, and recruitment of professional, technical, and auxiliary workers for all health activities. Within the Service, the National Center for Health Statistics has responsibility for statistics on health manpower resources.

The Health Manpower Statistics Branch was established within the Center in October 1964, with these functions:

1. To conduct statistical studies using primary or secondary sources to determine the numbers, geographic location, age, and other characteristics of health manpower in various fields;
2. To make short-range projections of manpower to be available in these fields;
3. To prepare publications in these areas to provide factual information on health manpower resources for programs of the Service, other governmental agencies, national professional and voluntary agencies, and other members of the health community;
4. To provide consultative assistance to such programs and agencies regarding methods of obtaining or interpreting manpower statistics.

In mid-1965, the Branch produced "Location of Manpower in 8 Health Occupations, 1962." This report was published as Section 19 in the *Health Manpower Source Book* series, PHS Pub. No. 263, Sections 1-19, 1952-65 (see listing in appendix I).

In June 1966, the Branch completed this publication, *Health Manpower, 1965*. The scope of this report encompasses about 140 health professions and occupations, each of which requires some special education or training to function in the health field. An attempt has been made to present statistical information on the numbers of health personnel employed and their location by State; growth in employment since 1950; distribution by type of practice, function, and/or specialty; trends in numbers of training programs and graduates since 1950; and the location of institutions that now offer training programs, with the numbers of students and graduates in the academic year 1964-65.

The effort to compile these data for a reference volume places emphasis on the importance of sound statistics and the reliance on a wide variety of government-private arrangements to provide such information. The associations and organizations mentioned in the publication were given an opportunity to make these health manpower statistics the best

that could be assembled at the present time. The gaps in knowledge are evident from the incompleteness of the information for many of the health fields.

Appreciation and thanks are extended to each of the associations, organizations, and individuals that contributed to this publication by providing tabular material or suggestions for the text. Special acknowledgement is made of the use of three publications issued in 1965-66 by the U. S. Department of Labor: *Health Careers Guidebook, Occupational Outlook Handbook,* and *Dictionary of Occupational Titles.* It is hoped that persons and organizations concerned with the provision of health services and the training of persons to provide these services will find the new NCHS publication of value.

CONTENTS

National Center for Health Statistics

FORREST E. LINDER, PH.D., *Director*

THEODORE D. WOOLSEY, *Deputy Director*

OSWALD K. SAGEN, PH.D., *Assistaint Director*

WALT R. SIMMONS, M.A., *Statistical Advisor*

ALICE M. WATERHOUSE, M.D., *Medical Advisor*

JAMES E. KELLY, D.D.S., *Dental Advisor*

LOUIS R. STOLCIS, M.A., *Executive Officer*

DONALD GREEN, *Information Officer*

HEALTH MANPOWER STATISTICS BRANCH

MARYLAND Y. PENNELL, M.Sc., *Chief*

Health Manpower, 1965

Maryland Y. Pennell, Chief
Health Manpower Statistics Branch

INTRODUCTION

About 3 million persons were employed in 1965 in the health professions and occupations identified in this publication. Together with the additional titles that apply to the same job or to a special aspect of the work, a total of more than 300 job titles are listed in appendix II. Even then, the inventory is incomplete and some types of health workers may have been inadvertently omitted. The listing is based in large part on those included in the new edition of the *Health Careers Guidebook.*[1]

Persons who work in these specific professions and occupations have had special education or training designed to help them function in a health setting. Many other persons perform the business, clerical, and maintenance services essential to the operation of health facilities and agencies, but their occupations are not unique to the health field (see table 1 and ch. 1).

To identify individuals in each of the health occupations is difficult. Yet it is desirable to know the total number of persons who have had special education or training and, of this number, the proportion in the labor force. Information is needed on geographic location; employment status and type of activity; educational background and special training; personal characteristics such as age, race, and sex; and employment characteristics related to kind and volume of services rendered and years of work experience.

Sources of information on health manpower, occupation by occupation, are presented in the chapters that follow. Sources of manpower statistics discussed in this introduction are related to education, license to practice, certification or registration, association membership, place of employment, and other factors.

Education

A *graduate or professional degree* awarded by an educational institution in the United States is positive identification for many professions. The doctorate is usually required for scientists in medical research; the master's degree, for social workers; a master's degree in public health, for public health educators or nutritionists. Professional degrees clearly mark the physician (M.D. or D.O.), the optometrist (O.D.), the dentist (D.D.S. or D.M.D.) the veterinarian (D.V.M.), and so forth.

[1] Bureau of Employment Security: *Health Careers Guidebook.* Employment Service, U.S. Department of Labor, Washington. U.S. Government Printing Office, 1965.

Each educational institution maintains a list of the individuals who have been graduated and their levels of degree. The National Center for Educational Statistics compiles statistics on the annual numbers of graduates as reported by schools, colleges, and universities. The 1964-65 data on degrees conferred in fields pertinent to health are shown in table 2. The professional categories of graduates of the 14 schools of public health, compiled by the American Public Health Association, are listed in tables 3 and 4.

A file of all graduates in a given field may be compiled from the lists of those persons who have completed approved academic programs. For example, the Association of American Medical Colleges maintains such a file on graduates of U. S. medical schools, by school and year of graduation. In like manner, the American Association of Colleges of Pharmacy can identify graduates from their institutions.

The names of all graduates of U. S. schools who have been awarded an M.D. degree are included in the records maintained by the American Medical Association; those with a D.O. degree, by the American Osteopathic Association; those with a D.V.M., by the American Veterinary Medical Association; and those with a D.D.S., by the American Dental Association. Thus, these associations represent all individuals in the profession, rather than only their members. It is difficult, however, for associations to maintain current information about persons who do not belong to the organization and who will not reply to periodic requests for data on place of employment and type of activity.

Persons with a *baccalaureate* as the highest educational level are not as easy to identify as those with a graduate or professional degree. Occupational therapists, physical therapists, statisticians, and sanitarians are among those whose educational requirement is a bachelor's degree or higher. The educational program may be offered as courses, as a separate department, or as a separate school. Sometimes the persons are reported as graduates when they have completed their academic work, but a period of supervised clinical practice may be required for professional recognition. This is the situation, for example, for occupational therapists.

Below the baccalaureate level but still in an educational setting are the increasing numbers of persons enrolled in community colleges and vocational schools. A 2-year course leads to an associate degree or certificate for professional nurses and for dental hygienists. A 1- or 1½-year course is the usual program for practical nurses and for medical record technicians.

The U. S. Office of Education, Division of Vocational and Technical Education has recently completed a survey of health occupations curriculums. These 1964-65 findings cover fields of training for persons who render supportive services to the health professions. The data are being processed for publication later in 1966.

Manpower information on persons who have received *on-the-job* training can only be obtained by *ad hoc* surveys or censuses of the general population or by surveys of the kinds of establishments in which they work. On-the-job training is usual for dental assistants and dental laboratory technicians who have completed their high school education prior to receiving inservice training; however, formal educational programs are being developed in both areas.

Persons who have been educated outside of the United States and later come to this country for additional training or for employment are hard to locate. Increasing numbers of *foreign-trained* physicians and nurses are entering this country; to know how long they stay or when they leave is difficult. State licenses, required for employment, are not required for certain types of training even though the individuals provide patient care while serving internships.

License or Permit

A license or permit to practice within a State, issued by a State agency, is a means of identifying some health personnel. For example, this is the best source of statistics on professional nurses (R.N.) and on practical nurses (L.P.N.).

About 28 occupations in the health field are licensed in one or more States. All States and the District of Columbia require that the following health personnel have a license to practice: dental hygienists, dentists, environmental health engineers, optometrists, pharmacists, physicians (M.D. and D.O.), podiatrists, practical nurses, professional nurses, and veterinarians. All except a few States license chiropractors and physical therapists. About 20 to 30 States license midwives, opticians, psychologists, and sanitarians or sanitary inspectors. One to five States license hospital administrators, nursing home administrators, clinical laboratory directors, clinical laboratory technologists or technicians, health officers, psychiatric aides, social workers, and X-ray technicians. In some States the law authorizes the licensing of naturopaths or other drugless healers.

The Council of State Governments, under contract with the National Center for Health Statistics, is in the process of analyzing data on policies and practices of the State agencies. The survey should provide information on licensing qualifications, reciprocity, and other related matters, as well as the numbers of licenses in effect.

In the 1962 Inventory of Professional Registered Nurses,[2] conducted by the American Nurses' Association and financed by the Public Health Service, some 964,000 licenses were processed, involving 848,000 nurses after allowing for duplication of those licensed in more than one State. Nearly 300,000 of these nurses were inactive at the time of renewal of their license. How many additional persons located in the United States have received nursing training and are not licensed is not known but probably equals the number who are inactive.

Current studies are under way of several types of licensed personnel, including dentists, pharmacists, professional nurses, and practical nurses. The surveys are being conducted by professional associations or boards and financed by the Public Health Service. The application form for renewal of licenses is the technique being used to provide such information as place of employment, type of activity, specialization, educational preparation, year of birth, and sex.

The information thus provided is relatively complete for all persons active at the time of renewal of the license to practice. However, it must be taken into account that for some occupations there is considerable variation in qualifications from one State to another, and the spread in renewal dates adds confusion to the elimination of duplicates licensed in more than one jurisdiction.

Certification or Registration

Within some professions there are specialty boards, certification boards, and/or registries established by the profession itself for the purpose of distinguishing quality. Persons who meet certain requirements of education, experience, and competency, and pass an examination given by the board may use specific professional designations. For example, MT(ASCP) indicates that the medical technologist has been registered by the Board of Registry of Medical Technologists of the American Society of Clinical Pathologists.

These organizations not only qualify persons who meet their standards but they usually know of persons working toward qualification. They maintain lists of all persons registered to date. The lists may appear in published form, as in *The Directory of Medical Specialists*[3] which provides information on all living physicians who are diplomates of the 20 American Specialty Boards.

Association Membership

To become a member of a professional association or society implies having met certain qualifications of education and/or experience. Associations usually maintain records on current and past members (who may decide to activate their membership at

[2] Marshall, E. D. and Moses, E. B.: *The Nation's Nurses; the 1962 Inventory of Professional Registered Nurses.* New York. American Nurses' Association, 1965.

[3] Advisory Board for Medical Specialities: *Directory of Medical Specialists, 1965-66.* Vol. 12. Chicago. Marquis-Who's Who, 1965.

a later date). Their addressograph lists provide information on geographic location (as in the case of The American Dietetic Association and the American Physical Therapy Association). Sometimes information on employment status and other items obtained at the time of renewal of membership is included (as in the case of the American Speech and Hearing Association). Membership lists may be published for general distribution or limited to paid members.

Association memberships may represent nearly all persons in the specific health field (as in the case of the American Occupational Therapy Association) or only a small portion of those carrying the job title (as in the case of the American Society of Radiologic Technologists). In the latter instance, persons who could qualify for membership do not choose to belong, for various reasons, while many others working in the field do not have the qualifications essential for membership.

Mailing lists of selected professional associations are circularized in connection with the National Registry of Scientific and Technical Personnel, a responsibility of the National Science Foundation. The fifth biennial registration of scientists conducted in 1964 included physical scientists in the fields of chemistry, earth sciences, meteorology, physics, and mathematics; life scientists in the fields of agriculture and biology; as well as scientists in psychology, statistics, economics, sociology, linguistics, and other fields. Nearly 224,000 individuals responded with data about field of science, highest degree, age, type of employer, work activity, years of professional experience, and salary.[4] The 80,000 doctorates are estimated to be about 90 percent of the Nation's science doctorates. The 1966 circularization has been completed, with release of summary characteristics and salary data scheduled for the end of the year.

Place of Employment

Agencies and establishments that provide health services are another source of manpower statistics. Examples are the occupational classification of persons employed by the Federal Government (table 5) and by State and local health departments (table 6).

The U. S. Department of Labor, Bureau of Labor Statistics, has collected information on numbers of health personnel and other types of employees in the surveys of scientific and technical personnel employed by State governments in 1964 and by local governments in 1963. The findings are to be available soon. Plans call for repeating the study of State governments in 1967 and of local governments the following year.

A survey of manpower resources in hospitals was conducted by the American Hospital Association (AHA) and financed by the Public Health Service. Information was requested on the numbers of full- and part-time employees in the spring of 1966 in about 40 categories (with detail as to registration or certification). Preliminary tabulations are planned for the fall of 1966, and publication of the findings in 1967.

A companion survey of manpower resources in non-AHA hospitals and extended care facilities is being conducted by the PHS Division of Nursing. Places that provide nursing and personal care reported on their staffing in a 1964 survey conducted by the National Center For Health Statistics; for some of the findings, see chapter 1.

The National Institute of Mental Health, Training Branch, conducted a survey of professional personnel employed in 1963 in mental health establishments. The findings on staffing by psychiatrists, psychologists, psychiatric social workers, and psychiatric nurses appear in the series of *Mental Health Manpower* current statistical and activities reports, begun in January-March 1964 and completed in April 1966.

Information on the staffing of home health agencies will be forthcoming in connection with the new program to pay for medical care for the elderly, which became effective July 1, 1966.

Little information is available on employment by voluntary health agencies, in private practitioners' offices, or in some of the other places where health services are provided.

[4] National Register of Scientific and Technical Personnel: *Summary of American Science Manpower, 1964*. Washington, D.C. National Science Foundation, 1964.

Other Sources

The *1960 Census of Population* provides statistics for each of 18 occupations usually considered to be in the health field. State tabulations of these occupations, based on a 25-percent sample of Census returns, have been published in PHS Pub. No. 263, Section 17, some of the tables being reproduced in the present publication (see table 35, ch. 9). Cross tabulations of occupation by industry, based on a 5-percent sample, have been published in PHS Pub. No. 263, Section 18. The summary table for the Nation as a whole is reproduced here as table 1, to show the many diverse occupations within the health services industry.

Commercial "list" houses compile names and addresses of individuals from a wide variety of sources, including those available from associations or State registrations. They sell their lists or provide mailing services. Other sources of identification of health personnel include occupational listings in telephone books and city directories.

Reliability of Estimates

The estimates of existing manpower resources cited in the chapters to follow differ widely in reliability. While little is firmly known about the accuracy of these estimates, it is likely that some are within 2 or 3 percent of the target while others should be accompanied by the caution, "plus or minus 50 percent."

A natural question arises as to whether it is possible to identify which of the figures shown are more accurate and which are relatively unreliable but are presented for want of anything better. To some extent this question can be answered by the context in which the figures are introduced. Furthermore, in the case of some health occupations it will be clear that the data are scanty, and it is likely that there is a direct correlation between the amount of data available and the reliability. As the "state of the arts" improves, both the amount and quality of statistics increase.

The following guidelines may also be of value in judging reliability:

1. The greatest reliability can be expected for those occupations for which a graduate or professional degree provides positive identification. If this circumstance applies and there is also an accounting system established to keep track of graduates, introduce in-migrants to the profession from overseas, eliminate deaths from the file, and periodically survey all or samples of the list to learn about current activity, then the statistics are likely to be highly reliable.
2. The statistics on numbers of graduates with specific advanced degrees are probably more reliable than the numbers active in the profession or occupation.
3. Where no more than the bachelor's degree is required as training, the data are apt to be less reliable, and where the necessary training is below the baccalaureate level, then even less confidence can be placed in the figures coming from educational sources.
4. If the data on numbers in the health occupation come from licensure information, the statistics are probably of a reasonably high dependability, but much will depend upon completeness of coverage, uniformity of licensing practices, and success in eliminating duplications between jurisdictions.
5. Statistics from specialty boards, certification boards, and registries may be entirely accurate counts of persons deemed to meet the requirements of listing, but they obviously are not intended to cover the profession completely and may represent only a minority working in the specialized field.
6. Association membership used alone as a guide to manpower resources must be treated with very great caution, although such a generalization is subject to exceptions. Some associations are quite successful in bringing in a high proportion of all working in the field. Others are weak or in competition with other associations.
7. Surveys of establishments are capable of producing highly reliable results for

persons working in those establishments, but there are problems of obtaining complete coverage of the establishments. Each survey must be judged on its merits. It is clear, however, that such surveys must miss some people with the appropriate training but not currently employed.

8. The same remarks apply to statistics on occupation from previous Censuses of the Population, but here there have been the additional problems that household respondents' reports and coding practices have necessarily made it difficult to sort out properly the detailed categories of health personnel that are of interest.

The chapters to follow include the best estimates known to the author, though it is acknowledged that in some instances these are only little better than informed guesses. It will be the task of the Health Manpower Statistics Branch of the National Center for Health Statistics gradually to improve the "state of the arts" in this area, and in successive reports to update and improve upon the estimates that will be found herein.

Table 1. OCCUPATION OF PERSONS EMPLOYED IN THE CIVILIAN LABOR FORCE: 1960

Detailed occupation [1]	All industries	Health services	Percent health
All occupations	64,646,563	2,589,253	4.0
Professional, technical, and kindred	7,223,241	1,167,218	16.2
Accountants and auditors	469,702	4,077	.9
Chiropractors	13,853	13,630	98.4
Clergymen	199,701	2,275	1.1
Dentists	86,887	85,263	98.1
Dietitians and nutritionists	26,470	18,190	68.7
Engineers, technical	859,547	2,775	.3
Lawyers and judges	208,696	1,696	.8
Librarians	84,332	6,918	8.2
Natural scientists: Biological scientists	13,415	4,036	30.1
Chemists	81,120	3,133	3.9
Physicists and other natural scientists	53,650	585	1.1
Nurses, professional	581,289	528,771	91.0
Nurses, student professional	57,746	57,746	100.0
Optometrists	16,205	13,073	80.7
Osteopaths	4,081	3,861	94.6
Personnel and labor relations workers	98,257	4,379	4.5
Pharmacists	92,233	6,504	7.1
Photographers	50,735	1,529	3.0
Physicians and surgeons	229,671	218,301	95.0
Public relations men and publicity writers	30,593	722	2.4
Recreation and group workers	37,487	1,507	4.0
Religious workers	57,069	1,386	2.4
Social and welfare workers, except group	95,103	9,795	10.3
Social scientists: Psychologists	11,694	3,522	30.1
Statisticians and actuaries	20,711	743	3.6
Teachers (elementary, secondary, n.e.c.)	1,670,810	3,666	.2
Technicians, medical and dental	138,813	127,947	92.2
Technicians, electrical engineering and other	277,905	1,589	.6
Therapists and healers (n.e.c.)	36,568	25,272	69.1
Veterinarians	15,205	382	2.5
All other	1,603,693	13,945	.9
Managers, officials, and proprietors	7,916,062	50,092	.6
Credit men	46,592	962	2.1
Purchasing agents and buyers (n.e.c.)	103,191	2,262	2.2
All other	7,766,279	46,868	.6
Clerical and kindred workers	9,303,231	399,703	4.3
Agents (n.e.c.)	158,610	1,511	1.0
Attendants, physician's and dentist's office	72,171	70,607	97.8
Bookkeepers	916,453	21,622	2.4
Cashiers	471,878	5,420	1.1
Fileclerks	132,925	4,265	3.2
Messengers and office boys	59,752	2,311	3.9
Office machine operators	304,952	3,119	1.0

Table 1. OCCUPATION OF PERSONS EMPLOYED IN THE CIVILIAN LABOR FORCE: 1960—Continued

Detailed occupation [1]	All industries	Health services	Percent health
Payroll and timekeeping clerks	105,917	1,768	1.7
Receptionists	134,866	55,286	41.0
Secretaries	1,463,731	101,339	6.9
Shipping and receiving clerks	278,210	645	.2
Stenographers	269,759	9,289	3.4
Stockclerks and storekeepers	329,661	6,899	2.1
Telephone operators	354,200	14,706	4.2
Typists	521,240	19,337	3.7
All other	3,728,906	81,579	2.2
Salesworkers	4,643,784	1,838	([2])
Craftsmen, foremen, and kindred workers	8,753,468	67,742	.8
Bakers	106,535	2,028	1.9
Carpenters	822,803	4,416	.5
Electricians	339,053	3,280	1.0
Foremen (n.e.c.)	1,174,314	3,709	.3
Inspectors (n.e.c.)	100,574	5,340	5.3
Mechanics and repairmen	2,221,844	25,810	1.2
Opticians, and lens grinders and polishers	20,406	1,772	8.7
Painters, construction and maintenance	376,022	5,796	1.5
Plumbers and pipe fitters	306,567	2,885	.9
Stationary engineers	267,415	9,650	3.6
All other	3,017,935	3,056	.1
Operatives and kindred workers	11,920,442	62,441	.5
Deliverymen and routemen	422,622	826	.2
Dressmakers and seamstresses, except factory	119,965	5,574	4.6
Laundry and drycleaning operatives	385,064	32,315	8.4
Meatcutters, except slaughter and packing	180,302	1,479	.8
Photographic process workers	40,747	509	1.2
Stationary firemen	88,314	5,726	6.5
Taxicab drivers and chauffeurs	162,881	2,331	1.4
Truck and tractor drivers	1,555,793	2,658	.2
All other	8,964,754	11,023	.1
Service workers, including household	7,171,837	799,887	11.2
Attendants, hospital and other institution	391,136	365,690	93.5
Attendants, professional and personal service	70,520	2,156	3.1
Barbers	179,670	1,190	.7
Chambermaids and maids	167,913	34,557	20.6
Charwomen and cleaners	182,279	21,846	12.0
Cooks, except private household	563,932	47,234	8.4
Counter and fountain workers	157,415	10,828	6.9
Elevator operators	73,500	5,388	7.3
Hairdressers and cosmetologists	305,858	1,366	.4
Housekeepers and stewards	146,644	29,845	20.4
Janitors and sextons	596,052	26,156	4.4
Kitchen workers (n.e.c.)	300,977	66,655	22.1
Midwives	896	896	100.0
Porters	142,718	12,219	8.6
Practical nurses	207,966	144,045	69.3
Protective service workers	688,256	6,604	1.0
Waiters and waitresses	823,864	11,549	1.4
All other	2,172,241	11,663	.5
Laborers	4,532,950	12,172	.3
Gardeners, except farm, and groundskeepers	195,092	3,109	1.6
All other	4,337,858	9,063	.2
Occupation not reported	3,181,548	28,160	.9

[1] Selection among the 297 specific occupation categories of those in which at least 500 persons were employed in the health-service industry. Some health occupations are not treated as specific categories. Based on 5 percent sample.

[2] Less than 0.05 percent.

Source: Divisions of Public Health Methods, Dental Public Health and Resources, and Nursing: Manpower in the 1960's. *Health Manpower Source Book 18.* PHS Pub. No. 263, Section 18. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1964.

Table 2. EARNED DEGREES CONFERRED, BY SELECTED FIELD OF STUDY AND LEVEL OF DEGREE, FOR 1,496 INSTITUTIONS: JULY 1, 1964 THROUGH JUNE 30, 1965

Major field of study [1]	Bachelor's	First professional requiring 5 or more years	Master's	Doctor's
All fields	492,984	45,946	112,195	16,467
Agriculture	**5,194**	----------	**1,157**	**478**
Food science	208	----------	103	34
Architecture	**608**	**1,725**	**373**	**10**
Biological sciences	**25,224**	**80**	**3,604**	**1,928**
Premedical, predental, and preveterinary sciences	3,223	36	13	----------
Biology, general	15,551	8	1,312	180
Botany, general	483	----------	343	202
Zoology, general	3,880	----------	575	239
Anatomy and histology	55	----------	65	79
Bacteriology, virology, mycology, parasitology, microbiology	934	4	341	225
Biochemistry	200	----------	236	290
Biophysics	18	----------	28	39
Cytology	----------	----------	1	3
Ecology	----------	----------	1	2
Embryology	6	----------	6	3
Entomology	143	----------	151	132
Genetics	38	----------	63	86
Nutrition	33	29	62	21
Optometry (preprofessional)	294	----------	----------	----------
Pathology	5	----------	39	33
Pharmacology	----------	----------	67	79
Physiology	146	----------	108	128
Plant pathology	20	----------	73	81
Plant physiology	----------	----------	17	21
Biological sciences, field of study not identified	195	3	103	85
Business and commerce	**59,992**	**3,017**	**7,585**	**321**
Computer science and systems analysis	**67**	**20**	**146**	**6**
Education	**118,534**	**637**	**43,741**	**2,708**
Health education, separate curriculum	321	----------	158	12
Education of the partially sighted	7	----------	5	----------
Education of the blind	13	----------	24	1
Education of the mentally retarded	754	----------	371	13
Education of the emotionally disturbed	55	----------	21	----------
Education of the deaf	171	----------	130	----------
Speech and hearing	1,927	8	472	34
Education of the crippled	75	----------	21	----------
Education of exceptional children	360	50	687	34
Home economics education	4,689	----------	448	14
Rehabilitation counselor training	39	----------	115	7
Engineering	**34,868**	**1,927**	**12,056**	**2,124**
Environmental health and sanitary engineering	11	----------	133	13
English and journalism	**38,910**	**111**	**5,461**	**706**
Fine and applied arts	**17,278**	**134**	**4,244**	**428**
Foreign languages and literature	**14,091**	**14**	**2,873**	**436**
Forestry	**1,515**	**61**	**209**	**51**
Geography	**1,637**	----------	**355**	**70**
Health professions	**11,664**	**15,855**	**2,530**	**173**
Chiropody or podiatry	20	123	----------	----------
Dental hygiene	304	----------	5	----------
Dentistry, D.D.S. and D.M.D. only	----------	3,135	----------	----------

Table 2. EARNED DEGREES CONFERRED, BY SELECTED FIELD OF STUDY AND LEVEL OF DEGREE, FOR 1,496 INSTITUTIONS: JULY 1, 1964 THROUGH JUNE 30,1965—Continued

Major field of study [1]	Bachelor's	First professional requiring 5 or more years	Master's	Doctor's
Hospital administration	13	223	37	1
Medical technology	2,004	----------	4	----------
Medicine, M.D. only	----------	7,347	----------	----------
Nursing and/or public health	7,735	173	809	8
Occupational therapy	435	----------	15	----------
Optometry	----------	361	27	1
Osteopathy	----------	394	2	----------
Pharmacy	376	3,072	166	69
Physical therapy, physiotherapy	638	----------	16	----------
Public health	86	50	773	24
Radiologic technology	13	4	4	----------
Veterinary medicine, D.V.M. only	----------	896	----------	----------
Clinical dental sciences	----------	----------	318	----------
Clinical medical sciences	----------	----------	192	29
Clinical veterinary medical sciences	----------	----------	64	30
Health professions, field of study not identified	40	77	98	11
Home economics	**5,208**	----------	**674**	**58**
Foods and nutrition	645	----------	115	16
Institution management, institution administration	205	----------	29	----------
Law (LL.B., J.D., or higher degree)	**208**	**11,792**	**672**	**29**
Library science	**623**	**2,257**	**954**	**12**
Mathematical subjects	**19,550**	**31**	**4,148**	**682**
Mathematics	19,256	14	3,853	606
Statistics	294	17	295	76
Merchant marine (deck officer only)	**229**	----------	----------	----------
Military, naval, or air force science	**1,905**	----------	**2**	----------
Philosophy	**4,810**	----------	**581**	**144**
Physical sciences	**17,876**	**40**	**4,918**	**2,829**
Chemistry	10,037	8	1,684	1,377
Pharmaceutical chemistry	2	----------	31	37
Physics	4,924	30	1,906	942
Psychology	**14,721**	----------	**2,241**	**847**
Clinical psychology	----------	----------	116	75
Counseling psychology	5	----------	138	15
Social psychology	37	----------	15	26
Rehabilitation counselor training	----------	----------	79	1
Psychology, all others	14,679	----------	1,893	730
Religion	**3,611**	**5,121**	**1,458**	**331**
Social sciences	**84,184**	**3,122**	**10,661**	**1,991**
Anthropology	1,203	----------	224	88
Economics (excl. agricultural economics)	10,875	20	1,268	410
Sociology	12,896	----------	789	230
Social work, social administration, social welfare	1,291	2,748	377	34
Trade and industrial training	**1,928**	----------	**38**	**9**
Broad general curriculums and miscellaneous fields	**8,549**	**2**	**1,514**	**96**

[1] All fields listed in the OOE publication are shown here, as well as all subfields for biological sciences, health professions, mathematical subjects and psychology. Other subfields have been selected as being pertinent to health.

Source: National Center for Educational Statistics: *Summary Report on Bachelor's and Higher Degrees Conferred During the Year 1964–65.* Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office. To be published. Data for United States, Canal Zone, Puerto Rico, and the Virgin Islands.

Table 3. LOCATION AND OWNERSHIP OF SCHOOLS OF PUBLIC HEALTH AND NUMBERS OF GRADUATES: 1964–65

Location	School	Ownership	Graduates		
			Bachelor's degree	Master's degree	Doctor's degree
	Total, 14 schools [1]		268	1,087	55
Calif.	University of California, Berkeley	Public	40	146	1
	University of California, Los Angeles	Public	20	51	2
Conn.	Yale University, New Haven	Private	—	30	2
La.	Tulane University, New Orleans	Private	—	56	3
Md.	Johns Hopkins University, Baltimore	Private	—	70	11
Mass.	Harvard University, Boston	Private	—	68	4
Mich.	University of Michigan, Ann Arbor	Public	10	155	1
Minn.	University of Minnesota, Minneapolis	Public	—	104	4
N.Y.	Columbia University, New York	Private	—	101	1
N.C.	University of North Carolina, Chapel Hill	Public	17	113	10
Pa.	University of Pittsburgh, Pittsburgh	Private	—	47	13
P.R.	University of Puerto Rico, San Juan	Public	23	37	—
Canada [2]	University of Montreal, Montreal	Private	158	61	—
	University of Toronto, Toronto	Public	—	48	3

[1] Excludes newly established school of public health at the University of Hawaii in Honolulu.

[2] The 2 Canadian schools are included in order to provide the total of 1,142 master's and doctor's degrees in table 4.

Source: Troupin, J. L.: *Schools of Public Health in the United States and Canada, for the Year Ending June 1965.* New York. American Public Health Association (Mimeo). Sixth annual report.

Table 4. PROFESSIONAL CATEGORY OF GRADUATES OF SCHOOLS OF PUBLIC HEALTH, BY GEOGRAPHIC SOURCE AND RECEIPT OF U.S. PUBLIC HEALTH SERVICE TRAINEESHIPS: 1964–65

Professional category	Total	Geographic source			Recipients of U.S. PHS traineeships
		U.S.A.	Canada	Other	
Total	[1] 1,142	[2] 801	106	235	[3] 497
Physicians	332	157	31	144	75
Educators, health educators	121	64	38	19	48
Nurses	107	95	8	4	80
Administrators	104	92	8	4	27
Sanitarians	66	64	—	2	48
Bacteriologists, laboratory scientists	58	46	4	8	28
Mathematicians, statisticians	54	47	1	6	34
Engineers	52	35	1	16	15
Dietitians, nutritionists	40	32	2	6	26
Veterinarians	36	29	2	5	13
Dentists	34	26	5	3	21
Chemists, biochemists	27	15	4	8	14
Social workers	24	20	—	4	15
Biologists, entomologists	18	15	—	3	13
Physicists	15	15	—	—	9
Physical therapists	10	10	—	—	9
Anthropologists, psychologists, sociologists	9	8	—	1	7
Industrial hygienists	8	6	—	2	2
Pharmacists	6	6	—	—	1
Dental hygienists	6	6	—	—	5
Other [4]	15	13	2	—	7

[1] Includes 1,087 master's degrees (M.P.H., D.P.H., M.S.P.H., M.S.Hyg., M.H.A. and other master's) and 55 doctor's degrees (Dr.P.H., Sc.D., and Ph.D.). The 11 schools in the United States awarded 993 degrees; the 1 school in Puerto Rico, 37 degrees; the 2 schools in Canada, 112 degrees.

[2] Includes 771 graduates from 50 States and the District of Columbia, 29 from Puerto Rico, and 1 from American Samoa.

[3] The other 645 graduates were sponsored as follows: 271, own government or own employer; 48, A.I.D.; 32, other U.S. Government; 53, WHO; 33, fund or foundation; 144, self-sponsored; 64, other.

[4] Includes 2 accountants, 2 economists, 2 lawyers, 1 architect, 1 historian, 1 optometrist, 1 physiologist, and 5 others.

Source: Troupin, J. L.: *Schools of Public Health in the United States and Canada, for the Year Ending June 1965.* New York. American Public Health Association (Mimeo). Sixth annual report.

Table 5. OCCUPATIONAL CLASSIFICATION OF FULL-TIME FEDERAL WHITE-COLLAR EMPLOYEES, BY SELECTED AGENCIES: PUBLIC HEALTH SERVICE, OCTOBER 31, 1965, AND ALL AGENCIES, OCTOBER 31, 1964

GS series[1]	Occupational series	Public Health Service, 1965	All Federal agencies, 1964[2]	Selected agencies, 1964		
				Department of Defense	Health, Education, & Welfare	Veterans' Administration
	All occupations	[3]25,223	1,678,254	502,689	74,136	115,251
000–099	Miscellaneous (n.e.c.)	246	37,107	20,188	330	1,702
100–199	Social science, psychology, and welfare:					
101	Social science	94	957	35	300	199
110, 119	Economics	29 (2)	3,727 (86)	104	42	2
180, 181	Psychology	174 (15)	1,943 (100)	577	210	1,034
184	Sociology	3	----	----	----	----
185	Social work	80	2,149	24	116	1,646
188	Recreational therapist	18	1,811	1,000	31	703
(100)	Other occupations within group	32	17,549	2,083	8,872	2
200–299	Personnel administration and industrial relations	447	30,531	17,242	887	1,372
300–399	General administrative, clerical, and office services:					
330–334	Digital computer systems	180	14,231	9,207	607	342
340	Program management	11	2,562	389	53	138
341	Administrative assistant and officer	378	9,500	3,629	552	349
359, 362	Electric accounting machine	88	7,345 (1,509)	4,954	365	467
(300)	Other occupations within group	7,294	348,611	156,324	26,262	25,390
400–499	Biological sciences:					
401, 404	Biology	1,450 (980)	1,344 (317)	251	461	51
403	Microbiology	329	1,215	411	412	215
405	Pharmacology	57	158	31	106	6
413	Physiology	58	249	91	60	27
414	Entomology	25	613	57	28	—
493	Home economics (nutrition)	15	198	20	27	—
(400)	Other occupations within group	73	34,048	836	977	553
500–599	Accounting and budget	788	105,849	42,181	2,670	4,059
600–699	Medical, hospital, dental, and public health:					
602	Medical officer	431	11,653	[4]421	[5]2,804	[5]8,156
605–621	Nurse	4,768 (2,499)	58,676 (35,955)	[4]6,663	[5]7,192	[5]43,976
630	Dietitian	70	1,161	5	176	972
631	Occupational therapist	28	555	1	55	494
633	Physical therapist	28	697	9	103	575
635	Corrective therapist	—	518	1	—	517
636	Physical medicine and rehabilitation therapy	42 (42)	1,047 (1,047)	6	58	977
637	Manual arts therapist	5	409	—	5	404
639	Educational therapist	3	174	—	5	169
644, 645	Medical technology	455 (262)	3,786 (2,639)	709	467	2,514
647, 648	Medical radiology	248 (248)	1,570 (95)	219	242	1,095
649	Electrocardiograph	10 (10)	254(254)	27	12	211
650	Medical technical	125 (125)	125 (125)	—	125	—
659	Electroencephalograph	6 (6)	144 (144)	14	11	117
660, 661	Pharmacy	50 (39)	1,153 (214)	92	274	777
662, 663	Optometry	—	73 (28)	57	1	13
665, 666	Speech pathology and audiology	5 (—)	157 (37)	43	7	107
667	Orthotist and prosthetist	4	203	35	4	160
668	Podiatrist	—	24	2	1	21
669	Medical record librarian	51	200	65	40	93
670	Hospital administration	66	301	15	70	201
680	Dental officer	12	1,272	[4]12	[5]452	[5]796
681	Dental assistant	217	1,308	518	212	570
682	Dental hygiene	11	214	139	12	60
683	Dental laboratory technician	33	601	174	37	386
685	Public health program specialist	1,502	1,646	—	1,623	—
690	Industrial hygiene	7	81	48	6	—
695, 696	Food and drug	—	1,045 (863)	—	1,037	—
699	Medical aid	215	1,593	151	206	1,208
(600)	Other occupations within group	49	571	15	50	504

Table 5. OCCUPATIONAL CLASSIFICATION OF FULL-TIME FEDERAL WHITE-COLLAR EMPLOYEES, BY SELECTED AGENCIES: PUBLIC HEALTH SERVICE, OCTOBER 31, 1965, AND ALL AGENCIES, OCTOBER 31, 1964—Continued

GS series[1]	Occupational series	Public Health Service, 1965	All Federal agencies, 1964[2]	Selected agencies, 1964		
				Department of Defense	Health, Education & Welfare	Veterans' Administration
700–799	Veterinary medical science	13	2,289	14	141	3
800–899	Engineering and architecture:					
801, 802	General engineering	152 (109)	32,144 (21,785)	20,601	130	328
803	Safety engineering	5	447	263	4	6
810	Civil engineering	47	8,461	4,659	17	10
819	Sanitary engineering	101	975	110	781	6
855, 856	Electronic engineering	96 (72)	30,012 (16,836)	16,024	93	42
893	Chemical engineering	30	1,290	760	31	—
(800)	Other occupations within group	151	54,710	29,316	165	386
900–999	Legal and kindred	12	32,567	1,919	6,957	4,694
1000–1099	Information and arts:					
1020	Illustrating	41	2,369	1,706	60	37
1021	Office drafting	13	217	92	18	1
1071	Audio-visual production	23	614	316	21	1
1081	Public information	159	1,731	627	225	20
1082	Writing and editing	92	1,719	875	142	4
1083	Technical writing and editing	46	1,471	1,091	49	2
1084	Visual information	22	664	316	29	6
1087	Editorial assistance	55	1,691	965	70	15
(1000)	Other occupations within group	99	6,189	2,078	140	200
1100–1199	Business and industry	155	47,044	24,907	189	1,288
1200–1299	Copyright, patent, and trademark	3	1,739	222	4	—
1300–1399	Physical sciences:					
1301, 1311	General physical sciences	291 (254)	9,364 (2,898)	2,325	703	70
1306	Health physics	16	223	71	14	2
1310	Physics	56	5,026	3,722	52	34
1320	Chemistry	933	7,716	2,469	1,882	578
1382	Food technology	1	91	40	7	—
(1300)	Other occupations within group	29	15,690	6,773	65	15
1400–1499	Library and archives	205 (98)	6,489	2,339	283	385
1500–1599	Mathematics and statistics:					
1520–1530	Mathematician and statistician	351 (6)	6,325 (476)	2,993	459	66
1531	Statistical clerical and administrative	414	7,019	2,728	591	275
(1500)	Actuary, cryptography, and other	—	165	49	22	16
1600–1699	Equipment, facilities, and service	117	16,748	12,320	191	121
1700–1799	Education:					
1715	Vocational rehabilation	3	106	—	2	94
1725	Public health educator	19	24	1	23	—
(1700)	Other occupations within group	111	21,574	14,814	660	100
1800–1899	Investigation:					
1860	Public health inspection	95	167	11	39	—
(1800)	Other occupations within group	380	31,639	385	413	118
1900–1999	Commodity quality control, inspection, and grading	10	17,044	11,978	13	5
2000–2099	Supply	496	73,739	55,528	647	2,785
2100–2199	Transportation	71	30,460	8,207	99	208
2300–2350	Postal group	—	487,394	—	—	—

[1] If the GS series indicates assistant or technician in the title, the number of employees is shown in parentheses ( ) after the total.

[2] Includes all employees in the United States and U.S. citizens employed abroad. Includes all branches of the Government for whom data could be obtained. Only three agencies are shown separately here.

[3] Does not include 5,085 blue-collar workers or 4,998 commissioned officers classified as follows: 2,341 physicians, 453 dentists, 297 nurses, 90 veterinarians, 652 sanitary engineers, 368 health service officers, 241 pharmacists, 207 scientists, 195 sanitarians, 79 dietitians, and 75 therapists.

[4] Does not include active duty uniformed services: 12,161 physicians, 5,919 dentists, 8,182 nurses, and other personnel.

[5] Includes physicians, dentists, and nurses whom the Public Health Service and Veterans' Administration classify under other pay laws.

Sources: U.S. Civil Service Commission: *Occupations of Federal White-Collar Workers: October 31, 1964.* Pamphlet 56-6. Washington. U.S. Government Printing Office. To be published.
U.S. Department of Health, Education, and Welfare, Public Health Service, Office of Personnel, Systems Management Staff.

Table 6. OCCUPATION OF FULL-TIME EMPLOYEES OF STATE HEALTH DEPARTMENTS AND LOCAL HEALTH UNITS: JANUARY 1, 1964 AND 1965

Occupation	State health department employees		Local health unit employees, 1964 [1]
	1965	1964	
All occupations	22,697	19,009	51,632
Physicians	708	609	1,668
Public health nurses	1,571	869	16,058
Clinic nurses	95	61	841
Dentists	166	164	402
Dental hygienists	66	58	496
Engineers	996	830	464
Sanitarians	1,072	688	7,508
Other sanitation personnel	544	350	2,188
Laboratory personnel	2,285	2,158	1,546
Health educators	286	233	361
Nutritionists	187	146	177
Social workers	291	230	688
Psychologists	66	69	156
Analysts and statisticians	544	387	250
Veterinarians	62	51	209
Public health investigators	403	337	543
X-ray technicians	197	222	380
Physical therapists	127	82	249
Administrative management	1,443	1,128	795
Clerical	8,776	7,733	11,634
Maintenance and service	2,101	1,677	3,143
Other personnel [2]	711	[3] 927	1,876

[1] 1965 data not available.

[2] Includes some personnel in special programs such as air pollution, water pollution, radiological health, industrial hygiene, alcoholism, and community health.

[3] Includes attorneys, consultants, program representatives, and others who work with administrative management and were included in that group in 1965.

Source: Bureau of State Services, Community Health: *Joint Form 5, Report of State Health Department Personnel by Organizational Unit, and Report of Public Health Personnel Submitted by Local Health Departments.* Public Health Service, U.S. Department of Health, Education, and Welfare. Mimeographed tables dated 1–4–66 and 5–17–65. Data for United States, Puerto Rico, Guam, and the Virgin Islands.

CHAPTER 1

Administration of Health Services

Administration is one of the top goals of advancement in many professions. In the health field it is customary for a physician to serve as the head of a public health department but relatively few medical administrators are now the directors of health agencies, institutions, or organizations. A visiting nurse service may be administered by a professional nurse; a laboratory, by a scientist. Among other professional persons in administrative positions are dentists, veterinarians with public health training, public-health engineers and other specialists in environmental health, health statisticians, public-health educators, health information specialists, social workers, and others with a solid foundation of professional skill.

In recent years an increasing number of administrators have been employed with professional training and competence in administration as a specialty in its own right. Working with the administrator and others are administrative officers and assistants, program analysts, program representatives, field representatives, and other staff members with similar position titles, all of whom help to strengthen efficiency, planning, and leadership within the health organization. An estimated 31,500 to 37,000 persons were employed in 1965 in the administrative positions listed below:

Health organization	*Estimated numbers employed*[a]
Health department	2,500 to 3,000 public-health administrators, administrative officers, program analysts, and program representatives
Hospitals	10,000 to 12,000 hospital administrators and assistants
Nursing and personal care homes	11,000 to 13,000 nursing-home administrators and assistants
Voluntary health agencies	8,000 to 9,000 voluntary-health-agency administrators, executives, and field representatives

[a] Excludes physicians, nurses, and other health personnel with specific professional skills discussed in subsequent chapters.

Workers are also needed to provide the necessary business, clerical, and maintenance services. Occupations that are concerned with these aspects include: accountant, admitting officer, business manager, cashier, controller, credit manager, director of office services, director of volunteer services, employment interviewer, employment manager, hospital engineer, housekeeper and housekeeping workers, job analyst, laundry manager and workers, maintenance workers, personnel director and officer of personnel, public relations director, purchasing agent, stationary engineers, and stockroom manager. No statistics on employment in these occupations are provided since these occupations are not unique to the health field.

Health Department Administration

State and local health departments are the official government agencies responsible for providing leadership in making the community a healthier and safer place in which to live. With few exceptions, the *health officer* or administrative head of a health department is a physician who usually has had specialized professional training and experience in public health (see ch. 18). The health officer, as chief executive of the

health department, administers the direct services for which responsibility is assigned to his department by law. He also assumes leadership in stimulating community-wide cooperation and action to strengthen gaps in health practices and services in the area.

In a large health department a *public health administrator* may serve as alter ego of the health officer on all matters pertaining to administrative management. This executive has responsibility for organizing, planning, and directing such functions as budget, personnel, procurement, legal and related administrative services, and perhaps statistics, research, and other professional programs. He has professional competence in administrative practices and procedures, particularly as they relate to public health programs. Often his training has been in a school of public health. In 1964-65, 104 administrators were graduated from U.S. schools of public health with major subjects in administration in public health, medical care or hospitals; 27 were sponsored by the U.S. Public Health Service (table 4, Introduction).

Working with the health officer and administrator is an *administrative officer* with responsibility for management of personnel, secretarial and clerical services, purchasing, property inventory, and other supporting services. The minimum educational requirement for this position is a bachelor's degree.

Another specialist frequently on the staff of larger health departments is a *program analyst.* This person is a planning specialist —a professional expert in his own right, with basic training in some field such as statistics, economics, or sociology.

The director of each program in the health department very likely has on his staff a *program representative.* This position requires someone with a bachelor's degree although he may not be trained in a specific health profession. The program representative takes part in promoting public participation in new health services, program planning, and fact gathering.

About 2,500 to 3,000 persons were employed in 1965 in the positions of public health administrator, administrative officer, program analyst, and program representative in State and local health departments and in Federal health programs (tables 5 and 6, Introduction). Membership in the Association of Management in Public Health (640 members) and the American Public Health Association provide possible identification of many of these persons.

Administration of Hospitals, Nursing Homes, and Related Institutions

As the hospital developed into a highly specialized institution, it required a skilled and trained person to manage its general activities and functions. This is the role of the *hospital administrator* who serves as the chief executive officer of the hospital. He administers and coordinates all activities of the hospital within the general policies established by a governing board. It is his responsibility to provide and maintain facilities, equipment, and assistance in order that the patient may be restored to health.

In 1965 there were approximately 13,000 to 15,000 administrators and assistants in some 9,000 hospitals of all types in the United States. This estimate is based on the administration of hospitals registered by the American Hospital Association[5] and on other hospitals included in the NCHS Master Facility Inventory.[6] The American College of Hospital Administrators has about 5,200 members.

About two-thirds of these administrators and assistants work in nonprofit or private hospitals, and the remainder work in Federal, State, and local government hospitals. Probably 3,000 or so are physicians or nurses. The growth of professional personnel as hospital administrators and assistants is indicated by the increase in numbers employed from fewer than 9,000 in 1950, to about 12,000 in 1960, and probably more than 13,000 in 1965.

[5] American Hospital Association: *Hospitals*, Guide Issue, Part 2. *J.A.H.A.* 39 (15): 404, Aug. 1965.

[6] National Center for Health Statistics: Development and maintenance of a national inventory of hospitals and institutions. *Vital and Health Statistics.* PHS Pub. No. 1000-Series 1-No. 8. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, Feb. 1965.

The graduate program for professional administrators consists of 1 or 2 years of academic study, and may include a year of "administrative residence" in a hospital. At the end of this program, students are eligible to receive a master's degree in hospital administration. In 1965, 297 students completed the academic requirements for a degree in hospital administration. Twenty-one schools in the United States offer graduate courses in this field (tables 7 and 8). Many new schools are expected to open within the next 5 years.

The 17,400 nursing and personal care homes in the United States also require administrative management. In 1965, an estimated 21,000 persons were employed as *nursing home administrators* and *assistant administrators.*[7] About 9,000 of these persons had additional duties such as nursing. The 12,000 persons without additional duties probably include some professional or practical nurses, although they reported that serving as administrator or assistant administrator was their only job in the home.

Administration of Voluntary Health Agencies

Voluntary health agencies are nonprofit organizations supported primarily by contributions from the public rather than from governmental sources or endowments. They engage in programs of research, education, and service to individuals and communities in their particular sphere of interest—generally a group of related diseases or of related services.

The *administrator* or *executive* of the health agency is administratively responsible for coordinating the activities of paid and voluntary personnel to see that an effective program is developed. Among his responsibilities are: to work with the board of directors to set the course of the agency's activities; to inform the community of the health problems and their resources for meeting them; to promote local fundraising; to help recruit volunteer workers; and to carry out personnel functions of the staff. In the majority of voluntary health agencies, the local units are so small that the person employed as administrator or executive is generally expected to also have specialized skills in one or more of the technical aspects of the local program, i.e., physical therapy, nursing, fundraising, health education, etc. The positions which place primary emphasis on administration and administrative skills are more frequently found at the State or national level.

The *field representative* maintains the contacts through which the State, regional or national organization and its affiliates communicate with each other and work together. He helps the State or local executive by acting as a consultant for the program in his community and works with community leaders to set up a local unit.

There are about 60 national voluntary health agencies in the United States. Most of the large agencies are members of the National Health Council and they employ an estimated 8,000 to 9,000 persons in the administrative, executive, field representative, and other professional positions on National, State, and local levels.

Table 7. SCHOOLS OFFERING HOSPITAL ADMINISTRATION PROGRAMS, STUDENTS, AND GRADUATES: SELECTED YEARS, 1949–50 THROUGH 1964–65

Academic year	Schools [1]	Students	Graduates
1964–65	16	695	279
1963–64	16	----------	243
1962–63	16	----------	----------
1961–62	15	----------	243
1960–61	14	----------	----------
1959–60	14	----------	----------
1954–55	13	----------	200
1949–50	13	----------	126

[1] Member programs of AUPHA. See table 8 for 5 additional programs in 1965.

Source: Association of University Programs in Hospital Administration.

[7] National Center for Health Statistics: Employees in nursing and personal care homes, United States May-June 1964. *Vital and Health Statistics.* PHS Pub. No. 1000-Series 12-No. 5. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, Sept. 1966.

Table 8. LOCATION AND OWNERSHIP OF SCHOOLS OFFERING HOSPITAL ADMINISTRATION PROGRAMS AND NUMBERS OF STUDENTS AND GRADUATES: 1965

Location	School	Ownership	Students	Graduates
	Total, 21 schools		811	297
Ala.	University of Alabama, University [1]	Public	3	
Calif.	University of California, Berkeley [2]	Public	22	13
	University of California, Los Angeles [2]	Public	25	13
Conn.	Yale University, New Haven [2]	Private	21	11
D.C.	George Washington University, Washington [2]	Private	165	47
Fla.	University of Florida, Gainesville [3]	Public	11	
Ga.	Georgia State College, Atlanta [1]	Public	18	
Ill.	University of Chicago, Chicago [2]	Public	28	13
Iowa	University of Iowa, Iowa City [2]	Public	30	21
Mich.	University of Michigan, Ann Arbor [2]	Public	31	15
Minn.	University of Minnesota, Minneapolis [2]	Public	70	28
Mo.	St. Louis University, St. Louis [2]	Private	44	24
	Washington University, St. Louis [2]	Private	29	14
N.Y.	Columbia University, New York City [2]	Private	24	9
	Cornell University, Ithaca [2]	Private	31	15
N.C.	Duke University, Durham [2]	Private	26	10
Ohio	Xavier University, Cincinnati	Private	61	18
Pa.	University of Pittsburgh, Pittsburgh [2]	Private	29	10
Tex.	Baylor University Army Medical Service School, Fort Sam Houston [2]	Private	86	25
	Trinity University, San Antonio [1]	Private	23	
Va.	Medical College of Virginia, Richmond [2]	Public	34	11

[1] First graduating class in 1967. [2] Member programs of AUPHA. [3] First graduating class in 1966.

Source: Association of University Programs in Hospital Administration.

CHAPTER 2

Anthropology and Sociology

Three of the basic social sciences have specialists concerned with the utilization of their findings in the solution of health problems. Anthropology and sociology are the two considered in this chapter; economics is discussed in chapter *10*.

The contributions of anthropologists and sociologists to health are primarily through research. Since a master's degree is usually required for employment, persons with a baccalaureate are not counted among those employed. Those in the health field are most often employed on the teaching or research staff of medical colleges and graduate departments of schools of public health and preventive medicine. A few find employment on hospital staffs and in large health departments.

Sociologists were included in the National Science Foundation National Register of Scientific and Technical Personnel for the first time in 1964, with about 2,700 respondents. Anthropologists are included for the first time in 1966. A survey of the supply of and demand for sociologists and anthropologists is in process in 1966, financed by the National Institutes of Health of the Public Health Service. Preliminary findings should be available early in 1967.

Information on the number of degrees conferred in the fields of anthropology and sociology is given in table 9, and on the institutions that conferred these degrees, in table 10. No information is available on degrees with specialization in health aspects of these subjects.

Anthropologist

The *anthropologist* makes comparative studies of the origin, evolution, and races of man, the cultures that he has created, and man's distribution and physical characteristics. Physical anthropologists study the meanings and causes of human physical differences and interrelated effects of culture, heredity, and environment on the human form. Cultural anthropologists study cultural factors related to personality, mental illness, psychological development, and psychobiological stress. These two kinds of anthropologists may be considered as part of our health manpower resources.

Of the 1,500 anthropologists employed in this country in 1965, about 300 were *physical anthropologists* and fewer than 100 were *cultural anthropologists* in the health field. These estimates have been provided by the American Anthropological Association.

Sociologist

Sociology is the science concerned with the origin and role of social groupings and of social behavior. *Sociologists* considered as part of health manpower try to identify social factors influencing the occurrence of disease, the behavior of patients, and the obstacles that stand in the way of realizing the full potential health gains of scientific progress.

Of the 4,000 to 5,000 sociologists employed in the United States in 1965, probably 200 to 400 are *medical sociologists* concerned with health. These estimates have been provided by the American Sociological Association.

Table 9. EARNED DEGREES CONFERRED IN ANTHROPOLOGY AND SOCIOLOGY: 1960–61 THROUGH 1964–65

Academic year	Anthropology			Sociology		
	Bachelor's	Master's	Doctor's	Bachelor's	Master's	Doctor's
1964–65	1,208	224	88	12,896	789	230
1963–64	964	180	85	11,053	646	198
1962–63	746	160	86	9,055	684	208
1961–62	577	143	82	8,183	578	173
1960–61	484	87	49	7,519	504	184

Source: National Center for Educational Statistics: *Summary Report on Bachelor's and Higher Degrees Conferred During the Year 1964–65.* Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office. To be published. Also prior annual issues. Data for United States, Canal Zone, Puerto Rico, and the Virgin Islands.

Table 10. LOCATION OF SCHOOLS CONFERRING DEGREES IN ANTHROPOLOGY AND/OR SOCIOLOGY: 1963–64

Location	School	Anthropology			Sociology		
		Bachelor's	Master's	Doctor's	Bachelor's	Master's	Doctor's
	Total, all schools	964	180	85	11,053	646	198
	Selected schools	676	167	85	3,205	487	198
Ala.	University of Alabama	3	1	—	27	1	—
Ariz.	University of Arizona	19	4	3	13	3	—
Calif.	Stanford University	28	8	3	12	4	—
	U of Cal Berkeley	101	10	12	109	21	8
	U of Cal Davis	3	1	—	13	—	—
	U of Cal Los Angeles	37	14	7	99	19	7
	U of Cal Riverside	4	—	—	10	—	—
	U of Cal Santa Barbara	14	—	—	43	3	—
	Univ of Sthrn California	1	—	—	31	3	2
Colo.	Colorado State Univ	—	—	—	12	2	—
	University of Colorado	21	4	1	56	2	2
	University of Denver	2	—	—	34	1	—
Conn.	Hartford Sem Foundation	—	3	2	—	—	1
	University of Connecticut	—	—	—	57	6	—
	Yale University	6	1	4	10	5	3
Del.	University of Delaware	—	—	—	7	—	—
D.C.	American University	4	—	—	12	2	5
	Catholic Univ of America	—	2	—	5	6	3
	George Washington Univ	10	2	—	31	2	—
Fla.	Florida State University	4	—	—	11	4	2
	University of Florida	6	3	—	14	—	1
Ga.	Emory University	—	—	—	22	1	1
Hawaii	University of Hawaii	14	—	—	42	5	—
Ill.	Loyola University	—	—	—	55	7	3
	Northwestern University	4	3	2	26	3	2
	Southern Illinois University	2	1	1	46	5	1
	University of Chicago	11	17	8	9	37	8
	University of Illinois	12	1	—	66	4	8
Ind.	Indiana University	11	6	1	28	6	3
	Purdue University	—	—	—	25	3	2
	University of Notre Dame	—	—	—	48	15	1
Iowa	Iowa St U of Sci & Tech	—	—	—	6	7	2
	University of Iowa	1	—	—	64	5	6
Kans.	Kans St U Ag & App Sci	—	—	—	15	3	—
	University of Kansas	7	1	—	23	3	—
Ky.	University of Kentucky	4	—	—	8	5	2
La.	La State Univ & A&M Col	—	—	—	37	9	2
	Tulane University	8	—	—	23	1	—
Md.	University of Maryland	—	—	—	74	5	3
Mass.	Boston University	3	—	—	78	8	—
	Brandeis University	3	5	—	25	3	—
	Harvard Univ—Radcliffe	19	15	13	97	5	6
	Tufts University	—	—	—	16	—	—
	Univ of Massachusetts	—	—	—	40	4	—
Mich.	Mich St U Agric & App Sci	15	11	2	18	12	2
	University of Michigan	23	10	2	46	16	6
	Wayne State University	2	—	—	75	13	3
Minn.	University of Minnesota	18	2	—	186	8	14
Miss.	Mississippi State Univ	—	—	—	5	5	3

Table 10. LOCATION OF SCHOOLS CONFERRING DEGREES IN ANTHROPOLOGY AND/OR SOCIOLOGY: 1963–64—Continued

Location	School	Anthropology			Sociology		
		Bachelor's	Master's	Doctor's	Bachelor's	Master's	Doctor's
Mo.	St Louis University	3	1	—	29	9	2
	University of Missouri	6	1	—	31	4	3
	Washington University	—	2	—	26	9	4
Nebr.	University of Nebraska	6	1	—	11	1	1
N.J.	Princeton University	—	—	—	6	5	7
	Rutgers The State Univ	—	—	—	96	3	—
N.Y.	Adelphi University	—	—	—	17	2	—
	Columbia University	25	4	6	43	7	13
	Cornell University	14	2	3	38	11	5
	Fordham University	—	—	—	23	14	1
	New Sch for Soc Research	—	—	—	11	9	6
	New York University	8	2	—	66	17	7
	St Johns University	—	—	—	—	11	—
	SUNY University Buffalo	11	—	—	55	—	2
	Syracuse University	12	1	—	45	3	3
	University of Rochester	3	2	—	2	—	—
	Yeshiva University	—	—	—	12	—	—
N.C.	Duke University	—	—	—	13	5	—
	Univ of N C at Chapel Hill	7	2	1	40	5	5
	Univ of N C at Raleigh	—	—	—	10	2	—
Ohio	Ohio State University	14	3	—	26	7	4
	University of Cincinnati	—	—	—	37	—	—
	Western Reserve Univ	—	—	—	22	7	—
Okla.	Okla St U Agric & App Sci	—	—	—	25	4	—
	University of Oklahoma	8	—	—	13	3	—
Oreg.	University of Oregon	7	1	2	77	8	6
Pa.	Bryn Mawr College	3	—	1	4	—	—
	Dropsie College	—	—	1	—	—	—
	Lehigh University	—	—	—	3	—	—
	Pennsylvania State Univ	13	1	—	25	3	1
	Temple University	1	—	—	32	3	—
	University of Pennsylvania	31	6	3	71	9	—
	University of Pittsburgh	5	—	1	25	—	1
R.I.	Brown University	11	1	—	19	3	2
Tenn.	George Peabody Col Tchrs	—	—	—	9	2	—
	University of Tennessee	—	—	—	28	2	2
	Vanderbilt University	—	—	—	20	2	1
Tex.	Baylor University	—	—	—	27	—	—
	Rice University	3	—	—	—	—	—
	Texas A & M Univ	—	—	—	5	—	—
	University of Houston	—	—	—	12	1	—
	University of Texas	11	2	—	42	2	2
Utah	University of Utah	6	—	—	58	4	1
	Utah St U Agric & App Sci	—	—	—	9	5	—
Va.	University of Virginia	—	—	—	6	—	—
	Virginia Polytechnic Inst	—	—	—	10	—	—
Wash.	University of Washington	14	3	3	78	3	4
	Washington State Univ	6	4	—	29	3	1
Wis.	University of Wisconsin	28	3	3	105	17	2

Source: National Center for Educational Statistics: *Earned Degrees Conferred 1963–64*. OE-54013-64. Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1966.

CHAPTER 3

Automatic Data Processing

A substantial part of the processing and analysis of statistical data is accomplished with the aid of electrical accounting machines (EAM) and electronic data processing equipment (EDP). Computers and other electronic business machines developed since 1950 are helping to streamline and expedite large-scale operations throughout the health field. Electronic data processing involves three main job areas—systems analysis, programming, and computer operations.

The *systems analyst* defines the broad outlines of the machine solution of the problem. He must have a detailed understanding of the application and know the overall capacities of the equipment.

He may be a member of the using department, with an educational background in business administration, statistics, engineering, or a related science. Knowledge of electronic data processing may have been obtained through formal courses or on-the-job training.

In 1964-65, the following degrees were awarded in the field of computer science and systems analysis: 67 bachelor's, 20 first professional, 146 master's, and 6 doctor's (table 2, Introduction).

The Data Processing Management Association estimated that 300 persons were employed in 1965 as systems analysts in the health field. The Association's 20,000 members include persons not employed in the health field.

The *programer* prepares problem solving procedures, flow charts, and computer instructions. These instructions, along with problem data, are translated into computer language and fed to the computer via punch card, tape, page readers, or other means of input.

Computer programming ordinarily calls for a college degree with courses in mathematics, physics, or engineering. A number of colleges are developing graduate and undergraduate courses in computer programming and technology.

The *computer operator* has the task of operating the console and reading the documentation provided, so that the machine creates the output information from the designated inputs. Educational requirements vary from on-the-job training to courses in a technical school or college. Similar education is required for the operation of conventional punch card equipment, including sorters, collators, and tabulators.

Information on the numbers of persons who are employed in the health field as programmers and operators of EAM and EDP equipment is not available, nor are estimates available for electronic technicians and related personnel.

CHAPTER 4

Basic Sciences in the Health Field*

Science is basic to all activities in the health field. Scientists with an academic background in one of the basic scientific disciplines or in the application of mathematics to these disciplines engage in research to provide new knowledge and deeper insights in every health profession. The biological sciences provide the core supply for medical research. However, modern medical research is also drawing heavily upon scientists trained in an increasing diversity of fields of study within the physical sciences, mathematics and statistics, psychology and social sciences. This text highlights the biological and physical sciences. Mathematics and statistics, psychology, and the selected social sciences of anthropology, economics, sociology, and social work are considered in other chapters.

In 1965, nearly 62,000 professional workers were engaged in medical and health-related research. This represents a threefold increase in numbers since 1954, the first year for which estimates are available (table 11).

The 1965 figure for research scientists includes 17,700 professional doctors of medicine, dentistry, and veterinary medicine; 26,300 research doctors, Ph. D.'s, Sc. D.'s, etc.; and 17,900 with master's or bachelor's degrees. These professional workers function as principal investigators and collaborators in medical and health-related research. Not included are persons with such training who perform as research assistants, technicians, and other supporting personnel.

Nearly two-thirds of the total number are engaged in medical research in universities and research institutes. The rest are almost equally divided between industry and government. Research is often combined with teaching and/or service for the M.D.'s and Ph.D.'s in medical schools, universities, teaching hospitals, and similar multipurpose institutions.

More than 700 colleges and universities enrolled about 57,700 graduate students in the biological and physical sciences in 1964-65 (table 12). Three-fourths of these students were enrolled in approximately 100 of the schools. The enrollment in each field of study in each of these schools will be presented in a forthcoming publication of the Resources Analysis Branch, Office of Program Planning, National Institutes of Health.

Total graduate enrollment in the selected science fields undergirding medical and health related research increased about 25 percent in the 3-year period, from 46,400 in the fall of 1962 to 57,700 in 1964. The basic medical sciences increased 29 percent (from 7,100 to 9,200); other biosciences increased 36 percent (from 10,600 to 14,400); and the physical sciences increased 19 percent (from 28,600 to 34,100).

During 1963-64, degrees conferred in the biological and physical sciences included 4,100 doctor's; 7,900 master's, and 36,700 bachelor's (table 13). At the doctoral level there were 743 in the basic medical sciences, 882 in other biosciences, and 2,455 in the physical sciences. In the 3 years since 1961-62, doctorates awarded in the basic medical sciences increased 29 percent, as compared with 16 or 17 percent for the other two categories.

The leading schools that conferred doctor's degrees in 1963-64 are identified in tables 14, 15, and 16. These 100 or so schools conferred 92 percent of the doctorates in the selected science fields.

Encouraging as these data may be, further expansion in the selected fields is necessary to provide an adequate supply of doctoral-level scientists for medical research and teaching. It is estimated that, in 1964-65, the National Institutes of Health provided

* The material for this chapter was provided by the Public Health Service, National Institutes of Health, Office of Program Planning, Resources Analysis Branch—Dr. Herbert H. Rosenberg, Chief.

stipend support to one-fifth of the predoctoral students in the biosciences—42 percent in the basic medical sciences and 7 percent in the other biosciences.

Table 11. ESTIMATED SCIENTIFIC AND PROFESSIONAL MANPOWER ENGAGED IN MEDICAL AND HEALTH-RELATED RESEARCH, BY TYPE OF EMPLOYER AND BY LEVEL OF TRAINING: SELECTED YEARS, 1954 THROUGH 1965

Employer and training	1954	1958	1960	1965
Total manpower	19,200	34,600	39,700	61,900
Type of employer				
Federal Government	3,700	6,900	7,800	10,700
Industry	3,400	6,500	7,200	11,900
Universities and research institutes	12,100	21,200	24,700	39,300
Level of training				
Ph.D., Sc.D.	----------	14,700	18,000	26,300
M.D., D.D.S., D.V.M.	----------	9,990	11,400	17,700
Less than doctoral [1]	----------	9,910	10,300	17,900

[1] M.S., M.P.H., M.A., B.S., A.B.

Source: Office of Program Planning, National Institutes of Health: Manpower for medical research requirements and resources, 1965–1970 *Resources for Medical Research, Report No. 3.* PHS Pub. No. 1001. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1964. Updated to 1965.

Table 12. GRADUATE ENROLLMENT IN BIOLOGICAL AND PHYSICAL SCIENCES: FALL OF 1962, 1963, AND 1964

Field of study	1962		1963		1964	
	Total	Fulltime	Total	Fulltime	Total	Fulltime
Total	46,359	29,386	51,598	32,468	57,721	36,941
Basic medical sciences	7,125	5,195	8,362	6,143	9,215	6,798
Anatomy [1]	727	514	859	633	970	730
Biochemistry	2,006	1,543	2,388	1,831	2,639	1,980
Biophysics	352	294	420	321	511	412
Microbiology [2]	2,155	1,455	2,460	1,691	2,637	1,821
Pathology [3]	286	194	328	207	323	216
Pharmacology	538	418	662	505	680	536
Physiology [4]	1,061	777	1,245	955	1,455	1,103
Other biosciences	10,643	6,525	12,277	7,406	14,445	8,920
Biology, general	3,658	1,585	4,390	1,841	5,336	2,397
Botany, general	1,398	957	1,447	981	1,609	1,086
Ecology	96	63	179	146	127	111
Entomology	885	602	954	688	991	693
Genetics	570	443	676	483	735	561
Nutrition	186	160	239	181	333	259
Plant pathology	538	383	574	429	601	427
Plant physiology	219	168	245	182	267	223
Zoology, general	2,437	1,641	2,736	1,832	3,254	2,187
Biosciences, all other	656	523	837	643	1,192	976
Physical sciences	28,591	17,666	30,959	18,919	34,061	21,223
Chemistry	12,309	7,659	13,567	8,316	14,529	9,114
Physics	11,005	6,437	11,781	6,765	13,016	7,769
Physical sciences, all other	5,277	3,570	5,611	3,838	6,516	4,340

[1] Includes histology, cytology, and embryology.
[2] Includes bacteriology, virology, mycology, and parasitology.
[3] Excludes plant pathology.
[4] Excludes plant physiology.

Source: Tabulation prepared by the Resources Analysis Branch, Office of Program Planning, National Institutes of Health, Public Health Service. Based on data from annual surveys conducted by the U.S. Office of Education.

Table 13. EARNED DEGREES CONFERRED IN BIOLOGICAL AND PHYSICAL SCIENCES, BY LEVEL OF DEGREE AND NUMBERS OF GRADUATES: 1961–62 THROUGH 1963–64

Field of study	Bachelor's [1]			Master's			Doctor's		
	1961–62	1962–63	1963–64	1961–62	1962–63	1963–64	1961–62	1962–63	1963–64
Total	29,836	32,141	36,657	6,555	7,049	7,860	3,452	3,830	4,080
Basic medical sciences	893	954	1,143	800	808	953	574	632	743
Anatomy [2]	70	33	45	90	74	122	44	61	51
Biochemistry	141	174	190	178	196	207	183	212	264
Biophysics	19	17	14	16	23	27	25	17	30
Microbiology [3]	570	612	763	323	293	350	181	191	183
Pathology [4]	6	—	—	30	48	52	11	14	29
Pharmacology	—	—	1	50	58	75	59	57	70
Physiology [5]	87	118	130	113	116	120	71	80	116
Other biosciences	13,049	14,911	17,987	1,826	2,109	2,340	756	818	882
Biology, general	9,999	11,674	13,752	788	939	1,122	153	168	186
Botany, general	413	369	443	249	277	288	130	168	169
Ecology	—	—	—	—	1	—	2	1	1
Entomology	126	122	132	152	149	161	94	83	99
Genetics	15	14	17	39	41	51	46	63	65
Nutrition	6	5	23	19	34	44	2	5	14
Plant pathology	14	15	23	60	74	67	64	78	61
Plant physiology	3	—	3	11	9	17	21	16	10
Zoology, general	2,404	2,650	3,488	455	516	493	222	209	217
Biosciences, all other	69	62	106	53	69	97	22	27	60
Physical sciences	15,894	16,276	17,527	3,929	4,132	4,567	2,122	2,380	2,455
Chemistry	8,086	8,822	9,720	1,404	1,443	1,566	1,114	1,219	1,271
Physics	4,812	4,785	4,956	1,425	1,567	1,848	667	752	778
Physical sciences, all other	2,996	2,669	2,851	1,100	1,122	1,153	341	409	406

[1] Includes first-professional degrees requiring 5 or more years of study—less than 0.05 percent of the total.
[2] Includes histology, cytology, and embryology.
[3] Includes bacteriology, virology, mycology, and parasitology.
[4] Excludes plant pathology.
[5] Excludes plant physiology.

Source: National Center for Educational Statistics: *Summary Report on Bachelor's and Higher Degrees Conferred During the Year 1963–64.* OE-50039. Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1965. Also prior annual issues. Data for United States, Canal Zone, Puerto Rico, and the Virgin Islands.

Table 14. LOCATION OF SCHOOLS CONFERRING DOCTOR'S DEGREES IN THE BASIC MEDICAL SCIENCES AND NUMBERS OF GRADUATES: 1963–64

Location	School	Total basic medical sciences	Anatomy	Biochemistry	Biophysics	Microbiology	Pathology	Pharmacology	Physiology
	Total, all schools	743	51	264	30	183	29	70	116
	Leading schools	679	44	255	26	174	24	57	99
Ala.	University of Alabama	1	—	1	—	—	—	—	—
Ariz.	University of Arizona	1	—	1	—	—	—	—	—
Calif.	California Inst of Tech	—	—	—	—	—	—	—	—
	Claremont Graduate School	—	—	—	—	—	—	—	—
	Stanford University	10	1	3	—	4	—	—	2
	U of Cal Berkeley	24	1	12	7	2	—	—	2
	U of Cal Davis	7	—	1	—	4	2	—	—
	U of Cal Los Angeles	16	1	7	1	4	—	2	1
	U of Cal Riverside	—	—	—	—	—	—	—	—
	U of Cal San Diego	—	—	—	—	—	—	—	—
	U of Cal San Francisco	7	1	4	—	—	—	1	1
	Univ of Sthrn California	8	—	3	—	2	—	2	1
Colo.	Colorado State University	—	—	—	—	—	—	—	—
	University of Colorado	4	—	1	1	1	—	—	1
	University of Denver	—	—	—	—	—	—	—	—
Conn.	University of Connecticut	4	—	3	—	1	—	—	—
	Yale University	10	1	2	—	3	—	2	2
Del.	University of Delaware	—	—	—	—	—	—	—	—
D.C.	Catholic Univ of America	—	—	—	—	—	—	—	—
	Georgetown University	7	—	2	—	1	—	1	3
	George Washington Univ	6	—	2	—	1	—	2	1
Fla.	Florida State University	—	—	—	—	—	—	—	—
	University of Florida	4	—	1	—	1	—	—	2
Ga.	Emory University	—	—	—	—	—	—	—	—
Hawaii	University of Hawaii	2	—	2	—	—	—	—	—
Ill.	Illinois Inst of Tech	1	—	1	—	—	—	—	—
	Loyola University	10	2	2	—	2	—	1	3
	Northwestern University	5	—	4	—	—	—	1	—
	Southern Illinois Univ	2	—	—	—	1	—	—	1
	University of Chicago	21	—	6	3	1	3	6	2
	University of Illinois	27	—	7	2	8	—	1	9
Ind.	Indiana University	9	1	3	—	2	—	1	2
	Purdue University	8	—	8	—	—	—	—	—
	University of Notre Dame	—	—	—	—	—	—	—	—
Iowa	Iowa St U of Sci & Tech	8	—	1	1	6	—	—	—
	University of Iowa	12	2	4	—	—	—	5	1
Kans.	Kansas St U Ag & App Sci	10	—	1	—	5	4	—	—
	University of Kansas	9	3	3	—	2	—	1	—
Ky.	University of Kentucky	1	—	1	—	—	—	—	—
La.	La State Univ & A & M Col	3	—	—	—	3	—	—	—
	Tulane Univ of Louisiana	17	—	7	—	6	—	1	3
Md.	Johns Hopkins University	19	2	9	2	5	—	—	1
	University of Maryland	13	1	4	—	5	—	3	—
Mass.	Boston University	10	3	1	—	1	—	—	5
	Brandeis University	8	—	5	—	3	—	—	—
	Harvard Univ—Radcliffe	16	—	9	2	—	—	4	1
	Mass Inst of Technology	—	—	—	—	—	—	—	—
	Tufts University	4	—	4	—	—	—	—	—
	University of Massachusetts	1	—	—	—	1	—	—	—
Mich.	Mich St U Agric & App Sci	10	—	—	—	4	3	—	3
	University of Michigan	12	2	4	—	2	—	2	2
	Wayne State University	1	—	—	—	1	—	—	—
Minn.	University of Minnesota	20	5	3	1	6	1	—	4
Mo.	St. Louis University	7	—	4	—	2	—	1	—
	University of Missouri	5	—	2	—	3	—	—	—
	Washington University	3	—	1	—	—	—	2	—
Nebr.	University of Nebraska	5	2	1	—	1	—	—	1
N.J.	Princeton University	1	—	1	—	—	—	—	—
	Rutgers The State Univ	23	—	9	—	11	—	—	3
N.Y.	Columbia University	13	2	7	—	1	—	1	2
	Cornell University	22	1	10	2	2	2	—	5
	Fordham University	3	2	—	—	—	—	—	1
	New York University	4	1	—	—	—	—	—	3
	Polytechnic Inst Brooklyn	—	—	—	—	—	—	—	—

Table 14. LOCATION OF SCHOOLS CONFERRING DOCTOR'S DEGREES IN THE BASIC MEDICAL SCIENCES AND NUMBERS OF GRADUATES: 1963–64—Continued

Location	School	Total basic medical sciences	Anatomy	Biochemistry	Biophysics	Microbiology	Pathology	Pharmacology	Physiology
	Rockefeller Institute	5	—	1	—	1	—	—	3
	St. Johns University	—	—	—	—	—	—	—	—
	SUNY Downstate Med Center	3	1	—	—	1	—	—	1
	SUNY University Buffalo	3	1	1	1	—	—	—	—
	SUNY Upstate Med Center	2	—	—	—	—	—	2	—
	Syracuse University	4	—	—	—	4	—	—	—
	University of Rochester	6	—	1	—	—	1	2	2
	Yeshiva University	4	2	1	—	—	—	1	—
N.C.	Duke University	8	2	6	—	—	—	—	—
	Univ of N C at Chapel Hill	6	—	4	—	1	1	—	—
	Univ of N C St at Raleigh	—	—	—	—	—	—	—	—
Ohio	Ohio State University	12	—	1	—	6	1	1	3
	University of Cincinnati	4	—	1	—	2	—	1	—
	Western Reserve Univ	6	—	3	—	—	1	1	1
Okla.	Okla St U Agric & App Sci	5	—	—	—	3	—	—	2
	University of Oklahoma	10	—	4	—	3	2	—	1
Oreg.	Oregon State University	6	—	—	—	6	—	—	—
	University of Oregon	4	—	2	—	—	—	2	—
Pa.	Carnegie Inst Technology	—	—	—	—	—	—	—	—
	Hahnemann Med Col & Hosp	4	—	1	—	3	—	—	—
	Lehigh University	—	—	—	—	—	—	—	—
	Pennsylvania State Univ	11	—	4	2	5	—	—	—
	Temple University	—	—	—	—	—	—	—	—
	University of Pennsylvania	12	1	4	—	1	2	—	4
	University of Pittsburgh	6	—	5	—	1	—	—	—
R.I.	Brown University	—	—	—	—	—	—	—	—
Tenn.	University of Tennessee	10	—	3	—	1	—	3	3
	Vanderbilt University	3	—	2	—	—	—	1	—
Tex.	Baylor University	3	—	2	—	1	—	—	—
	Rice University	—	—	—	—	—	—	—	—
	Texas A & M University	8	—	3	—	1	—	—	4
	University of Houston	—	—	—	—	—	—	—	—
	University of Texas	11	2	1	—	6	—	—	2
Utah	University of Utah	8	—	5	—	3	—	—	—
	Utah St U Agric & App Sci	1	—	—	—	—	—	—	1
Va.	University of Virginia	1	—	—	—	—	—	—	1
	Virginia Polytechnic Inst	6	—	6	—	—	—	—	—
Wash.	University of Washington	10	1	6	1	1	—	1	—
	Washington State Univ	4	—	—	—	4	—	—	—
Wis.	University of Wisconsin	39	—	21	—	12	1	2	3

Source: National Center for Educational Statistics: *Earned Degrees Conferred 1963–64*. OE-54013-64. Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1966.

Table 15. LOCATION OF LEADING SCHOOLS CONFERRING DOCTOR'S DEGREES IN BIOSCIENCES (OTHER THAN BASIC MEDICAL) AND NUMBERS OF GRADUATES: 1963–64

Location	School	Total biosciences	Biology	Botany	Entomology	Genetics	Plant pathology	Zoology	All[1] others
	Total, all schools	882	186	169	99	65	61	217	85
	Leading schools	833	179	160	95	64	60	199	76
Ala.	University of Alabama	1	1	—	—	—	—	—	—
Ariz.	University of Arizona	7	—	1	—	—	2	4	—
Calif.	California Inst of Tech	2	1	—	—	—	—	—	1
	Claremont Graduate School	2	—	2	—	—	—	—	—
	Stanford University	7	7	—	—	—	—	—	—
	U of Cal Berkeley	38	—	6	8	2	4	16	2
	U of Cal Davis	34	—	5	3	11	10	1	4
	U of Cal Los Angeles	22	—	12	—	—	—	10	—
	U of Cal Riverside	4	—	—	—	—	1	2	1
	U of Cal San Diego	5	1	—	—	—	—	—	4
	U of Cal San Francisco	—	—	—	—	—	—	—	—
	Univ of Sthrn California	3	3	—	—	—	—	—	—
Colo.	Colorado State University	3	—	—	—	1	—	2	—
	University of Colorado	4	—	1	—	—	—	3	—
	University of Denver	—	—	—	—	—	—	—	—
Conn.	University of Connecticut	5	—	—	2	—	—	3	—
	Yale University	17	14	—	—	—	—	—	3
Del.	University of Delaware	4	4	—	—	—	—	—	—
D.C.	Catholic Univ of America	7	7	—	—	—	—	—	—
	Georgetown University	—	—	—	—	—	—	—	—
	George Washington Univ	3	2	1	—	—	—	—	—
Fla.	Florida State University	3	3	—	—	—	—	—	—
	University of Florida	7	1	1	2	—	3	—	—
Ga.	Emory University	2	2	—	—	—	—	—	—
Hawaii	University of Hawaii	2	—	—	—	1	—	1	—
Ill.	Illinois Inst of Tech	—	—	—	—	—	—	—	—
	Loyola University	—	—	—	—	—	—	—	—
	Northwestern University	10	10	—	—	—	—	—	—
	Southern Illinois Univ	—	—	—	—	—	—	—	—
	University of Chicago	12	—	2	—	—	—	6	4
	University of Illinois	18	—	8	4	—	1	5	—
Ind.	Indiana University	7	—	3	—	—	—	4	—
	Purdue University	31	21	6	4	—	—	—	—
	University of Notre Dame	6	6	—	—	—	—	—	—
Iowa	Iowa St U of Sci & Tech	19	—	7	5	2	2	2	1
	University of Iowa	5	—	3	—	—	—	—	2
Kans.	Kansas St U Ag & App Sci	12	1	—	5	2	2	2	—
	University of Kansas	10	—	6	2	—	—	2	—
Ky.	University of Kentucky	—	—	—	—	—	—	—	—
La.	La State Univ & A & M Col	11	—	2	4	—	4	1	—
	Tulane Univ of Louisiana	2	—	—	—	—	—	2	—
Md.	Johns Hopkins University	6	1	—	—	2	—	—	3
	University of Maryland	12	—	1	4	—	1	3	3
Mass.	Boston University	1	—	—	—	1	—	—	—
	Brandeis University	—	—	—	—	—	—	—	—
	Harvard Univ—Radcliffe	21	21	—	—	—	—	—	—
	Mass Inst of Technology	17	9	—	—	—	—	—	8
	Tufts University	1	1	—	—	—	—	—	—
	University of Massachusetts	6	1	2	2	—	—	1	—
Mich.	Mich St U Agric & App Sci	12	—	2	1	—	3	6	—
	University of Michigan	21	—	6	—	1	—	14	—
	Wayne State University	2	2	—	—	—	—	—	—
Minn.	University of Minnesota	28	—	1	4	10	6	6	1
Mo.	St Louis University	1	1	—	—	—	—	—	—
	University of Missouri	6	—	1	—	1	—	4	—
	Washington University	8	—	4	—	—	—	3	1
Nebr.	University of Nebraska	2	—	1	—	—	—	1	—
N.J.	Princeton University	6	6	—	—	—	—	—	—
	Rutgers The State Univ	23	—	9	4	—	2	8	—
N.Y.	Columbia University	20	—	6	—	—	—	14	—
	Cornell University	34	—	2	13	9	6	—	4
	Fordham University	—	—	—	—	—	—	—	—
	New York University	17	17	—	—	—	—	—	—
	Polytechnic Inst Brooklyn	—	—	—	—	—	—	—	—
	Rockefeller Institute	7	—	—	—	1	—	—	6

Table 15. LOCATION OF LEADING SCHOOLS CONFERRING DOCTOR'S DEGREES IN BIOSCIENCES (OTHER THAN BASIC MEDICAL) AND NUMBERS OF GRADUATES: 1963–64—Continued

Location	School	Total bio-sciences	Biology	Botany	Ento-mology	Genetics	Plant pa-thology	Zoology	All[1] others
	St Johns University	2	2	—	—	—	—	—	—
	SUNY Downstate Med Center	—	—	—	—	—	—	—	—
	SUNY University Buffalo	2	2	—	—	—	—	—	—
	SUNY Upstate Med Center	—	—	—	—	—	—	—	—
	Syracuse University	1	—	1	—	—	—	—	—
	University of Rochester	9	2	—	—	—	—	—	7
	Yeshiva University	—	—	—	—	—	—	—	—
N.C.	Duke University	12	—	5	—	—	—	7	—
	Univ of N C at Chapel Hill	4	—	2	—	—	—	2	—
	Univ of N C St at Raleigh	9	—	1	3	3	1	1	—
Ohio	Ohio State University	22	—	9	4	—	—	9	—
	University of Cincinnati	2	—	—	—	—	—	2	—
	Western Reserve Univ	2	1	—	—	—	—	—	1
Okla.	Okla St U Agric & App Sci	17	—	3	2	3	—	9	—
	University of Oklahoma	8	—	1	—	—	—	7	—
Oreg.	Oregon State University	23	—	12	5	1	—	5	—
	University of Oregon	4	4	—	—	—	—	—	—
Pa.	Carnegie Inst Technology	—	—	—	—	—	—	—	—
	Hahnemann Med Col & Hosp	—	—	—	—	—	—	—	—
	Lehigh University	—	—	—	—	—	—	—	—
	Pennsylvania State Univ	9	2	2	—	3	1	1	—
	Temple University	—	—	—	—	—	—	—	—
	University of Pennsylvania	2	—	1	—	—	—	—	1
	University of Pittsburgh	—	—	—	—	—	—	—	—
R.I.	Brown University	8	8	—	—	—	—	—	—
Tenn.	University of Tennessee	8	—	1	—	—	—	5	2
	Vanderbilt University	2	2	—	—	—	—	—	—
Tex.	Baylor University	—	—	—	—	—	—	—	—
	Rice University	4	4	—	—	—	—	—	—
	Texas A & M University	12	—	—	3	4	2	2	1
	University of Houston	—	—	—	—	—	—	—	—
	University of Texas	14	1	8	—	—	—	5	—
Utah	University of Utah	5	2	—	—	—	—	2	1
	Utah St U Agric & App Sci	6	—	—	3	—	—	2	1
Va.	Univerity of Virginia	6	6	—	—	—	—	—	—
	Virginia Polytechnic Inst	1	—	—	1	—	—	—	—
Wash.	University of Washington	6	—	3	—	—	—	—	3
	Washington State University	6	—	—	—	1	3	2	—
Wis.	University of Wisconsin	51	—	10	7	5	6	12	11

[1] Includes ecology, nutrition, plant physiology, and all others.

Source: National Center for Educational Statistics: *Earned Degrees Conferred 1963–64*. OE-54013-64. Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1966.

Table 16. LOCATION OF LEADING SCHOOLS CONFERRING DOCTOR'S DEGREES IN PHYSICAL SCIENCES AND NUMBERS OF GRADUATES: 1963–64

Location	School	Total physical sciences	Chemistry	Physics	All others [1]
	Total, all schools	2,455	1,271	778	406
	Leading schools	2,235	1,144	720	371
Ala.	University of Alabama	6	1	5	—
Ariz.	University of Arizona	18	8	2	8
Calif.	California Inst of Tech	41	14	14	13
	Claremont Graduate School	—	—	—	—
	Stanford University	40	17	9	14
	U of Cal Berkeley	104	44	48	12
	U of Cal Davis	4	4	—	—
	U of Cal Los Angeles	40	17	11	12
	U of Cal Riverside	10	8	1	1
	U of Cal San Diego	9	—	5	4
	U of Cal San Francisco	4	—	—	4
	Univ of Sthrn California	4	3	—	1
Colo.	Colorado State University	—	—	—	—
	University of Colorado	38	12	18	8
	University of Denver	2	—	1	1
Conn.	University of Connecticut	11	7	4	—
	Yale University	39	21	11	7
Del.	University of Delaware	20	20	—	—
D.C.	Catholic Univ of America	14	6	8	—
	Georgetown University	12	6	3	3
	George Washington Univ	1	1	—	—
Fla.	Florida State University	13	9	3	1
	University of Florida	19	16	3	—
Ga.	Emory University	4	4	—	—
Hawaii	University of Hawaii	2	2	—	—
Ill.	Illinois Inst of Tech	4	2	2	—
	Loyola University	2	2	—	—
	Northwestern University	22	18	1	3
	Southern Illinois Univ	1	1	—	—
	University of Chicago	46	25	12	9
	University of Illinois	82	44	25	13
Ind.	Indiana University	36	16	15	5
	Purdue University	55	41	14	—
	University of Notre Dame	24	14	10	—
Iowa	Iowa St U of Sci & Tech	42	33	6	3
	University of Iowa	30	23	3	4
Kans.	Kansas St U Ag & App Sci	12	7	5	—
	University of Kansas	34	19	6	9
Ky.	University of Kentucky	2	2	—	—
La.	La State Univ & A & M Col	11	4	5	2
	Tulane Univ of Louisiana	5	2	3	—
Md.	Johns Hopkins University	25	9	13	3
	University of Maryland	25	7	17	1
Mass.	Boston University	5	1	4	—
	Brandeis University	9	2	7	—
	Harvard Univ—Radcliffe	80	26	24	30
	Mass Inst of Technology	81	33	37	11
	Tufts University	1	1	—	—
	University of Massachusetts	2	2	—	—
Mich.	Mich St U Agric & App Sci	36	27	7	2
	University of Michigan	56	14	23	19
	Wayne State University	20	19	1	—
Minn.	University of Minnesota	29	19	3	7
Mo.	St Louis University	13	3	3	7
	University of Missouri	12	3	4	5
	Washington University	17	6	7	4
Nebr.	University of Nebraska	13	8	5	—
N.J.	Princeton University	45	25	11	9
	Rutgers The State Univ	24	17	2	5
N.Y.	Columbia University	61	14	31	16
	Cornell University	41	24	17	—
	Fordham University	12	9	3	—
	New York University	34	17	12	5
	Polytechnic Inst Brooklyn	34	27	6	1
	Rockefeller Institute	—	—	—	—

Table 16. LOCATION OF LEADING SCHOOLS CONFERRING DOCTOR'S DEGREES IN PHYSICAL SCIENCES AND NUMBERS OF GRADUATES: 1963–64—Continued

Location	School	Total physical sciences	Chemistry	Physics	All others [1]
	St Johns University	2	1	1	—
	SUNY Downstate Med Center	—	—	—	—
	SUNY University Buffalo	8	5	3	—
	SUNY Upstate Med Center	—	—	—	—
	Syracuse University	18	7	11	—
	University of Rochester	21	8	9	4
	Yeshiva University	—	—	—	—
N.C.	Duke University	22	10	12	—
	Univ of N C at Chapel Hill	19	13	3	3
	Univ of N C St at Raleigh	1	—	1	—
Ohio	Ohio State University	46	22	10	14
	University of Cincinnati	33	21	7	5
	Western Reserve Univ	13	12	1	—
Okla.	Okla St U Agric & App Sci	7	5	2	—
	University of Oklahoma	9	3	2	4
Oreg.	Oregon State University	19	14	4	1
	University of Oregon	12	6	5	1
Pa.	Carnegie Inst Technology	28	14	14	—
	Hahnemann Med Col & Hosp	—	—	—	—
	Lehigh University	4	—	3	1
	Pennsylvania State Univ	56	20	21	15
	Temple University	6	3	3	—
	Univ of Pennsylvania	39	24	12	3
	University of Pittsburgh	14	10	2	2
R.I.	Brown University	28	15	12	1
Tenn.	University of Tennessee	12	11	1	—
	Vanderbilt University	19	7	12	—
Tex.	Baylor University	1	1	—	—
	Rice University	25	7	8	10
	Texas A & M University	20	7	6	7
	University of Houston	1	1	—	—
	University of Texas	45	28	14	3
Utah	University of Utah	20	9	4	7
	Utah St U Agric & App Sci	2	1	1	—
Va.	University of Virginia	21	8	13	—
	Virginia Polytechnic Inst	6	3	2	1
Wash.	University of Washington	36	22	6	8
	Washington State Univ	16	11	5	—
Wis.	University of Wisconsin	68	29	20	19

[1] Includes general physical sciences, astronomy, metallurgy, meteorology, pharmaceutical chemistry, geology, geophysics, oceanography, and all other earth and physical sciences.

Source: National Center for Educational Statistics: *Earned Degrees Conferred 1963–64*. OE–54013–64. Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1966.

CHAPTER 5

Biomedical Engineering

Biomedical engineering is a relatively new field which is aiding research, diagnosis and therapy of many diseases and disorders. It has developed from the collaboration of physical and medical scientists. Typical activities in this field include the development of new instruments for use in patient care or in research, the invention and perfection of orthopedic and prosthetic appliances, and the adaptation of computer technology and bioengineering methods for research use in medicine and biology. This work is being conducted in hospitals, scientific foundations, government laboratories for medical research, universities, and electronic and instrumentation industries.

Biomedical engineers—also called bioengineers or medical engineers— working with physicians and biomedical scientists utilize engineering ideas and techniques to improve medical care, including diagnosis, surgery, and rehabilitation. Their interest is both in health services to the individual patient and in related research to gain further understanding of life science processes.

An estimated 2,500 persons were employed as biomedical engineers in 1965. This figure may be in error as much as 500 in either direction, with the Foundation for Medical Technology's estimate higher than that of the Biomedical Engineering and Instrumentation Branch of the National Institutes of Health (NIH).

The minimum educational requirement for biomedical engineers is a bachelor's degree in engineering with some courses in the biophysical sciences. Graduate and undergraduate courses are now being developed in universities for specific training in biomedical engineering.

Biomedical engineering technicians are responsible for assembling, adapting, and maintaining many new kinds of medical devises and instruments. These technicians come from many diverse fields to use their special skills in this occupation. Persons with special training in plastics, for example, work on repair and replacement materials and the development of artificial organs. (Orthopedic and appliance workers who make and fit artificial limbs and braces and electronic technicians who are involved in certain aspects of computer programming and operation are discussed in other sections of this publication.)

Information on the number of technicians currently employed is not available, but the total is estimated at about 5,000 for 1965. This estimate is based on an average of two technicians per engineer, an assumption acceptable to both the Foundation for Medical Technology and the NIH Biomedical Engineering and Instrumentation Branch.

Courses in biomedical engineering technology are being developed by some technical institutes to supplement on-the-job training.

CHAPTER 6

Chiropractic and Naturopathy

In some States the law authorizes the licensing of "drugless healers." Chiropractors, naturopaths, and allied practitioners thus may be identified through the licenses now in effect. Probably fewer than 25,000 individuals currently are in practice, although how reliable this estimate is cannot be stated.

Chiropractors

Chiropractic is a system of mechanical therapeutics based on the belief that the nervous system largely determines the state of health and that any interference with this system impairs normal functions and lowers the body's resistance to disease. Chiropractors treat their patients primarily by specific adjustment of parts of the body, especially the spinal column. Chiropractic as a system of healing does not include the use of drugs or surgery.

About 23,000 *chiropractors* were engaged in practice in 1965 in the United States, Puerto Rico, and other U.S. outlying areas according to the International Chiropractors Association (table 17). Prior estimates have indicated about 16,000 in 1930,[8] 20,000 in 1950, increasing perhaps to 23,000 in the past 15 years. The 1950 and 1960 Censuses of Population reported 13,091 and 14,360 chiropractors, respectively, in the civilian labor force.[9]

The greatest numbers of chiropractors are in independent private practice. Others are employed by industrial firms, chiropractic schools or clinics, or as salaried assistants to established practitioners of chiropractic.

In 1966, chiropractors were recognized by law in 48 States. These laws usually require 4 years of training in a chiropractic school, following high school graduation.

Twelve schools recognized by two chiropractic associations are listed in table 18. In 1964-65, 611 individuals were graduated with the degree of Doctor of Chiropractic (D.C.).

Naturopaths and Allied Practitioners

Naturopathy is a school of healing employing a combination of nature's forces such as air, light, water, vibration, heat, electricity, dietetics, and massage. It does not include the use of drugs, surgery, and X-ray or radiation (except for diagnostic purposes). Many naturopaths are former chiropractors and use chiropractic treatment.

Probably no more than 1,000 of these "healers" are currently licensed. A 1932 report[8] had estimated that there were about 2,500 *naturopaths*, *sanipractors*, and other *drugless healers* in practice at that time, but no State distribution was shown.

Manpower statistics available at the present time are scant. Preliminary findings from a 1965-66 survey of State licensing of all occupations in the health field show the following licenses in effect: 100 in Arizona (of which 53 are for practitioners within the State), 66 in California, 47 in Connecticut (of which 29 are for practitioners within the State), 136 in Florida (apparently all for practitioners within the State), 14 in Hawaii (of which 13 are for practitioners within the State), 60 in Illinois, 148 in Oregon (of which 121 are practitioners within the State), 42 in Utah, and 107 in Washington. The absence of a State from this list does not imply that there are no licensed naturopaths.

[8] Reed, L. S.: *The Healing Cults: A Study of Sectarian Medical Practice: Its Extent, Causes, and Control.* Committee on the Costs of Medical Care Pub. No. 16. Chicago. University of Chicago Press, Mar. 1932.

[9] Prindle, R. A. and Pennell, M. Y.: Industry and occupation data from 1960 census, by State. *Health Manpower Source Book 17.* PHS Pub. No. 263, Section 17. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1963.

The "yellow pages" index of the Washington, D.C. telephone directory lists by name four naturopathic physicians or naturopaths. One has a Maryland address and three are in the District of Columbia (two of whom are also listed as chiropractors). A glance at the classified directories for some large cities across the nation shows the presence of naturopathic physicians in at least half of the States.

A 1958 investigation of naturopathic institutions[10] listed the following as teaching naturopathy and/or granting degrees then:

Sierra States University, Los Angeles, California
University of Natural Healing Arts, Denver, Colorado
Central States College of Physiatrics, Eaton, Ohio
National College of Naturopathic Medicine, Portland, Oregon
Western States College, Portland, Oregon

The same five schools apparently are in existence in 1966. However, at least one of the schools—Western States College—has given up naturopathic training in favor of chiropractic.

[10] Bureau of Economic and Business Research: *Survey of Naturopathic Schools.* University of Utah, Dec. 1958.

Table 17. LOCATION OF CHIROPRACTORS IN RELATION TO POPULATION: JANUARY 1, 1965

Location	Civilian population in thousands	Number of chiropractors [1]	Chiropractors per 100,000 population
All locations	193,652	23,409	12.1
United States	190,789	23,394	12.3
Alabama	3,403	294	8.6
Alaska	220	15	6.8
Arizona	1,595	224	14.0
Arkansas	1,934	163	8.4
California	18,042	4,252	23.6
Colorado	1,949	366	18.8
Connecticut	2,779	172	6.2
Delaware	487	28	5.7
District of Columbia	800	40	5.0
Florida	5,704	764	13.4
Georgia	4,239	428	10.1
Hawaii	648	21	3.2
Idaho	689	70	10.2
Illinois	10,499	992	9.4
Indiana	4,839	544	11.2
Iowa	2,756	792	28.7
Kansas	2,192	618	28.2
Kentucky	3,124	499	16.0
Louisiana	3,461	177	5.1
Maine	975	76	7.8
Maryland	3,419	184	5.4
Massachusetts	5,329	217	4.1
Michigan	8,108	856	10.6
Minnesota	3,535	505	14.3
Mississippi	2,308	150	6.5
Missouri	4,389	1,310	29.8
Montana	697	108	15.5
Nebraska	1,467	96	6.5
Nevada	413	54	13.1
New Hampshire	652	204	31.3
New Jersey	6,695	518	7.7
New Mexico	999	124	12.4
New York	17,985	2,208	12.3
North Carolina	4,795	226	4.7
North Dakota	634	72	11.4
Ohio	10,134	852	8.4
Oklahoma	2,448	402	16.4
Oregon	1,875	276	14.7
Pennsylvania	11,459	1,135	9.9
Rhode Island	893	53	5.9
South Carolina	2,509	156	6.2
South Dakota	712	134	18.8
Tennessee	3,796	183	4.8
Texas	10,331	1,490	14.4
Utah	999	122	12.2
Vermont	409	42	10.3
Virginia	4,268	95	2.2
Washington	2,944	388	13.2
West Virginia	1,791	48	2.7
Wisconsin	4,121	600	14.6
Wyoming	339	51	15.0
Puerto Rico and other U.S. outlying areas	2,863	15	0.5

[1] The American Chiropractic Association has about 8,000 members; the International Chiropractors Association, 4,500.
Sources: Mailing list count provided by the International Chiropractors Association.
U.S. Bureau of the Census: Population estimates as of Jan. 1, 1965 (special release).

Table 18. LOCATION AND OWNERSHIP OF CHIROPRACTIC SCHOOLS AND NUMBERS OF STUDENTS AND GRADUATES: 1964–65

Location	School [1]	Students	Graduates
	Total, 12 schools	2,940	611
	Schools approved by the American Chiropractic Association		
Calif.	Los Angeles College of Chiropractic, Glendale	211	45
Ill.	National College of Chiropractic, Chicago	290	39
Ind.	Lincoln Chiropractic College, Indianapolis	189	48
Minn.	Northwestern College of Chiropractic, Minneapolis	55	11
Mo.	Logan College of Chiropractic, St. Louis	238	46
N.Y.	Chiropractic Institute of New York, New York	197	40
	Columbia Institute of Chiropractic, New York	290	27
Oreg.	Western States College, Portland [2]	34	6
Tex.	Texas Chiropractic College, Pasadena	64	11
	Schools approved by the Chiropractic Education Commission [3]		
Calif.	Cleveland Chiropractic College, Los Angeles	164	36
Iowa	Palmer School of Chiropractic, Davenport	1,075	261
Mo.	Cleveland Chiropractic College, Kansas City	133	41

[1] All private schools.
[2] An affiliate but not approved.
[3] An organization of the International Chiropractors Association.

Sources: The American Chiropractic Association and the International Chiropractors Association.

CHAPTER 7

Clinical Laboratory Services

Upwards of 85,000 persons in a wide variety of occupations are engaged in providing services within the clinical laboratory setting, in addition to the physicians who specialize in clinical pathology (see table 75, ch. 18). That this is a fast growing field is indicated by the threefold increase in numbers during the past 15 years—from an estimated 30,000 workers in 1950, to about 50,000 in 1955, and perhaps as many as 68,000 in 1960.

Statistics on the numbers of clinical laboratory personnel employed in 1965 by location or by type of employer are lacking. Projection of a 1958 survey of hospitals[11] would indicate that between 45,000 and 50,000 laboratory personnel were employed in about 6,500 to 7,000 hospitals. Another 25,000 to 30,000 persons (other than nurses) perform some laboratory work in physicians' offices.[12] Perhaps as many as 10,000 persons work in 2,000 or so private independent laboratories, according to reports under the Federal Insurance Contribution Acts for OASDI programs.[13]

Nearly 4,000 laboratory workers are reported as employd by State and local health departments (table 6, Introduction). A smaller number probably work for industry and independent research organizations.

To aid in the diagnosis and treatment of illness requires that clinical laboratory personnel embrace a wide variety of skills associated with different types of education and experience. About 40 percent of the individuals are college graduates. The others are high school or junior college graduates with varying combinations of formal education, commercial or vocational school training, apprenticeship training in a clinical laboratory, and/or experience which enables them to work as medical technicians, cytotechnologists, histologic technicians, or laboratory assistants (see also ch. 27 and 35).

Scientists in the Clinical Laboratory

An estimated 3,500 or more professional scientists with graduate degrees in chemistry or the biological sciences were engaged in the performance of medical laboratory services in 1965. An academic degree in a specific science followed by a period of work experience in a laboratory is the usual course of entry into this field.

Included in this field are about 1,600 *clinical chemists*, perhaps an equal number of *microbiologists*, and other biological scientists. Most of these scientists are employed in clinical laboratories directed by pathologists or other physicians. Others direct their own laboratories or work in these independent laboratories.

The American Association of Clinical Chemists (AACC) has nearly 1,500 members, in addition to which there are qualified chemists who are not AACC members. Certification programs in clinical chemistry and in toxicological chemistry are administered by the American Board of Clinical Chemistry. The examination is open to doctoral-level chemists upon evidence of adequate training, experience, and competency. As of December 31, 1965, a total of 290 persons were diplomates of this Board.

The American Academy of Microbiology is the professional organization of microbiologists at the doctoral level, with 683 members known as fellows. One of its committees is the American Board of Microbiology which has inaugurated two recognition programs, for those at the doctoral level and for those at the baccalaureate level. As of December 1965, the Board had certified 466 in the doctoral program.

---

[11] American Hospital Association: *Hospitals*, Guide Issue, Part 2. *J.A.H.A.* 33(15):434-435, Aug. 1959.

[12] American Chemical Society: The chemist in the clinical lab. *Chemical & Engineering News*. 41:102-116, July 1963.

[13] U.S. Bureau of the Census: *1962 County Business Patterns*. Washington. U.S. Government Printing Office, 1965.

The Board of Registry of Medical Technologists of the American Society of Clinical Pathologists registers medical technologists with a master's or doctor's degree. Those who pass a national certification examination may use the professional designation of Spec (ASCP). As of September 6, 1965, 32 persons had this designation.

Clinical Laboratory Technologists

Technologists, as used in this section, include (a) persons with a bachelor's degree in chemistry, microbiology or other biological science, and (b) persons registered with the Board of Registry of Medical Technologists of the American Society of Clinical Pathologists. Those active in the profession in 1965 numbered nearly 35,000 or about 10 times the staff of scientists in the clinical laboratories.

The number of college graduates with a bachelor's degree in a major other than medical technology who were employed in a clinical laboratory in 1965 probably ranged between 2,000 and 3,000. A recognition program for persons engaged in laboratory work in the field of clinical chemistry is being developed for persons below the doctoral level, through the joint efforts of the American Chemical Society and the American Association of Clinical Chemists. The National Registry of Microbiologists, a subcommittee of the American Board of Microbiology, had registered 559 in their baccalaureate program by December 1965. The Board of Registry of Medical Technologists of the American Society of Clinical Pathologists had registered 134 *chemistry technologists*—C(ASCP) and 94 *microbiologists*—M (ASCP), as of September 1965. Other registries of medical technologists also include persons with a bachelor's degree in one of the sciences.

About 32,000 *medical technologists—MT (ASCP)'s* were engaged in 1965 in the performance of clinical, microscopic, bacteriologic, and other tests under the supervision of a pathologist or other physician (table 19). Some of them serve as laboratory supervisors or assist in the training of student medical technologists and other laboratory personnel.

The minimum educational requirements for this medical technologist are 3 years of college plus 12 months of specialized training in a school of medical technology accredited by the American Medical Association Council on Medical Education (tables 20 and 21). About 600 of the 781 schools have programs that lead to a bachelor's degree from an affiliated college or university. More than 3,000 students complete their training each year. However, not all MT(ASCP)'s now employed have the equivalent of a college education.

National certification examinations given by the Board of Registry of Medical Technologists of the American Society of Clinical Pathologists enable persons with the education prescribed above and who pass the Registry examination to use the professional designation of MT(ASCP). The total number of persons registered as of September 1965 was about 40,000, of whom 32,000 were employed full time. Almost 3,500 were certified in 1965.

MT(ASCP)'s may be certified as *blood banking* or as *nuclear medical technologists* (in addition to those in chemistry and microbiology mentioned earlier in this chapter). Persons so certified numbered 476 and 85, respectively, as of September 1965.

The American Society of Medical Technologists, with a membership of about 10,000, is the professional organization of MT (ASCP)'s.

Clinical Laboratory Technicians and Assistants

Probably in excess of 45,000 individuals with varying combinations of experience and post high school training were engaged in various types of clinical laboratory work in 1965. A large proportion of the men in this group received their training while serving in the Armed Forces.

Various levels of laboratory jobs have developed over the years for persons without a college degree. Minimum levels of educa-

tion and experience have been established for only a few of these positions, such as cytotechnologist, histologic technician, and certified laboratory assistant—each of which is described below. No information is available on training programs offered by commercial schools.

Nearly 1,500 *cytotechnologists* or cytotechnicians who have received formal training in AMA cytology laboratory schools were employed in 1965, as well as 1,500 or so who had been trained on the job. These persons specialize in screening slides in the search for abnormalities that are warning signs of cancer.

Requirements for the formal training of cytotechnologists have been developed in the past decade. The minimum requirements for a cytotechnologist are 2 years of college plus 12 months of training. Half of the training takes place in an AMA approved school of cytotechnology (tables 22 and 23); the balance of the time is spent working under supervision in an acceptable cytology laboratory. Between 300 and 400 complete their training each year.

National cytotechnology certification examinations given by the Board of Registry of Medical Technologists (ASCP) enable persons who successfully complete the curriculum and apprenticeship and who pass the Registry exam to use the designation of CT(ASCP). A total of 1,230 persons were currently registered as of September 1965.

About 2,500 *histologic technicians* were employed by pathologists in clinical laboratories in 1965 and quite a few more worked in research and other laboratory situations. They specialize in cutting and staining body tissues for microscopic examination.

Since 1947, the Board of Registry of Medical Technologists (ASCP) has given limited certification, following examination, to persons with a high school diploma plus 1 year of supervised training in a clinical pathology laboratory. As of September 1965, 2,362 persons were currently registered as HT(ASCP)'s.

Some hospitals have set up training courses. However, there is no formal approval of such programs as yet for histologic technicians.

The *Certified Laboratory Assistant* program initiated in 1963 by the American Society of Clinical Pathologists and the American Society of Medical Technologists is a 12-months' post high school course of theoretical and practical training in a hospital or laboratory school approved for training by the Board of Certified Laboratory Assistants and the American Society of Clinical Pathologists. As of April 1966, the Board had approved 115 schools, an increase of 32 over those operating during the academic year 1964-65 (table 24).

Graduates who pass an examination given by the Board may place the initials CLA after their names. A total of 1,080 persons were certified as of November 1965. They usually work under the supervision of the medical technologist, performing the simpler tests and procedures.

Training and certification requirements for other positions vary greatly. Usually the only formal requirement for commercial school enrollment is a high school diploma. Graduates of commercial schools may choose to belong to any of several self-established registries for laboratory technical personnel not under general medical auspices.

Table 19. NUMBER OF REGISTERED MEDICAL TECHNOLOGISTS: SELECTED YEARS, 1950 THROUGH 1965

Year	Total MT(ASCP)'s	Active MT(ASCP)'s [1]
1965	40,000	[2] 32,000
1960	30,000	23,000
1955	18,000	----------
1950	14,000	----------

[1] Estimated number employed full time.
[2] About 90 percent of these persons have a bachelor's degree.

Source: Board of Registry of Medical Technologists of the American Society of Clinical Pathologists.

Table 20. ACCREDITED SCHOOLS OFFERING PROGRAMS IN MEDICAL TECHNOLOGY, ENROLLMENT AND GRADUATES: SELECTED YEARS, 1949–50 THROUGH 1965–66

Academic year	Schools	Students [1]	Graduates
1965–66	781	[2] 4,161	----------
1964–65 [3]	784	4,648	3,283
1963–64 [3]	779	4,291	2,679
1962–63	776	4,602	3,259
1961–62	757	4,191	2,856
1960–61	734	----------	2,809
1959–60	702	3,209	2,573
1954–55	575	----------	1,956
1949–50	----------	----------	2,011

[1] Note that schools have classes starting several times during the year. These are fall enrollments.

[2] Estimated.

[3] Final figures based on reports from individual schools, to replace preliminary estimates published in *J.A.M.A.*

Source: Council on Medical Education: Education Number of the *J.A.M.A.* Chicago. American Medical Association. Annual issues. Data for United States, Puerto Rico, and the Canal Zone.

Table 22. APPROVED SCHOOLS OF CYTOTECHNOLOGY, ENROLLMENTS, AND GRADUATES: 1962–63 THROUGH 1965–66

Academic year	Schools	Students	Graduates
1965–66	80	[1] 340	----------
1964–65 [2]	79	357	325
1963–64 [2]	77	348	304
1962–63	----------	----------	292

[1] Estimated.

[2] Final figures based on reports from individual schools, to replace preliminary estimates published in *J.A.M.A.*

Source: Council on Medical Education: Education Number of the *J.A.M.A.* Chicago. American Medical Association. Annual issues. Data for United States and Puerto Rico.

Table 21. LOCATION OF ACCREDITED SCHOOLS OFFERING PROGRAMS IN MEDICAL TECHNOLOGY AND NUMBERS OF STUDENTS AND GRADUATES: 1964–65

Location	Schools	Students	Graduates	Location	Schools	Students	Graduates
Total	[1] 762	4,648	[2] 3,283				
Alabama	12	96	58	Montana	4	19	13
Alaska	—	—	—	Nebraska	9	84	53
Arizona	5	34	25	Nevada	2	6	6
Arkansas	7	60	26	New Hampshire	2	20	14
California	52	322	240	New Jersey	27	94	81
Canal Zone	1	—	1	New Mexico	5	9	5
Colorado	13	92	72	New York	37	201	144
Connecticut	14	71	58	North Carolina	14	87	68
Delaware	3	15	9	North Dakota	5	42	22
District of Columbia	8	48	25	Ohio	48	321	208
Florida	16	89	54	Oklahoma	13	89	66
Georgia	17	86	76	Oregon	6	66	49
Hawaii	5	19	18	Pennsylvania	41	204	151
Idaho	7	18	11	Puerto Rico	2	38	26
Illinois	44	240	150	Rhode Island	5	35	13
Indiana	17	117	84	South Carolina	7	27	11
Iowa	16	80	80	South Dakota	7	41	26
Kansas	10	73	46	Tennessee	19	108	70
Kentucky	15	101	63	Texas	41	291	165
Louisiana	18	166	118	Utah	7	28	25
Maine	3	11	11	Vermont	2	14	15
Maryland	6	27	35	Virginia	10	64	42
Massachusetts	27	144	65	Washington	12	91	69
Michigan	40	229	191	West Virginia	8	58	36
Minnesota	13	125	104	Wisconsin	30	159	147
Mississippi	5	32	19	Wyoming	1	10	7
Missouri	24	147	112				

[1] An additional 22 schools did not submit reports on students or graduates.

[2] No graduates in 1964–65 reported by 112 schools. About one-third of the 648 remaining schools reported only 1 or 2 graduates during the year.

Source: Council on Medical Education, American Medical Association.

Table 23. LOCATION OF APPROVED SCHOOLS OF CYTOTECHNOLOGY AND NUMBERS OF STUDENTS AND GRADUATES: 1964–65

Location	Schools	Students	Graduates
Total	75	357	[1] 325
Alabama	1	4	4
California	4	37	38
Colorado	1	4	4
Connecticut	2	10	9
District of Columbia	1	2	2
Florida	3	10	8
Georgia	2	9	9
Illinois	2	21	21
Indiana	2	4	4
Kansas	1	6	6
Kentucky	1	6	6
Louisiana	1	10	6
Maryland	2	5	9
Michigan	2	6	7
Minnesota	1	7	7
Nebraska	1	3	2
New York	4	11	11
North Carolina	8	25	21
Ohio	7	23	23
Oklahoma	1	10	10
Oregon	1	9	9
Pennsylvania	8	36	15
Puerto Rico	1	4	4
Rhode Island	1	10	10
South Carolina	1	4	2
Tennessee	1	17	14
Texas	5	25	26
Utah	1	2	2
Virginia	3	16	15
Washington	3	6	6
West Virginia	1	6	6
Wisconsin	2	9	9

[1] Of the 75 schools, 9 reported no graduates, 20 reported 1 or 2 graduates, and 46 reported 3 or more graduates. An additional 4 schools did not submit reports on students or graduates.

Source: Council on Medical Education, American Medical Association.

Table 24. LOCATION OF APPROVED SCHOOLS OF CERTIFIED LABORATORY ASSISTANTS AND NUMBERS OF STUDENTS AND GRADUATES: 1964–65 AND 1966

Location	Schools April 1966	Academic year 1964–65		
		Schools	Students	Graduates
Total	115	83	712	[1] 467
Alabama	3	1	10	10
Arkansas	1	1	4	2
Connecticut	4	1	6	4
Delaware	1	—	—	—
Florida	4	4	36	35
Georgia	4	2	24	24
Illinois	6	4	43	43
Indiana	4	4	22	16
Iowa	1	1	8	2
Kansas	1	1	15	8
Kentucky	3	2	14	6
Maryland	2	1	20	—
Massachusetts	3	3	21	14
Michigan	1	1	3	2
Minnesota	3	3	108	87
Mississippi	1	1	6	—
Missouri	1	1	6	—
Nebraska	1	—	—	—
New Hampshire	1	1	6	5
New Jersey	6	5	34	17
New York	4	4	20	14
North Carolina	3	3	38	19
Ohio	6	4	20	20
Pennsylvania	20	15	130	92
Rhode Island	1	—	—	—
South Carolina	1	1	4	4
South Dakota	1	1	2	—
Tennessee	3	2	8	8
Texas	7	—	—	—
Vermont	1	1	4	2
Virginia	7	6	44	12
Washington	1	1	18	14
West Virginia	5	4	26	5
Wisconsin	3	3	7	2
Japan (USAF Hospital)	1	1	5	—

[1] Students graduated January-September 1965. Additional students were scheduled for graduation later in 1965.

Source: Board of Certified Laboratory Assistants (ASCP-ASMT).

CHAPTER 8

Dentistry and Allied Services*

Dentistry is that branch of the health professions responsible for maintaining and improving the health of the teeth and related structures. The early diagnosis and treatment of tooth decay, periodontal disease, malocclusion and other oral disorders are necessary to ensure the proper chewing of food, and they contribute to normal speech and facial appearance. Prompt detection of oral cancer and other systemic conditions which manifest themselves in the mouth is necessary for the maintenance of general health.

Modern dentistry places great emphasis upon the prevention of dental disease, through such measures as fluoridation, and upon dental health education. Educational programs stress the importance of proper diet, correct oral hygiene practices, and the importance of regular dental examinations. Dental research, both basic and applied, is another increasingly important component of professional activity.

Dentists and three allied occupational groups—dental hygienists, dental assistants and dental laboratory technicians—constitute the dental work force. In 1965, the active dental manpower supply numbered about 225,000 according to estimates prepared by the Public Health Service.

Dental occupation	*Number of persons*
Dentists	93,400
Dental hygienists	15,100
Dental assistants	91,000
Dental laboratory technicians	25,500

Training facilities for dentists and dental auxiliaries are being established on a continuing basis in response to the growing demand for dental services. The Council on Dental Education of the American Dental Association accredits dental schools and auxiliary training programs. All dental schools hold institutional membership in the American Association of Dental Schools.

Dentists

In mid-1965, the Nation's *dentists* numbered approximately 109,300, excluding graduates of the 1965 class. The supply of dentists includes 102,175 non-Federal dentists located in the 50 States and the District of Columbia —about 86,320 of whom are professionally active—and 7,125 Federal dentists in the Armed Forces, Public Health Service, and Veterans' Administration.

The supply of dentists providing services for the civilian population declined sharply between 1950 and 1965, continuing a trend of many years standing (table 25). In 1950 there were about 50 active non-Federal dentists per 100,000 civilians, but by 1965 the ratio had fallen to 45 per 100,000.

The distribution of dentists by State varied widely in 1965, ranging from 66 active non-Federal dentists per 100,000 civilians in New York and Oregon to 20 in South Carolina (table 26). In general, States in the Northeast and Far West had dentist-population ratios more favorable than the national average, while the South and Southwest had the least satisfactory dentist supply.

Almost all dentists provide care to patients, primarily in private dental offices, but also in public and private clinics and hospitals, military installations, and other institutions. Diagnosis and treatment of existing oral diseases and abnormalities may involve the filling of decayed teeth, the treatment of soft and hard tissues surrounding the teeth, extraction of teeth, the making of artificial teeth and dentures, and straightening of teeth. The dentist may also provide preventive services including the topical application of fluorides, the scaling and polishing of teeth, and adjustment of the occlusion.

* This chapter was prepared by the Public Health Service, Division of Dental Health, Resource Analysis Branch–Miss Ruth D. Bothwell, Chief.

Some active dentists are primarily engaged in nonclinical activities, such as teaching, research, or administration of dental programs. These dentists are employed by dental schools, public health departments, dental societies, and various other public and private organizations. A number of dentists in private practice also devote a part of their professional time to teaching and research and to voluntary services, such as examination of school children's teeth and other community service projects.

Although most dentists are general practitioners, the number of specialists more than doubled in the 1955-65 decade (table 27). A dentist, to be recognized as a specialist, needs at least 2 years of advanced study and several years of experience in his specialty. In 1965, 6,460 dentists were recognized as specialists in eight areas of dentistry. Over one-half of the specialists engaged exclusively in orthodontia (straightening of teeth) and one-fourth limited their practices to oral surgery. There are no more than a few hundred dentists in each of the other six dental specialties—endodontia (root canal treatment), oral pathology, pedodontia (dentistry for children), periodontia (treatment of gums and underlying bone), prosthodontia (making of artificial teeth and dentures), and public health dentistry.

In each State and the District of Columbia, a dentist (D.D.S. or D.M.D.) must be a graduate of an accredited dental school and obtain a license before practicing dentistry. The dentist receives 4 years of professional education in a dental school, following 2 or more years of predental college training. In the academic year 1965-66, nearly 50 percent of the dental students had earned a bachelor's degree prior to entering dental school, while another 30 percent had completed 3 years of predental college work. To qualify for licensure in a State, the dental school graduate must pass both a written and a clinical examination. In 1965, 40 States accepted the written examination given by the National Board of Dental Examiners in lieu of the State's own written examination; however, each State still examines the clinical skills of the candidate.

Eight new dental schools have been established since 1950 and several others have expanded their training facilities. As a result, the number of annual graduates has increased by more than 20 percent in the last 15 years (table 28). In 1965, a total of 3,181 dentists were graduated from the 49 dental schools in the United States and Puerto Rico (table 29). Undergraduate enrollment totaled 14,020 in the 1965-66 academic year.

Dental Hygienists

The *dental hygienist* is the only dental auxiliary who provides service directly to the patient and who, like the dentist, is required in each State to obtain a license to practice. The hygienist, working under the direction of the dentist, performs prophylaxes (scaling and polishing of the teeth), exposes and processes dental X-ray films, applies fluoride solution to the teeth of children, instructs individual patients in toothbrushing techniques and proper diet as related to the teeth, and performs other duties in conformity with her training and licensing.

In 1965, an estimated 15,100 dental hygienists were in practice. Approximately 6,000 hygienists were members of the American Dental Hygienists' Association in that year. Since 1950, the number of active hygienists has increased by about 8,000, but there are still only 16 active hygienists per 100 practicing dentists. Because part-time employment is common, the hygienist supply is actually not as favorable as this ratio suggests.

By far the majority of the dental hygienists provide services to patients. They work primarily in private dental offices, but also in public and parochial schools, public and private clinics, hospitals and other institutions. Other hygienists are engaged in nonclinical activities, for example, determining the dental treatment needs of school children and reporting these findings to parents, and giving dental health talks in classrooms.

Dental hygienists receive at least 2 years

of education at the college level. The dental hygiene curriculum, open to high school graduates, includes the basic sciences, dental sciences and liberal arts. About one-half of the dental hygiene programs are integral parts of schools of dentistry and most of the other programs are offered by junior colleges.

Two types of college training are available to the hygiene student. The 2-year associate degree or certificate program qualifies a hygienist for clinical practice. The level of training required for leadership positions in teaching and public health is provided by the 4-year bachelor's degree program in dental hygiene. Hygienists completing the latter program qualify for graduate training leading to the master's degree in related fields.

The number of schools offering the dental hygiene program has increased significantly in recent years, from 37 in 1960 to 56 in 1965 (table 30). As a result, the number of students in training increased by more than 50 percent during this period. Enrollment in the academic year 1965-66 totaled 3,863 students, and 1,491 hygienists were graduated in 1965 (table 31). The bachelor's degree program was offered by 20 schools in 1965, including 13 schools which offered both the 2-year and 4-year programs. The remaining 36 schools offered only the associate degree or certificate in dental hygiene.

Dental Assistants

More than 85 percent of the dentists in private practice today employ one or more *dental assistants*. The dental assistant's primary function, that of assisting the dentist at the chairside, includes preparing the patient for treatment, keeping the operating field clear, mixing filling materials, and passing instruments. Other duties involve exposing and processing X-rays, sterilizing instruments, assisting with laboratory work, ordering supplies, and handling the office records and accounts.

Most dental schools now routinely train dental students in the effective utilization of chairside assistants. Approximately 91,000 persons were employed as dental assistants in 1965 as compared with only 55,200 in 1950. Dental assistants usually work full time.

Traditionally, dental assistants have been trained on the job by their dentist-employers. However, the number of institutions offering accredited training programs for assistants increased from 26 to 64 within the 4-year period 1961-65 (table 32). To be accredited, a program must provide 1 academic year of training in dental assisting. However, 2-year programs are also available in which the required training in dental assisting is supplemented with another year of general education.

The 2-year training program leading to an associate degree or certificate was offered by 24 institutions in 1965, including 5 that provided both the 2-year and the 1-year certificate programs. The remaining 40 schools offered only the 1-year program. In the academic year 1965-66, 2,798 students were in training (table 33). The number graduating reached 1,241 in 1965.

Experienced dental assistants who are graduates of either the 1-year or 2-year accredited training program, or who have completed equivalent training, are eligible to be certified by the Certifying Board of the American Dental Assistants Association. Of the 14,200 members of the Association in 1965, approximately 3,900 were certified.

Dental Laboratory Technicians

The *dental laboratory technician* is a highly skilled craftsman who performs many tasks involved in the construction of complete and partial dentures, fixed bridgework, crowns and other such dental restorations and appliances. Dentists are relieved of many time-consuming tasks by utilizing the skills of the technician to perform tasks such as waxing, investing, casting, soldering, finishing and polishing. The technician does not have direct contact with the patient, but performs his work in accordance with instructions received from the dentist.

The dental laboratory technician may be employed in a dental office and work directly for the dentist. Most technicians, however,

are employed in commercial dental laboratories which serve the majority of the Nation's dentists.

The number of technicians has increased from about 21,000 in 1950 to an estimated 25,500 in 1965. Approximately 20,200 technicians work in 6,700 commercial dental laboratories and 5,300 technicians are employed by dentists in private practice. The Joint Commission on Accreditation of Dental Laboratories has recently been established to accredit commercial laboratories.

There are only a few formal educational programs for dental laboratory technicians at the present time. In 1965, six accredited institutions offered a 2-year educational program for dental laboratory technicians. Three of these programs have been established since 1960. Basic and dental sciences are taught during the first year, and supervised practical laboratory experience is provided in the second year. The six accredited programs enrolled 342 students in the academic year 1965-66, and 119 technicians completed their training in these programs in 1965 (table 34).

Most technicians receive on-the-job training in commercial laboratories or dental offices. A formal apprenticeship program for dental technicians was established in 1965. Apprentices receive approximately 8,000 hours of on-the-job training, including a minimum of 144 hours of related supplemental instruction.

There were approximately 6,200 certified dental laboratory technicians in 1965. Technicians who have completed the 2-year accredited curriculum and 3 years of employment experience, or who have fulfilled other requirements in lieu of the formal training, may be certified after passing an examination given by the National Board for Certification of the National Association of Dental Laboratories.

Table 25. DENTISTS IN RELATION TO POPULATION: SELECTED YEARS, JULY 1, 1950 THROUGH 1965

Dentists and population	1950	1955	1960	1965
Total dentists [1]	87,164	94,879	101,947	109,301
Total population (thousands) [2]	152,271	165,931	180,684	194,583
Dentists per 100,000 population	57.2	57.2	56.4	56.2
Active non-Federal dentists	75,313	76,087	82,630	86,317
Resident civilian population (thousands)	150,790	162,967	178,153	191,890
Active non-Federal dentists per 100,000 civilians	49.9	46.7	46.4	45.0

[1] Excludes graduates of the year concerned, but includes all other dentists, active or inactive.

[2] Includes all persons in the United States and in the Armed Forces overseas.

Sources: Total dentist data—Bureau of Economic Research and Statistics: *Distribution of Dentists in the United States by State, Region, District and County.* Chicago. American Dental Association. 1966 issue (to be published) and prior annual issues. Adjustment for current year graduates made by Division of Dental Health, Public Health Service.
Bureau of Membership Records: *American Dental Directory.* Chicago. American Dental Association, 1966. Also prior annual editions.
Active dentist data—Estimates prepared by the Division of Dental Health, Public Health Service.
Population data—U.S. Bureau of the Census: Population estimates. *Current Population Reports,* Series P-25, No. 327, Feb. 1966.

Table 26. NUMBER OF NON-FEDERAL DENTISTS AND RATE PER 100,000 CIVILIANS: JULY 1, 1965

Location	Civilian population in thousands [1]	Number of non-Federal dentists [2]		Rate per 100,000 civilians	
		Total	Active	Total dentists	Active dentists
United States	191,890	102,174	86,317	53	45
Alabama	3,438	1,068	962	31	28
Alaska	221	69	60	31	27
Arizona	1,587	646	529	41	33
Arkansas	1,950	610	529	31	27
California	18,299	11,227	9,028	61	49
Colorado	1,933	1,133	988	59	51
Connecticut	2,821	1,863	1,590	66	56
Delaware	497	205	161	41	32
District of Columbia	787	755	628	96	80
Florida	5,713	2,834	2,257	50	40
Georgia	4,264	1,259	1,048	30	25
Hawaii	648	459	418	71	65
Idaho	686	323	309	47	45
Illinois	10,599	6,320	5,271	60	50
Indiana	4,877	2,216	1,881	45	39
Iowa	2,759	1,537	1,317	56	48
Kansas	2,195	1,007	870	46	40
Kentucky	3,140	1,156	994	37	32
Louisiana	3,501	1,290	1,085	37	31
Maine	975	447	366	46	38
Maryland	3,464	1,483	1,221	43	35
Massachusetts	5,309	3,767	3,063	71	58
Michigan	8,198	4,240	3,830	52	47
Minnesota	3,549	2,456	2,018	69	57
Mississippi	2,301	628	573	27	25
Missouri	4,470	2,355	1,914	53	43
Montana	696	373	337	54	48
Nebraska	1,459	921	738	63	51
Nevada	432	181	131	42	30
New Hampshire	663	301	259	45	39
New Jersey	6,735	4,211	3,543	63	53
New Mexico	1,008	311	265	31	26
New York	18,032	14,250	11,891	79	66
North Carolina	4,821	1,508	1,284	31	27
North Dakota	640	280	233	44	36
Ohio	10,227	4,942	4,238	48	41
Oklahoma	2,448	958	844	39	34
Oregon	1,894	1,473	1,251	78	66
Pennsylvania	11,505	6,603	5,837	57	51
Rhode Island	867	488	412	56	48
South Carolina	2,489	578	488	23	20
South Dakota	696	294	257	42	37
Tennessee	3,817	1,539	1,409	40	37
Texas	10,387	3,814	3,188	37	31
Utah	986	596	565	60	57
Vermont	397	190	151	48	38
Virginia	4,294	1,633	1,410	38	33
Washington	2,929	2,025	1,847	69	63
West Virginia	1,811	669	600	37	33
Wisconsin	4,140	2,533	2,087	61	50
Wyoming	335	150	142	45	42

[1] State figures do not add to total due to rounding.

[2] Excludes graduates of the 1965 class.

Sources: Total dentist data—Bureau of Economic Research and Statistics: *Distribution of Dentists in the United States by State, Region, District and County.* Chicago. American Dental Association. 1966 issue to be published. Adjustment to exclude 1965 graduates made by Division of Dental Health, Public Health Service.
Bureau of Membership Records: *American Dental Directory.* Chicago. American Dental Association, 1966.
Active dentist data—Estimates prepared by Division of Dental Health, Public Health Service.
Population data—U.S. Bureau of the Census: Population estimates. *Current Population Reports,* Series P–25, No. 324, Jan. 1966.

Table 27. NUMBER OF DENTAL SPECIALISTS: 1955, 1960, AND 1965

Specialist	1955	1960	1965
All specialists [1]	3,034	4,170	6,462
Endodontists [2]	----------	----------	----------
Oral pathologists	24	42	52
Oral surgeons	844	1,183	1,636
Orthodontists	1,521	2,097	3,437
Pedodontists	148	229	568
Periodontists	245	307	376
Prosthodontists	225	278	336
Public health dentists	27	34	57

[1] Includes diplomates of specialty boards authorized by the American Dental Association, members of recognized national specialty societies, and dentists licensed in a specialty by 1 of the 10 States which currently licenses dental specialists.

[2] Endodontia was not recognized as a dental specialty in 1955 or 1960. Data are not available for 1965.

Source: Bureau of Economic Research and Statistics: *Facts About States for the Dentist Seeking a Location*. Chicago. American Dental Association. 1966 issue to be published. Also 1956 and 1961 issues.

Table 28. DENTAL SCHOOLS, STUDENTS, AND GRADUATES: SELECTED YEARS, 1949–50 THROUGH 1965–66

Academic year	Schools	Students	Graduates
1965–66	49	14,020	[1] 3,200
1964–65	49	13,876	3,181
1963–64	48	13,691	3,213
1962–63	48	13,576	3,233
1961–62	47	13,513	3,207
1960–61	47	13,580	3,290
1959–60	47	13,581	3,253
1954–55	43	12,601	3,081
1949–50	41	11,460	2,565

[1] Estimate prepared by Division of Dental Health, Public Health Service.

Source: Council on Dental Education: *Dental Students' Register, 1965–66*. Chicago. American Dental Association. Also prior annual issues. Data for United States and Puerto Rico.

Table 30. SCHOOLS FOR TRAINING DENTAL HYGIENISTS, STUDENTS, AND GRADUATES: SELECTED YEARS, 1949–50 THROUGH 1965–66

Academic year	Schools	Students	Graduates
1965–66	56	3,863	[1] 1,650
1964–65	53	3,502	1,491
1963–64	49	3,278	1,429
1962–63	47	3,005	1,257
1961–62	43	2,752	1,219
1960–61	37	2,497	1,023
1959–60	34	2,237	992
1954–55	31	1,938	857
1949–50	18	1,091	529

[1] Estimate prepared by Division of Dental Health, Public Health Service.

Source: Council on Dental Education: *Dental Students' Register, 1965–66*. Chicago. American Dental Association. Also prior annual issues.

Table 32. INSTITUTIONS OFFERING DENTAL ASSISTANT TRAINING PROGRAMS, STUDENTS, AND GRADUATES: 1961–62 THROUGH 1965–66

Academic year[1]	Institutions	Students	Graduates
1965–66	64	2,798	[2] 1,700
1964–65	50	[3] 1,919	1,241
1963–64	44	1,551	895
1962–63	35	1,419	718
1961–62	26	1,181	658

[1] Data not available for earlier years.

[2] Estimate prepared by Division of Dental Health, Public Health Service.

[3] Students based on 49 institutions.

Source: Council on Dental Education: *Dental Students' Register, 1965–66*. Chicago. American Dental Association. Also prior annual issues.

Table 29. LOCATION AND OWNERSHIP OF DENTAL SCHOOLS AND NUMBERS OF STUDENTS AND GRADUATES: 1965

Location	School	Ownership	Students [1]	Graduates [2]
	Total, 49 schools		14,020	3,181
Ala.	University of Alabama School of Dentistry, Birmingham	Public	194	43
Calif.	University of Pacific, College of Physicians and Surgeons, School of Dentistry, San Francisco	Private	216	58
	Loma Linda University School of Dentistry, Loma Linda	Private	219	43
	University of California School of Dentistry, San Francisco	Public	297	73
	University of California at Los Angeles School of Dentistry, Los Angeles [3]	Public	58	----------
	University of Southern California School of Dentistry, Los Angeles	Private	394	89
D.C.	Georgetown University School of Dentistry, Washington	Private	390	77
	Howard University College of Dentistry, Washington	Private	268	48
Ga.	Emory University School of Dentistry, Atlanta	Private	301	63
Ill.	Loyola University of Chicago School of Dentistry, Chicago	Private	343	95
	Northwestern University Dental School, Chicago	Private	287	56
	University of Illinois College of Dentistry, Chicago	Public	335	77
Ind.	Indiana University School of Dentistry, Indianapolis	Public	345	87
Iowa	State University of Iowa, College of Dentistry, Iowa City	Public	207	50
Ky.	University of Kentucky College of Dentistry, Lexington [4]	Public	151	----------
	University of Louisville School of Dentistry, Louisville	Private	208	56
La.	Loyola University School of Dentistry, New Orleans	Private	219	52
Md.	University of Maryland School of Dentistry, Baltimore	Public	386	87
Mass.	Harvard University School of Dental Medicine, Boston	Private	58	8
	Tufts University School of Dental Medicine, Boston	Private	387	96
Mich.	University of Detroit School of Dentistry, Detroit	Private	291	55
	University of Michigan School of Dentistry, Ann Arbor	Public	341	76
Minn.	University of Minnesota School of Dentistry, Minneapolis	Public	398	92
Mo.	Saint Louis University School of Dentistry, Saint Louis	Private	210	46
	University of Missouri at Kansas City School of Dentistry, Kansas City	Public	451	108
	Washington University School of Dentistry, Saint Louis	Private	189	38
Nebr.	Creighton University School of Dentistry, Omaha	Private	179	44
	University of Nebraska College of Dentistry, Lincoln	Public	140	29
N.J.	Fairleigh Dickinson University School of Dentistry, Teaneck	Private	182	45
	New Jersey College of Medicine and Dentistry, Jersey City	Public	171	35
N.Y.	Columbia University School of Dental & Oral Surgery, New York	Private	125	26
	New York University College of Dentistry, New York	Private	653	154
	State University of New York at Buffalo School of Dentistry, Buffalo	Public	250	45
N.C.	University of North Carolina School of Dentistry, Chapel Hill	Public	191	43
Ohio	Ohio State University College of Dentistry, Columbus	Public	575	132
	Western Reserve University School of Dentistry, Clevelend	Private	236	59
Oreg.	University of Oregon Dental School, Portland	Public	303	73
Pa.	Temple University School of Dentistry, Philadelphia	Private	488	112
	University of Pennsylvania School of Dental Medicine, Philadelphia	Private	480	105
	University of Pittsburgh School of Dentistry, Pittsburgh	Private	381	92
P.R.	University of Puerto Rico School of Dentistry, San Juan	Public	109	27
Tenn.	Meharry Medical College School of Dentistry, Nashville	Private	97	20
	University of Tennessee College of Dentistry, Memphis	Public	366	117
Tex.	Baylor University College of Dentistry, Dallas	Private	365	86
	University of Texas Dental Branch, Houston	Public	393	97
Va.	Medical College of Virginia School of Dentistry, Richmond	Public	287	69
Wash.	University of Washington School of Dentistry, Seattle	Public	267	57
W.Va.	West Virginia University School of Dentistry, Morgantown	Public	178	30
Wisc.	Marquette University School of Dentistry, Milwaukee	Private	461	111

[1] Undergraduate enrollment in academic year 1965–66.

[2] Graduates in 1965.

[3] First graduating class in 1968.

[4] First graduating class in 1966.

Source: Council on Dental Education: *Dental Students' Register, 1965–66.* Chicago. American Dental Association.

Table 31. LOCATION AND OWNERSHIP OF SCHOOLS FOR TRAINING DENTAL HYGIENISTS, AND NUMBERS OF STUDENTS AND GRADUATES: 1965

Location	School	Ownership	Students [1]	Graduates [2]
	Total, 56 schools [3]		3,863	1,491
Calif.	Diablo Valley College, Concord	Public	32	15
	Foothill College, Los Altos [4]	Public	33	----
	Loma Linda University, Loma Linda ‡	Private	50	21
	University of California, San Francisco ‡	Public	48	24
	University of Southern California, Los Angeles ‡	Private	77	39
Colo.	Rangely College of Mesa County Junior College, Rangely	Public	34	10
Conn.	University of Bridgeport, Fones School of Dental Hygiene, Bridgeport †	Private	134	53
D.C.	Howard University, Washington	Private	43	16
Fla.	Palm Beach Junior College, Lake Worth	Public	74	28
	Pensacola Junior College, Pensacola	Public	60	22
	St. Petersburg Junior College, St. Petersburg	Public	46	24
Hawaii	University of Hawaii, Honolulu	Public	37	15
Idaho	Idaho State University, Pocatello	Public	24	9
Ill.	Northwestern University, Chicago	Private	51	32
	Southern Illinois University, Vocational Technical Institute, Carbondale	Public	53	16
Ind.	Indiana University, Indianapolis †	Public	69	33
	Indiana University Fort Wayne Regional Campus, Fort Wayne [4]	Public	21	----
Iowa	State University of Iowa, Iowa City ‡	Public	61	36
Ky.	University of Louisville, Louisville †	Public	40	16
La.	Loyola University, New Orleans	Private	61	18
Maine	Westbrook Junior College, Portland	Private	46	21
Mass.	Forsyth School for Dental Hygienists, Boston	Private	193	65
Mich.	Ferris State College, Big Rapids [5]	Public	38	----
	University of Detroit, Detroit	Private	67	32
	University of Michigan, Ann Arbor †	Public	75	38
Minn.	University of Minnesota, Minneapolis	Public	89	37
Mo.	University of Missouri at Kansas City, Kansas City †	Public	47	24
Nebr.	University of Nebraska, Lincoln † [4]	Public	20	----
N.J.	Fairleigh Dickinson University, Teaneck †	Private	79	26
N. Mex.	University of New Mexico, Albuquerque	Public	43	9
N.Y.	Broome Technical Community College, Binghamton	Public	81	25
	City University of New York, New York City Community College of Applied Arts and Sciences, Brooklyn	Public	165	69
	Columbia University, New York ‡	Private	54	16
	Erie County Technical Institute, Buffalo	Public	187	71
	Hudson Valley Community College, Troy	Public	92	42
	Monroe Community College, Rochester	Public	91	35
	Onondaga Community College, Syracuse	Public	83	27
	State University of New York Agricultural and Technical Institute at Farmingdale, Farmingdale	Public	146	60
N.C.	Central Piedmont Community College, Charlotte [5]	Public	38	----
	University of North Carolina, Chapel Hill †	Public	29	14
Ohio	Cuyahoga Community College, Cleveland [4]	Public	45	----
	Ohio State University, Columbus †	Public	158	74
Oreg.	University of Oregon, Portland	Public	56	30
Pa.	Temple University, Philadelphia †	Private	110	39
	University of Pennsylvania, Philadelphia	Private	89	43
	University of Pittsburgh, Pittsburgh	Private	65	13
R.I.	University of Rhode Island, Kingston	Public	35	15
Tenn.	Meharry Medical College, Nashville	Private	10	5
	University of Tennessee, Memphis	Public	93	45
Tex.	Baylor University Caruth School of Dental Hygiene, Dallas †	Private	78	35
	University of Texas, Houston	Public	60	25
Vt.	University of Vermont, Burlington	Public	44	16
Wash.	University of Washington, Seattle ‡	Public	34	18
W.Va.	West Liberty State College, West Liberty †	Public	96	37
	West Virginia University, Morgantown ‡	Public	64	2
Wisc.	Marquette University, Milwaukee †	Private	115	56

[1] Enrollment in academic year 1965–66.

[2] Graduates in 1965.

[3] A total of 69 programs are offered in the 56 schools. Schools offering a 4-year program only are designated with a double dagger (‡); those schools providing both 4-year and 2-year programs are designated with a dagger (†). The remaining schools with no dagger offer a 2-year program only.

[4] First graduating class in 1966.

[5] First graduating class in 1967.

Source: Council on Dental Education: *Dental Students' Register, 1965–66*. Chicago. American Dental Association.

Table 33. LOCATION AND OWNERSHIP OF INSTITUTIONS OFFERING DENTAL ASSISTANT TRAINING PROGRAMS AND NUMBERS OF STUDENTS AND GRADUATES: 1965

Location	Institution	Ownership	Students [1]	Graduates [2]
	Total, 64 institutions [3]		2,798	1,241
Ariz.	Phoenix Dental Assisting School, Phoenix	Public	31	16
Calif.	Cabrillo College, Aptos ‡	Public	40	5
	Cerritos College, Norwalk †	Public	143	25
	Chaffey College, Alta Loma	Public	34	30
	City College of San Francisco, San Francisco ‡	Public	85	15
	College of Marin, Kentfield ‡	Private	57	11
	College of San Mateo, San Mateo ‡	Public	98	33
	Contra Costa College, San Pablo †	Public	47	16
	Diablo Valley College, Concord ‡	Public	39	11
	Foothill College, Los Altos Hills ‡	Public	44	19
	Fullerton Junior College, Fullerton ‡	Public	167	34
	Grossmont College, El Cajon ‡	Public	89	16
	Laney College, Oakland	Public	55	28
	Long Beach City College, Long Beach †	Public	49	25
	Los Angeles City College, Los Angeles †	Public	140	54
	Monterey Peninsula College, Monterey ‡	Public	25	3
	Orange Coast College, Costa Mesa ‡	Private	88	28
	Pasadena City College, Pasadena ‡	Public	88	23
	Reedley College, Reedley ‡	Public	76	12
	Sacramento City College, Sacramento ‡	Public	68	23
	San Diego Mesa College, San Diego †	Public	164	23
	San Jose City College, San Jose ‡	Public	52	16
	Santa Rosa Junior College, Santa Rosa ‡	Public	61	14
Fla.	Lindsey Hopkins Education Center, Miami	Public	25	26
	Tomlinson Adult Education Center, St. Petersburg	Public	25	24
Hawaii	Kapiolani Technical School, Honolulu	Public	27	36
Idaho	Boise Junior College, Boise	Public	15	13
Ill.	Bloom Township Community College, Chicago Heights	Public	21	12
	Morton Junior College, Cicero ‡	Public	10	4
	University of Illinois, Chicago	Public	24	23
Ky.	Jefferson Area Vocational School, Jeffersontown	Public	24	41
Md.	Montgomery Junior College, Takoma Park ‡	Public	45	10
Mass.	Beth Israel Hospital, Boston	Private	6	8
	David Hale Fanning Trade High School, Worcester	Public	20	16
	Springfield Technical Institute, Springfield	Public	28	29
	University Hospital, Boston University, Boston	Private	27	17
Mich.	Ferris State College, Big Rapids ‡	Public	91	15
	University of Detroit, Detroit	Private	22	16
Minn.	Brainerd Area Vocational Technical School, Brainerd	Public	15	13
	University of Minnesota, Minneapolis	Public	30	29
Mo.	Meramac Community College, Kirkwood	Public	35	16
Nebr.	Lincoln Public Schools, Lincoln	Public	17	12
	Omaha Technical School of Dental Assisting, Omaha	Public	18	13
N.J.	Essex County Adult Technical School, Newark	Public	20	20
	Union County Technical Institute, Scotch Plains	Public	19	18
N.Mex.	University of New Mexico, Albuquerque	Public	14	8
N.Y.	New York University, New York	Public	42	35
N.C.	Central Piedmont Community College, Charlotte [4]	Public	16	----
	Technical Institute of Alamance, Burlington	Public	13	11
	Wayne Technical Institute, Goldsboro	Public	24	22
Ohio	Jane Addams Vocational High School, Cleveland	Public	23	21
Oreg.	Blue Mountain Community College, Pendleton	Public	20	18
	Lane Community College, Eugene	Public	23	16
	Oregon Technical Institute, Klamath Falls ‡	Public	38	7
	Portland Community College, Portland	Public	41	36
Pa.	Murrell Dobbins Technical School, Philadelphia	Public	35	29
	University of Pittsburgh, Pittsburgh	Private	46	25
P.R.	University of Puerto Rico, San Juan	Public	16	15
Tenn.	Chattanooga Public Schools, Chattanooga	Public	18	15
Utah	Intermountain Indian School Health Center, Brigham City	Public	8	8
	Utah Trade Technical Institute, Provo [4]	Public	35	----
Wash.	Edison Technical School, Seattle	Public	18	27
	Tacoma Vocational-Technical Institute, Tacoma	Public	30	36
Wisc.	Madison Vocational, Technical and Adult School, Madison	Public	34	21

See footnotes on p. 52.

[1] Enrollment in academic year 1965–66.

[2] Graduates in 1965.

[3] A total of 69 programs are offered in the 64 institutions. Institutions providing a 2-year program only designated with a double dagger (‡); those schools offering both 2-year and 1-year programs are designated with a dagger (†). Other listed schools with no dagger offer only a 1-year program.

[4] First graduating class in 1966.

Source: Council on Dental Education; *Dental Students' Register, 1965–66*, Chicago, American Dental Association.

Table 34. LOCATION AND OWNERSHIP OF INSTITUTIONS OFFERING TRAINING PROGRAMS FOR DENTAL LABORATORY TECHNICIANS, AND NUMBERS OF STUDENTS AND GRADUATES: 1965

Location	Institution	Ownership	Students [1]	Graduates [2]
	Total, 6 institutions		342	119
Calif.	University of California Extension Dental Program, Los Angeles	Public	100	37
	City College of San Francisco, San Francisco	Public	39	14
Ill.	Southern Illinois University, Vocational Technical Institute, Carbondale	Public	58	21
Ky.	University of Kentucky Program in Dental Technology, Lexington [3]	Public	8	
N.Y.	New York City Community College of the City University of New York, Brooklyn	Public	105	36
N.C.	Durham Technical Institute, Durham	Public	32	11

[1] Enrollment in academic year 1965–66. [2] Graduates in 1965. [3] First graduating class in 1967.

Source: Council on Dental Education: *Dental Students' Register, 1965–66*. Chicago. American Dental Association.

CHAPTER 9

Dietetic and Nutritional Services

Dietetic and nutritional services deal with the application of the scientific principles of nutrition to the feeding of individuals and groups. Dietitians assume major responsibility for food selection, preparation, and management of food services. Nutritionists engage in investigating and solving problems of nutrition for the promotion of health.

Together, the number of *dietitians* and *nutritionists* employed in 1965 was probably in excess of 30,000. The decennial censuses had reported 22,000 persons so employed in 1950 and 26,000 in 1960 (table 35). The great majority of these persons are dietitians; about 1,000, more or less, are nutritionists. The location and type of employment of the members of the American Dietetic Association are shown in table 36.

For both groups, the college major generally is home economics, with special emphasis on foods and nutrition and/or institution management. This education can be obtained in the home economics departments of about 450 colleges and universities. In 1963-64, 4,906 persons were awarded baccalaureates in home economics, of which 690 were for majors in foods and nutrition and 158 in institution management or administration. From colleges and universities with departments of nutrition and/or biochemistry, there were 23 bachelor's degrees in nutrition (tables 37 and 38).

Education or work experience leads to the differentiation between the two professions, as discussed in the sections that follow.

Dietitians

Dietitians plan and direct food service programs in hospitals, schools, restaurants, and other public or private institutions. Their work includes planning menus and diets that meet nutritional requirements for health or medical treatment, directing the personnel who prepare and serve the meals, managing purchases and accounts, and providing guidance on the application of principles of nutrition to the selection of food.

More than half of the employed dietitians work in hospitals and related institutions, although increasing numbers are finding employment in educational institutions, health agencies, industrial plants, and commercial eating places. The American Dietetic Association (ADA) reporting on the 18,400 members in 1965 indicated that 7,060 were unemployed—generally homemakers not seeking work. Of the 11,340 employed ADA members, 61 percent were administrative and therapeutic dietitians in hospitals and clinics; 4 percent each were in college and school food service; 14 percent were in restaurants and commercial places of business; 1 percent were consultant, research, or teaching dietitians; 7 percent were public health, research, or teaching nutritionists; 6 percent were full-time graduate students; and 3 percent did not specify field of employment (table 36).

Five types of dietitians are recognized, the most numerous being *administrative* dietitians directly concerned with food-service programs. The director of the dietary department may have qualified dietitians to assist in operating large services. *Therapeutic* dietitians employed by hospitals formulate modified diets prescribed by the physician and instruct patients and their families on how to meet their special food needs. The dietary *consultant* advises on food service practices and facilities and on nutritional problems in group feeding for child care centers, hospitals, nursing homes, schools, and other establishments. The *teaching* dietitian conducts educational programs in dietetics, nutrition, and institution management for dietetic interns, nursing students, and other personnel. Any of these specialists may engage in *research* pertaining to die-

tetics; for example, as part of a clinical research study involving the patient, physician, and other health workers in a medical center.

For qualification as a professional dietitian, The American Dietetic Association recommends the completion of an approved dietetic internship, or 3 years of qualifying experience meeting established standards.

In 1965, 670 graduates of accredited colleges and universities in the United States, Puerto Rico, and other countries were enrolled in dietetic internship programs approved by the ADA (table 39). Of the 63 internship programs approved that year, 55 were for hospitals, 4 for colleges and universities, 3 for business and industry, and 1 for a food clinic (table 40).

Some dietitians take graduate courses leading to a master's or doctor's degree. Statistics from the Office of Education show that 131 persons received advanced degrees in foods and nutrition, 29 in institution management or administration from departments of home economics, and 83 in nutrition from departments of nutrition or biochemistry in 1965 (tables 37 and 38).

Membership in The American Dietetic Association serves as a high standard of qualification in the profession, in lieu of certification or a license.

Nutritionists

Nutritionists plan and conduct programs concerning food in relation to health. Their work includes interpreting and evaluating food and nutrient information for acceptance and use by individuals and groups.

Three types of nutritionists are recognized. The *public health* nutritionist is responsible for the nutrition component of health programs, providing consultation and education for professional workers and participating in research studies. The *teaching* nutritionist conducts educational programs in nutrition for the preparation of professional workers as well as for the public. In colleges they train nutrition personnel; in the Federal Extension Service they advise agency administrators and county home economists; in business they give technical advice in connection with consumer education programs. The *research* nutritionist is concerned with the interrelationship of nutrients in food and the effects on health.

Preparation for nutritionist positions usually requires academic training at both undergraduate and graduate levels (tables 37 and 38). For qualification as a public health nutritionist, the American Public Health Association recommends an advanced degree in nutrition. In 1965, 14 schools offered graduate programs in public health nutrition, the majority of which were in schools of public health (tables 41 and 42).

Nutrition workers are found in many professional societies, in addition to The American Dietetic Association. Over 1,000 research scientists who are actively concerned with the chemistry, physiology or some other phase of nutrition belong to the American Institute of Nutrition. Nutritionists are identified with three sections of the American Home Economics Association—Health and Welfare section, 573 members; Food and Nutrition section, 4,985; and Institution Administration section, 1,051. Many public health nutritionists, food technologists, nutrition educators, and other interested persons belong to the Food and Nutrition section of the American Public Health Association.

Other Food Service Staff

The food service staff in hospitals and other health-related institutions, colleges and other educational institutions, and restaurants and other commercial institutions may include food service supervisors and clerical workers in addition to service workers. The *food service supervisor's* specific duties include supervision of employees and of food-service areas—depending on the size of the dietary department of the institution and the way in which it is organized. *Food service clerical workers* with basic stenographic and clerical skills assist the dietitian with the paper work of the dietary department. *Food service workers* have a wide

range of jobs in food storing, preparing, cooking and serving, and in cleaning the dishes and kitchen. A great deal of the training for all three occupations is on-the-job instruction. However, specialized training for supervisory positions is now offered to high school graduates by a few vocational schools and community colleges. In addition, there are short-term training institutes planned by health departments, State universities, and hospitals.

Correspondence courses conducted by The American Dietetic Association have trained 279 food service supervisors since 1960; as many as 200 students may be enrolled in 1967. The number of persons employed as members of food service staffs is not known.

Table 35. LOCATION OF DIETITIANS AND NUTRITIONISTS IN RELATION TO POPULATION: APRIL 1, 1960

Location	Number employed [1]	Rate per 100,000 population	Location	Number employed [1]	Rate per 100,000 population
United States	26,119	14.6			
Alabama	505	15.5	Montana	62	9.2
Alaska	19	8.4	Nebraska	162	11.5
Arizona	89	6.8	Nevada	38	13.3
Arkansas	251	14.1	New Hampshire	93	15.3
California	1,761	11.2	New Jersey	708	11.7
Colorado	330	18.8	New Mexico	117	12.3
Connecticut	485	19.1	New York	3,461	20.6
Delaware	74	16.6	North Carolina	935	20.5
District of Columbia	237	31.0	North Dakota	66	10.4
Florida	703	14.2	Ohio	1,379	14.2
Georgia	799	20.3	Oklahoma	252	10.8
Hawaii	66	10.4	Oregon	171	9.7
Idaho	71	10.6	Pennsylvania	1,597	14.1
Illinois	1,446	14.3	Rhode Island	162	18.9
Indiana	451	9.7	South Carolina	399	16.7
Iowa	265	9.6	South Dakota	56	8.2
Kansas	405	18.6	Tennessee	607	17.0
Kentucky	342	11.3	Texas	1,216	12.7
Louisiana	459	14.1	Utah	56	6.3
Maine	103	10.6	Vermont	46	11.8
Maryland	448	14.4	Virginia	658	16.6
Massachusetts	1,149	22.3	Washington	427	15.0
Michigan	1,020	13.0	West Virginia	173	9.3
Minnesota	434	12.7	Wisconsin	469	11.9
Mississippi	326	15.0	Wyoming	32	9.7
Missouri	539	12.5			

[1] As reported in the 1960 Census of Population.

Source: Prindle, R. A. and Pennell, M. Y.: Industry and occupation data from the 1960 census, by State. *Health Manpower Source Book 17.* PHS Pub. No. 233, Section 17. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1963.

Table 36. LOCATION OF MEMBERS OF THE AMERICAN DIETETIC ASSOCIATION: 1965

Location	Total employed ADA members	Dietitians				Nutritionists	Full-time graduate students
		Hospitals and clinics	College and school food service	Restaurants and commercial business	Consultant, research, teaching		
All locations	[1] 11,340	6,839	930	1,605	160	784	698
United States	10,974	6,639	919	1,531	150	751	673
Alabama	162	93	10	40	2	9	6
Alaska	20	10	2	1	—	1	6
Arizona	96	53	4	15	2	7	11
Arkansas	52	33	—	11	—	6	2
California	1,293	838	96	116	27	99	91
Colorado	211	142	15	29	4	11	5
Connecticut	194	112	35	18	2	10	10
Delaware	42	15	7	5	—	5	2
District of Columbia	161	77	7	26	1	19	29
Florida	270	152	34	27	3	30	15
Georgia	141	83	11	24	1	8	10
Hawaii	57	41	2	6	—	5	3
Idaho	24	11	5	5	—	—	3
Illinois	730	454	38	96	7	56	41
Indiana	234	126	37	29	4	14	18
Iowa	172	95	20	39	2	7	7
Kansas	170	102	16	24	6	12	6
Kentucky	125	77	10	19	—	3	14
Louisiana	159	89	31	21	1	5	10
Maine	27	14	3	5	—	2	3
Maryland	258	151	26	43	1	16	13
Massachusetts	392	232	30	68	6	23	24
Michigan	430	273	29	54	5	34	26
Minnesota	287	194	12	52	4	11	11
Mississippi	57	34	5	13	—	4	1
Missouri	232	168	9	24	2	11	13
Montana	39	21	3	4	1	6	4
Nebraska	101	71	3	17	—	5	3
Nevada	16	13	—	—	—	2	1
New Hampshire	34	27	3	1	—	2	—
New Jersey	238	126	19	38	4	23	16
New Mexico	51	31	3	7	1	4	3
New York	941	520	70	130	8	90	92
North Carolina	155	74	23	22	2	10	22
North Dakota	35	23	1	8	—	1	2
Ohio	688	426	52	103	8	38	28
Oklahoma	142	73	19	31	1	7	7
Oregon	133	78	16	17	1	11	5
Pennsylvania	627	384	50	93	14	33	28
Rhode Island	66	46	2	11	1	2	4
South Carolina	58	39	—	8	—	6	3
South Dakota	45	29	4	5	1	3	3
Tennessee	173	107	9	29	3	13	9
Texas	440	258	59	60	6	26	17
Utah	72	48	5	14	1	2	1
Vermont	24	11	1	9	—	1	1
Virginia	239	132	19	40	3	23	14
Washington	260	175	37	19	5	14	6
West Virginia	62	46	—	10	—	3	2
Wisconsin	321	203	26	40	10	17	21
Wyoming	18	9	1	5	—	1	1
Puerto Rico	70	33	—	21	1	3	10
Canal Zone	7	6	—	—	—	1	—
Guam	2	2	—	—	—	—	—
Virgin Islands	4	2	—	—	—	1	1
Armed Forces overseas	25	11	1	7	1	2	3
Canada	159	101	5	26	3	11	7
Foreign areas	99	45	5	20	5	15	4

[1] Includes 324 for whom field of employment was not reported. An additional 7,060 members were unemployed.

Source: American Dietetic Association.

Table 37. EARNED DEGREES CONFERRED IN FOODS AND NUTRITION, INSTITUTION MANAGEMENT OR ADMINISTRATION, AND NUTRITION: 1960–61 THROUGH 1964–65

Academic year	Bachelor's	First professional [1]	Master's	Doctor's
Foods and Nutrition (Home Economics)				
1964–65	645	----------	115	16
1963–64	690	----------	123	10
1962–63	620	----------	105	13
1961–62	545	----------	87	12
1960–61	534	----------	118	7
Institution Management or Administration (Home Economics)				
1964–65	205	----------	29	—
1963–64	158	----------	14	—
1962–63	125	----------	14	—
1961–62	148	----------	18	—
1960–61	161	----------	16	1
Nutrition (Biological Sciences)				
1964–65	33	29	62	21
1963–64	23	----------	44	14
1962–63	5	----------	34	5
1961–62	6	----------	19	2
1960–61 [2]	----------	----------	----------	----------

[1] Not applicable to Foods and Nutrition and to Institution Management or Administration.

[2] Data not reported separately.

Source: National Center for Educational Statistics: *Summary Report on Bachelor's and Higher Degrees Conferred During the Year 1964–65.* Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office. To be published. Also prior annual issues. Data for United States, Canal Zone, Puerto Rico, and the Virgin Islands.

Table 39. DIETETIC INTERNSHIP PROGRAMS AND INTERNS: SELECTED YEARS, 1951 THROUGH 1965

Year	Programs	Total interns	Interns with bachelor's degrees from	
			U.S. schools [1]	Other schools
1965	[2] 63	670	631	39
1964	63	670	636	34
1963	62	651	592	59
1962	61	645	580	65
1961	63	617	559	58
1960	65	569	510	59
1955	69	674	632	42
1951	65	687	670	17

[1] Accredited colleges and universities in the United States and Puerto Rico.

[2] Includes Ohio State University program in medical dietetics for undergraduate students.

Sources: Programs—American Hospital Association: *Hospitals* Guide Issue, Part 2. *J.A.H.A.* 39(15):404, Aug. 1965 Also prior annual issues.
Interns—American Dietetic Association.
Data for United States and Puerto Rico.

Table 41. SCHOOLS OFFERING MASTER'S DEGREES IN PUBLIC HEALTH NUTRITION AND NUMBERS OF STUDENTS AND GRADUATES: SELECTED YEARS, 1949–50 THROUGH 1965–66

Academic year	Schools	Students	Graduates
1965–66	14	135	70
1964–65	14	117	73
1963–64	13	116	72
1962–63	13	80	46
1961–62	12	73	56
1960–61	11	44	33
1959–60	10	49	40
1954–55	10	38	36
1949–50	6	37	34

Source: The individual schools.

Table 38. LOCATION OF SCHOOLS CONFERRING EARNED DEGREES IN FOODS AND NUTRITION, INSTITUTION MANAGEMENT AND ADMINISTRATION, AND NUTRITION, AND NUMBERS OF GRADUATES BY LEVEL OF DEGREE: 1963–64

Location	School	Foods and nutrition			Institution management and administration		Nutrition		
		Bachelor's	Master's	Doctor's	Bachelor's	Master's	Bachelor's	Master's	Doctor's
	Total, all schools	690	123	10	158	14	23	44	14
	Selected schools	646	123	10	149	14	23	44	14
Ala.	Auburn University	6	—	—	—	—	—	—	—
	Tuskegee Institute	23	2	—	—	—	—	—	—
	University of Alabama	8	4	—	—	—	—	—	—
Ariz.	Arizona State University	3	—	—	—	—	—	—	—
	University of Arizona	7	—	—	—	—	—	—	—
Ark.	Agric Mech & Normal Col	5	—	—	—	—	—	—	—
Calif.	Immaculate Heart College	3	—	—	—	—	—	—	—
	Loma Linda University	—	4	—	—	—	6	8	2
	U of Cal Berkeley	8	—	—	—	—	—	—	—
	U of Cal Davis	4	—	—	—	—	—	—	—
Colo.	Colorado State University	13	2	—	—	—	—	—	—
Conn.	University of Connecticut	9	—	—	—	—	—	—	—
Del.	University of Delaware	11	—	—	—	—	—	—	—
D.C.	Howard University	3	—	—	—	—	—	—	—
Fla.	Florida A & M University	4	—	—	—	—	—	—	—
	Florida State University	8	1	1	—	—	—	—	—
Ga.	University of Georgia	9	1	—	—	—	—	—	—
	Berry College	—	—	—	3	—	—	—	—
	Savannah State College	—	—	—	3	—	—	—	—
Hawaii	University of Hawaii	1	4	—	4	—	—	—	—
Ill.	Mundelein College	4	—	—	—	—	—	—	—
	Rosary College	3	—	—	—	—	—	—	—
Ind.	Purdue University	25	3	—	12	—	2	—	—
	St. Mary's College	—	—	—	—	—	2	—	—
Iowa	Iowa State U of Sci & Tech	40	6	1	7	3	—	—	—
	Marycrest College	4	—	—	—	—	—	5	2
	University of Iowa	—	—	—	—	—	—	—	—
Kans.	Kansas St U Ag & App Sci	7	3	1	9	3	—	1	—
	University of Kansas	—	—	—	—	—	—	—	—
Ky.	Nazareth Col of Kentucky	3	—	—	—	—	—	—	—
	University of Kentucky	6	—	—	6	—	—	—	—
La.	Grambling College	—	—	—	5	—	—	—	—
	La State Univ & A & M Col	6	1	—	—	—	—	—	—
	Nthwstrn St Col Louisiana	—	—	—	3	—	—	—	—
	Southern Univ & A & M Col	9	—	—	—	—	—	—	—
Md.	University of Maryland	2	7	—	1	—	—	12	8
Mass.	Mass Inst of Technology	—	—	—	—	—	—	—	—
	Regis College	4	—	—	—	—	—	—	—
	State Col at Framingham	26	—	—	—	—	—	—	—
	Simmons College	—	—	—	5	—	—	—	—
Mich.	Mercy College of Detroit	6	—	—	—	—	—	—	—
	Mich St U Agric & App Sci	1	4	1	1	3	—	—	—
	Wayne State University	6	1	—	—	—	—	—	—
Minn.	College of St Catherine	3	—	—	—	—	—	—	—
	University of Minnesota	18	—	—	—	—	—	—	—
Miss.	Univ of Sthrn Mississippi	—	—	—	3	—	—	—	—
Mo.	Fontbonne College	11	—	—	—	—	—	—	—
	St Louis University	—	2	—	—	—	—	—	—
	University of Missouri	11	—	—	—	—	—	—	—
	Webster College	4	—	—	—	—	—	—	—
N.J.	College of St. Elizabeth	7	—	—	—	—	—	—	—
N.Y.	CUNY Hunter College	—	8	—	—	—	—	—	—
	Cornell University	—	11	—	—	1	—	9	1
	Marymount College	5	—	—	—	—	—	—	—
	New York University	7	3	—	—	—	—	—	—
	Pratt Institute	—	—	—	16	—	—	—	—
	Rochester Inst Technology	—	—	—	14	—	—	—	—
	Russell Sage College	5	—	—	—	—	—	—	—
	Syracuse University	4	—	—	—	—	2	1	—

Table 38. LOCATION OF SCHOOLS CONFERRING EARNED DEGREES IN FOODS AND NUTRITION, INSTITUTION MANAGEMENT AND ADMINISTRATION, AND NUTRITION, AND NUMBERS OF GRADUATES BY LEVEL OF DEGREE: 1963–64—Continued

Location	School	Foods and nutrition			Institution management and administration		Nutrition		
		Bachelor's	Master's	Doctor's	Bachelor's	Master's	Bachelor's	Master's	Doctor's
N.C.	Univ of N C at Greensboro	—	1	—	3	—	—	—	—
N.Dak.	North Dakota State Univ	10	1	—	—	—	—	—	—
Ohio	Baldwin-Wallace College	5	—	—	—	—	—	—	—
	Kent State University	3	—	—	14	—	—	—	—
	Miami University	4	—	—	—	—	—	—	—
	Ohio State University	13	—	—	4	—	9	—	—
	Our Lady of Cincin Col	3	—	—	—	—	—	—	—
	University of Cincinnati	5	—	—	—	—	—	—	—
	Ursuline College	4	—	—	—	—	—	—	—
	Western Reserve Univ	—	—	—	—	—	1	4	1
Okla.	Okla St U Agric & App Sci	6	5	—	—	—	—	—	—
	University of Oklahoma	1	—	—	—	—	1	—	—
Oreg.	Oregon State Univ	6	1	—	2	—	—	—	—
Pa.	Carnegie Inst Technology	11	—	—	—	—	—	—	—
	Drexel Inst of Technology	3	5	—	3	2	—	—	—
	Immaculata College	6	—	—	—	—	—	—	—
	Marywood College	12	—	—	—	—	—	—	—
	Pennsylvania State Univ	30	9	2	8	—	—	—	—
	Seton Hill College	7	—	—	—	—	—	—	—
	University of Pittsburgh	—	—	—	—	—	—	4	—
P.R.	University of Puerto Rico	16	—	—	—	—	—	—	—
R.I.	Salve Regina College	4	—	—	—	—	—	—	—
	Univ of Rhode Island	5	3	—	—	—	—	—	—
S.Dak.	S D St C Agri & Mech Arts	5	—	—	—	—	—	—	—
Tenn.	Southern Missionary Col	3	—	—	—	—	—	—	—
	Tenn Ag & Indus St Univ	3	—	—	—	—	—	—	—
	University of Tennessee	20	4	1	12	—	—	—	—
Tex.	North Texas State Univ	4	—	—	—	—	—	—	—
	Prairie View A & M Col	10	—	—	—	—	—	—	—
	Texas Technological Col	8	3	—	—	—	—	—	—
	Texas Womans University	5	5	1	—	—	—	—	—
	University of Texas	10	2	—	3	—	—	—	—
Utah	Brigham Young University	8	3	—	—	—	—	—	—
	University of Utah	4	—	—	—	—	—	—	—
	Utah St U Agric & App Sci	3	3	—	—	—	—	—	—
Vt.	Univ of Vt & St Agric Col	3	—	—	—	—	—	—	—
Va.	Virginia Polytechnic Inst	3	3	—	—	—	—	—	—
Wash.	University of Washington	—	—	—	8	—	—	—	—
	Walla Walla College	3	—	—	—	—	—	—	—
	Washington State Univ	—	—	—	—	2	—	—	—
W.Va.	Marshall University	4	—	—	—	—	—	—	—
Wis.	Stout State College	27	—	—	—	—	—	—	—
	University of Wisconsin	17	8	2	—	—	—	—	—

Source: National Center for Educational Statistics: *Earned Degrees Conferred 1963–64*. OE–54013–64. Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1966.

Table 40. LOCATION AND OWNERSHIP OF APPROVED DIETETIC INTERNSHIP PROGRAMS AND NUMBER OF INTERNS: 1965

Location	Program	Ownership	Interns
	Total, 63 programs		[1] 670
	Food clinic internship		
Mass.	Frances Stern Food Clinic—Boston Dispensary	Private	6
	Hospital internships		
Ala.	Tuskegee Institute, Tuskegee Institute	Public	7
	University of Alabama Hospitals and Clinics, Birmingham	Public	7
Calif.	Highland Alameda County Hospital, Oakland	Public	10
	Letterman General Hospital, San Francisco	Public	8
	Loma Linda University, School of Nutrition and Dietetics, Los Angeles	Private	12
	University of California, School of Public Health, Berkeley	Public	6
	University of California Medical Center, San Francisco	Public	15
	Veterans' Administration Center, Los Angeles	Public	20
Colo.	Colorado State Hospital, Pueblo	Public	7
	Fitzsimons General Hospital, Denver	Public	7
Conn.	Yale-New Haven Hospital, New Haven	Private	12
D.C.	Freedman's Hospital, Washington	Public	10
	Walter Reed General Hospital, Washington	Public	12
Ill.	Cook County Hospital, Chicago	Public	10
	University of Chicago Clinics, Chicago	Private	8
	Veterans' Administration Hospital, Hines	Public	21
Ind.	Indiana University Medical Center, Indianapolis	Public	11
Iowa	University of Iowa Hospitals, Iowa City	Public	8
Kans.	University of Kansas Medical Center, Kansas City	Public	6
Mass.	Beth Israel Hospital, Boston	Private	13
	Massachusetts General Hospital, Boston	Private	24
	Peter Bent Brigham Hospital, Boston	Private	14
Mich.	Harper Hospital, Detroit	Private	15
	Henry Ford Hospital, Detroit	Private	14
	University of Michigan Medical Center, Ann Arbor	Public	13
Minn.	Ancker Hospital, St. Paul	Public	7
	St. Mary's Hospital, Rochester	Private	18
	University of Minnesota Hospitals, Minneapolis	Public	18
Mo.	Barnes Hospital, St. Louis	Private	13
	St. Louis University Hospitals, St. Louis	Private	10
N.Y.	Grasslands Hospital, Valhalla	Public	9
	Hudson River State Hospital (Food Service Administration), Poughkeepsie	Public	6
	New York Hospital, New York	Private	17
	St. Luke's Hospital, New York	Private	8
	U.S. Public Health Service Hospital, New York	Public	12
	Veterans' Administration Hospital, New York	Public	12
N.C.	Duke University Medical Center, Durham	Private	10
Ohio	Cincinnati General Hospital, Cincinnati	Public	9
	Good Samaritan Hospital, Cincinnati	Private	19
	Miami Valley Hospital, Dayton	Private	9
	St. Luke's Hospital, Cleveland	Private	9
	University Hospitals of Cleveland, Cleveland	Private	6
Okla.	University of Oklahoma Medical Center, Oklahoma City	Public	10
Oreg.	University of Oregon Medical School Hospitals and Clinics, Portland	Public	9
Pa.	Shadyside Hospital, Pittsburgh	Private	5
P.R.	University (District) Hospital, Rio Piedras	Public	7
Tenn.	Vanderbilt University Hospital, Nashville	Private	12

Table 40. LOCATION AND OWNERSHIP OF APPROVED DIETETIC INTERNSHIP PROGRAMS AND NUMBER OF INTERNS: 1965—Continued

Location	Program	Ownership	Interns
Tex.	Baylor University Medical Center, Dallas	Private	4
	Brooke General Hospital, Fort Sam Houston	Public	11
	Veterans' Administration Hospital, Houston	Public	16
Utah	Latter-Day Saints Hospital, Salt Lake City	Private	6
Va.	Medical College of Virginia, Richmond	Public	12
Wash.	Seattle Internship for Hospital Dietitians (King County Hospital; Swedish Hospital; Children's Orthopedic Hospital), Seattle	Public-private	14
Wisc.	University Hospitals, University of Wisconsin, Madison	Public	6
	Milwaukee County Institutions, Milwaukee	Public	10
	Business and industry internships		
Conn.	Aetna Life Affiliated Companies, Hartford	Private	6
N.Y.	Eastman Kodak Company, Rochester	Private	7
Ohio	Stouffer Foods Corporation, Cleveland	Private	8
	College and university internships		
Calif.	Mills College, Oakland	Private	7
Okla.	Oklahoma State University, Stillwater	Public	7
Pa.	Drexel Institute of Technology, Philadelphia	Private	6
Wash.	University of Washington, Seattle	Public	11

[1] Includes 8 interns in the undergraduate program at Ohio State University.

Source: American Dietetic Association.

Table 42. LOCATION AND OWNERSHIP OF SCHOOLS OFFERING MASTER'S DEGREES IN PUBLIC HEALTH NUTRITION AND NUMBERS OF STUDENTS AND GRADUATES: 1965–66

Location	School	Ownership	Students	Graduates
	Total, 14 schools		135	70
Calif.	University of California, School of Public Health, Berkeley	Public	21	11
	University of California, School of Public Health, Los Angeles	Public	31	8
Mass.	Harvard University, School of Public Health, Boston	Private	4	4
	Massachusetts Institute of Technology, Cambridge	Private	6	2
Mich.	University of Michigan, School of Public Health, Ann Arbor	Public	11	9
Minn.	University of Minnesota, School of Public Health, Minneapolis	Public	4	2
N.Y.	Columbia University, School of Public Health, New York	Private	33	17
	Columbia University Teachers College, New York	Private	3	—
	Cornell University, Graduate School of Nutrition, Ithaca	Private	1	—
N.C.	University of North Carolina, School of Public Health, Chapel Hill	Public	3	2
Ohio	Western Reserve University, Department of Nutrition, Cleveland	Private	6	5
Pa.	University of Pittsburgh, School of Public Health, Pittsburgh	Private	5	5
	Pennsylvania State University, College of Home Economics, University Park	Private	3	2
Tenn.	University of Tennessee, College of Home Economics, Knoxville	Public	4	3

Source: The individual schools.

CHAPTER 10

Economic Research in the Health Field

The major functions of the *health economist*, whether he is or is not formally trained in economics, are to appraise health as an economic asset and to analyze ways in which the provision of health care goods and services affects the health of individuals and hence the well-being of families and nations. Usually health economic research activities are grouped into five broad categories related to health—financing, organization, facilities, utilization, and manpower. Health economic research provides information essential for decision making in both public and private agencies.

In a program setting, the health economist makes his contribution mainly through research and analytical studies rather than through the provision of services. For this reason the field will remain relatively small, in relation to personnel who provide health services, in the foreseeable future. Approximately 500 persons were employed as health economists in 1965. (This estimate was provided by the Health Economics Branch, Division of Medical Care Administration, Bureau of State Services, Community Health, Public Health Service.)

Basic research in health economics is carried out primarily by economists employed in universities and research foundations. Applied research in health economics is frequently the responsibility of the health economist employed by large health-related organizations. Examples of large organizations employing health economists are the Public Health Service and other components of the U.S. Department of Health, Education, and Welfare; State and local health departments; national professional health societies; and voluntary health agencies.

The responsibilities of a health economist who is employed at a university vary depending upon the orientation of the university. A faculty member who teaches health economics is likely to spend more time in teaching other aspects of economics than he devotes to health. Frequently, the university economist combines teaching with research activities and occasional outside consultations. Some faculty members have research appointments only, with no teaching responsibilities; others may have joint teaching appointments both in the university's department of economics or business school and in the school of public health or school of medicine. In organizations other than universities and research foundations, health economists are usually a part of the overall administrative staff with responsibility for conducting specialized studies. They frequently serve as advisers and consultants in program analysis, and in the development of new programs. In these situations the health economist provides information on program costs, value of the program to the economy, and various aspects of supply and demand.

A bachelor's degree with a major in economics is usually required for most beginning jobs in health economics in both government and private industry. A master's degree, and usually the doctorate, is required for career appointments at universities and research foundations.

Information on the number of degrees conferred in economics is given in table 43, and on the institutions that conferred these degrees, in table 44. No information is available on degrees with specialization in health economics.

At present, few courses limited to *health* economics are offered. However, a small number of graduate schools and schools of public health offer such specific courses. At other schools, the subject matter of health economics is taught as part of a more comprehensive course such as economic development, social insurance, investment in human resources, welfare economics, hospital administration, or medical care administration. With the increased interest in health eco-

nomics, more schools are beginning to attract qualified faculty to offer courses and to do research specific to health economics. It is anticipated that more graduate schools will begin to develop teaching programs geared to the student whose major area of concentration is health economics.

Table 43. EARNED DEGREES CONFERRED IN ECONOMICS: 1960–61 THROUGH 1964–65

Academic year	Bachelor's	First professional requiring 5 or more years	Master's	Doctor's
1964–65	10,875	20	1,268	410
1963–64	10,582	25	1,111	385
1962–63	9,399	—	1,029	331
1961–62	8,387	18	853	268
1960–61	7,939	—	820	266

Source: National Center for Educational Statistics: *Summary Report on Bachelor's and Higher Degrees Conferred During the Year 1964–65.* Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office. To be published. Also prior annual issues. Data for United States, Canal Zone, Puerto Rico, and the Virgin Islands.

Table 44. LOCATION OF SCHOOLS CONFERRING DEGREES IN ECONOMICS AND NUMBERS OF GRADUATES: 1963–64

Location	School	Graduates		
		Bachelor's	Master's	Doctor's
	Total, all schools	10,582	1,111	385
	Selected schools	4,667	1,022	385
Ariz.	University of Arizona	10	6	—
Ark.	University of Arkansas	5	3	1
Calif.	Claremont Graduate School	—	4	1
	Stanford University	111	8	9
	U of Cal Berkeley	122	49	8
	U of Cal Los Angeles	103	15	4
	Univ of Sthrn California	25	10	7
Colo.	University of Colorado	33	7	4
	University of Denver	21	7	—
Conn.	Trinity College	34	4	—
	University of Connecticut	53	11	—
	Yale University	102	39	7
Del.	University of Delaware	21	3	—
D.C.	American University	20	15	8
	Catholic Univ of America	12	2	1
	Georgetown University	89	10	7
	George Washington Univ	27	13	3
	Howard University	24	9	—
Fla.	Florida State University	11	5	—
	University of Florida	44	—	4
Ga.	University of Georgia	41	4	—
Hawaii	University of Hawaii	16	4	—
Ill.	Northern Illinois Univ	13	4	—
	Northwestern University	28	13	5
	Southern Illinois Univ	46	6	—
	University of Chicago	[1] 46	10	12
	University of Illinois	63	40	13
Ind.	Indiana University	33	27	15
	Purdue University	139	27	9
	University of Notre Dame	81	8	1
Iowa	Drake University	10	5	—
	Iowa St U of Sci & Tech	16	2	1
	University of Iowa	25	3	3
Kans.	Kansas St U Ag & App Sci	9	11	—
	University of Kansas	27	4	3
Ky.	University of Kentucky	5	2	3
La.	La State Univ & A & M Col	30	7	2
	Tulane Univ of Louisiana	20	1	8
Md.	Johns Hopkins University	10	1	8
	University of Maryland	57	3	—
Mass.	Boston College	165	18	—
	Boston University	26	6	1

Table 44. LOCATION OF SCHOOLS CONFERRING DEGREES IN ECONOMICS AND NUMBERS OF GRADUATES: 1963–64—Continued

Location	School	Graduates		
		Bachelor's	Master's	Doctor's
	Clark University	7	5	3
	Harvard University	91	18	34
	Mass Inst of Technology	—	2	25
	Univ of Massachusetts	30	2	1
	Williams College	20	18	—
Mich.	Mich St U Agric & App Sci	57	15	3
	University of Detroit	4	8	—
	University of Michigan	97	14	10
	Wayne State University	23	8	2
Minn.	University of Minnesota	62	10	5
Miss.	Univ of Sthrn Mississippi	11	6	—
Mo.	St Louis University	12	7	—
	University of Missouri	48	11	1
	Washington University	25	11	2
Nebr.	University of Nebraska	13	6	1
N.J.	Fairleigh Dickinson Univ	64	16	—
	Princeton University	49	12	11
	Rutgers The State Univ	131	7	2
	Seton Hall University	13	8	—
N.Y.	CUNY Brooklyn College	151	8	—
	CUNY City College	166	29	—
	Columbia University	88	33	31
	Cornell University	95	5	2
	Fordham University	99	11	1
	New Sch for Soc Research	3	19	4
	New York University	117	51	8
	St Johns University	34	7	—
	SUNY University Buffalo	13	1	2
	Syracuse University	51	7	6
	Union Col & University	22	3	—
	University of Rochester	11	8	—
N.C.	Duke University	26	1	4
	Univ of N C at Chapel Hill	58	7	2
Ohio	Kent State University	15	3	—
	Miami University	23	3	—
	Onio State University	60	9	5
	Ohio University	5	4	—
	University of Cincinnati	41	7	4
	Xavier University	47	20	—
Okla.	Okla St U Agric & App Sci	17	6	—
	University of Oklahoma	9	7	5
Oreg.	University of Oregon	63	6	4
Pa.	Bucknell University	33	4	—
	Carnegie Inst Technology	1	2	3
	Lehigh University	27	5	—
	Pennsyvlania State Univ	37	5	—
	Univ of Pennsylvania	56	26	19
	University of Pittsburgh	27	2	4
P.R.	University of Puerto Rico	24	7	—
R.I.	Brown University	62	2	1
S.C.	Univ of South Carolina	9	4	—
S.Dak.	S D St C Agric & Mech Arts	27	9	—
Tenn.	East Tenn State Univ	23	3	—
	Memphis State University	10	4	—
	University of Tennessee	18	5	—
	Vanderbilt University	23	19	6
Tex.	North Texas State Univ	7	4	—
	St Marys University	31	4	—
	Southern Methodist Univ	13	5	2
	University of Houston	14	—	1
	University of Texas	55	8	7
Utah	Brigham Young University	26	5	—
	University of Utah	36	3	1
Va.	University of Virginia	51	1	4
Wash.	University of Washington	66	7	3
Wis.	University of Wisconsin	247	23	8

[1] Includes 25 first-professional degrees requiring 5 or more years.

Source: National Center for Educational Statistics: *Earned Degrees Conferred 1963–64*. OE–54013–64. Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1966.

CHAPTER 11

Environmental Health

New and highly complex problems resulting from the Nation's population growth, increasing urbanization, and industrial expansion have been reported in many phases of human living. The result is expanding and new challenges to man's health from his environment. The acute awareness of this problem is evident in the recent reports of the Environmental Pollution Panel of the President's Science Advisory Committee[14] and the National Academy of Sciences, National Research Council.[15]

To attack such multidimensional problems as air pollution, food protection, occupational health, radiological health, water supply and pollution, and other health hazards in the general environment requires a wide variety of professional and technical skills. The Surgeon General's Committee on Environmental Health Problems previously had called attention to the urgent and crucial nature of the requirements for diversely trained personnel.[16] Environmental health requires such personnel as biologists, chemists, ecologists, all types of engineers, epidemiologists, hydrologists, limnologists, meteorologists, microbiologists, pathologists, pharmacologists, physicists, physiologists, sanitarians, and toxicologists, as well as administrators, analysts, dentists, information specialists, nurses, physicians, statisticians, and veterinarians.

The absence of a comprehensive roster of highly qualified scientists and technologists primarily concerned with environmental health in the United States was pointed out at the Conference on Educational Needs held at Airlie House in 1962.[17] The sections that follow concentrate on these key members of the environmental health team:

Occupation	*Estimated number of workers, 1965*
Environmental health engineers	8,000 to 9,000
Sanitarians and sanitarian technicians	15,000 or more
Environmental health scientists	2,500 to 3,000
Environmental health specialists	7,000 to 8,000

Manpower statistics for other personnel such as *engineering aides* and *environmental health technicians* are not available.

The minimum educational requirement for professional personnel is a bachelor's degree in engineering or in one of the biological or physical sciences. However, the trend is towards requiring graduate study in one of these fields or in an area of specialization such as air pollution, industrial hygiene, radiation science, or sanitary science.

Graduate programs of training in the field of environmental health are supported by the Public Health Service in 81 institutions. In 1965 stipend support was provided for some 267 engineers, 54 sanitarians, and 470 scientists and specialists (tables 45 and 46).

The Public Health Service also provides short-course training activities at four major locations:

Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio; Occupational Health Research and Training Facility, Cincinnati, Ohio; Division of Radiological Health, Training Branch, Rockville, Maryland; Southwest Laboratory, Las Vegas, Nevada.

[14] Report of the Environmental Pollution Panel, President's Science Advisory Committee: *Restoring the Quality of Our Environment*. Washington. U.S. Government Printing Office, 1965.

[15] National Research Council: *Waste Management and Control*. National Research Council Pub. No. 1400. Washington. National Academy of Sciences, 1966.

[16] *Report of the Committee on Environmental Health Problems to the Surgeon General*. PHS Pub. No. 908. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1962.

[17] National Research Council: *Educational Needs in Environmental Health*. Washington. National Academy of Sciences, 1962.

In addition, short courses are conducted at other PHS field stations as well as regional training institutes held at large universities. During fiscal year 1966, nearly 5,000 persons attended these courses. The number enrolled in each training activity was as follows: 1,946, in air pollution; 1,226, in radiological health; 736, in food protection; 310, in water supply and pollution; 300, in occupational health; 230, in computational analysis; and 140 in solid wastes.

Environmental Health Engineer

The *environmental health engineer* holds an engineering degree and has specialized training and/or experience which enables him to plan and conduct programs for the prevention and control of environmental health hazards. These programs include air pollution, disease vectors, ionizing radiation, milk and food, solid wastes, water pollution, water supply, and other problem areas in man's environment. His job title may depend on his area of activity such as *air pollution engineer*, *industrial hygiene engineer*, or *radiological engineer*, or he may have the more general classification of *public health engineer* or *sanitary engineer*.

An estimated 8,000 to 9,000 environmental health engineers were employed in this country in 1965. The latest survey data are for 1962, at which time 5,500 persons were identified as sanitary engineers.[18] This listing was known to be incomplete, the total supply at that time being estimated as 1,000 to 2,000 higher than the survey respondents.

A survey conducted in 1949-50 resulted in 4,900 respondents, of whom 4,200 were active in the profession. The American Public Health Association issued a mimeographed "Roster of Public Health and Sanitary Engineers" and the Public Health Service analyzed the findings, concluding that there were "about 5,000 practicing sanitary engineers in the United States" in 1950.[19]

In 1956 the National Science Foundation and the Public Health Service cooperated in developing the sanitary engineer's portion of the National Register of Scientific and Technical Personnel.[20] The survey was repeated biennially until 1964 when the Register was expanded to a more representative cross-section of the engineering profession. One out of every six members of 41 major engineering societies with a total membership of over 600,000 was selected in the sample. Tabulations of the 57,800 responses indicate that 3,592 had their greatest competence in the area of environmental health, and 3,222 were employed in that area.[21]

The location of the survey respondents in 1962 and their characteristics are presented in tables 47 and 48. Of the 4,923 respondents, 4,641 were employed full time. Equal numbers—1,600 or so—were employed by State and local governments and by private industry and business. Management or administration was the most important function with nearly one-third of the respondents engaged in that activity. About one-third had a graduate degree, usually a master's.

The number of graduate degrees awarded in sanitary engineering is shown in table 49. The usual undergraduate degree for environmental health engineers is in civil, electrical, chemical, or mechanical engineering. Specialized training at the graduate level is offered by the 59 schools listed in table 50.

Engineers should be licensed under the registration laws of the States where they are employed. Most States have such requirements.

Environmental health engineering is represented by a number of professional organizations, seven of which have banded together

[18] Pennell, M. Y. and Baker, K. I.: Location of manpower in 8 health occupations. *Health Manpower Source Book 19*. PHS Pub. No. 263, Section 19. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1965.

[19] Lyon, W. A. and Miller, A. P.: The composition of the sanitary engineering profession [1950]. *Scientific Manpower Series 2*. National Scientific Register. Office of Education, Federal Security Agency. Washington. U.S. Government Printing Office, 1952.

[20] Butrico, F. A. and Light, I.: *Sanitary Engineering Manpower* [1956-57]. PHS Pub. No. 703. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1959.

[21] Engineers Joint Council: *Engineering Manpower in Profile* [1964]. *A Report from the National Engineers Register*. New York, 1965.

to form the Environmental Engineering Intersociety Board, Inc. (formerly the American Sanitary Engineering Intersociety Board, Inc.). The seven are: Air Pollution Control Association, American Institute of Chemical Engineers, American Public Health Association, American Society for Engineering Education, American Society of Civil Engineers, American Water Works Association, and Water Pollution Control Federation. Based on a review of the education and qualifying experience plus the satisfactory completion of a written examination, certification as a diplomate is awarded by the Board. A roster of diplomates is maintained, known as the American Academy of Environmental Engineers (AAEE). The AAEE Roster of 1965 lists about 1,000 persons in the United States.

Sanitarian and Sanitarian Technician

The *sanitarian* plans and conducts environmental sanitation programs within the many aspects of public health. He determines standards for sanitation and enforces regulations for food processing and serving, collection and disposal of solid wastes, sewage treatment and disposal, plumbing, vector control, recreational areas, hospitals and other institutions, noise, ventilation, air pollution, radiation, and other areas. His responsibilities may include conferring with government and nongovernment groups to interpret and promote environmental health programs.

The professional sanitarian may have the assistance of a *sanitarian technician*, also called a sanitary inspector or sanitarian aide, who investigates public and private establishments to determine compliance with or violation of public sanitation laws and regulations. These individuals take samples of such materials as water, food, and air, and perform the tests (or order testing) to determine contamination.

An estimated 15,000 sanitarians and sanitarian technicians were employed in 1965. Prior estimates by the Public Health Service had indicated about 5,000 in 1950 and 11,000 in 1960.

The first national survey of persons who regarded themselves as sanitarians was conducted in 1962. The State location of the 10,674 sanitarians identified is given in table 51. State and county governments were the major employers. The area of inspection, testing, and control was the primary activity of half of those answering the survey questionnaire. Two-thirds indicated specialization in milk, food, and meat technology (table 52).

The minimum educational qualification for a professional sanitarian is a bachelor's degree with specific training in such fields as sanitary science, dairy science, food technology, entomology, or other physical and biological sciences. Approximately 150 persons graduate with majors in environmental health annually (table 53).

The sanitarian technician is more likely to have had 2 years of college, followed by inservice or field training. Short-course academic training supplements undergraduate college education and provides continued education for large numbers of sanitarians and their aides.

Graduate training through the master's or doctoral level is desirable in environmental health sciences. The M.P.H. degree is recommended, or the M.S. degree in one of the environmental health sciences.

The following 29 States are known to require registration or licensing of sanitarians: Alabama, Arkansas, California, Colorado, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Kentucky, Louisiana, Massachusetts, Michigan, Montana, Nebraska, New Jersey, New Mexico, North Carolina, Oklahoma, Oregon, South Carolina, South Dakota, Tennessee, Texas, Utah, West Virginia, Washington, and Wisconsin.[22]

A model registration act was developed on June 18, 1960 by the Sanitarians Joint Council which is made up of the International Association of Milk, Food and Environmental Sanitarians (4,000 members), and the National Association of Sanitarians

[22] Lewis, R. W.: Analysis of sanitarians registration acts. *J. Environmental Health*. 28(4) : 298-304, Jan.-Feb. 1966.

(5,600 members), along with the American Public Health Association. The minimum qualifications established were as follows: (1) a bachelor's degree with a minimum of 30 semester hours of academic work in the basic natural sciences, (2) employed full time as a sanitarian for not less than 2 years, and (3) having passed an examination given and conducted by the State registration board. Effective January 1, 1966, active membership in the National Association of Sanitarians requires meeting similar standards.

An American Intersociety Board of Certification of Sanitarians which was organized in October 1964 by the Sanitarians Joint Council provides recognition of professional achievement.

Environmental Health Scientist

The *environmental health scientist* is concerned with the study and determination of the effects of environmental factors, singly and in the aggregate, upon the health of man. These scientists with capabilities in the biological, physical, and social sciences have responsibility for the development of new knowledge and methods which can be used in:

1. Analysis and detection of environmental pollutants,
2. Characterization of the pollutant-stressors,
3. Biological effects of the pollutant-stressors,
4. Epidemiological significance, and
5. Factors for the design of surveillance systems and control standards.

Because of the many specialities and professional skills which are needed to solve a problem, academic institutions do not provide a broad training in environmental science, but rather provide graduate training in one or more of the specialties. Many of these scientists in problem-oriented or categorical programs engage in research relevant to the program missions.

Environmental Health Specialist

Environmental health specialists are concerned with the conduct of control programs in air pollution, food protection, occupational health, radiological health, solid wastes, vector control, and other special areas of environmental health. In general, this group of personnel are employed in Federal, State, and local government agencies and in control positions in industry.

With the exception of the categorical programs of industrial hygiene and radiological health, valid and meaningful manpower statistics are not available.

Industrial hygienists, including *industrial-hygiene engineers*, conduct health programs in industrial plants or similar organizations, to eliminate or control occupational health hazards and diseases. They are concerned with four categories of stresses: (1) chemical stresses such as dust or gas, (2) physical stresses such as radiation or noise, (3) biological factors including insects and fungi, and (4) ergonomic items such as monotony and work pressure.

The industrial hygienists may make direct measurements of the industrial environment, evaluate the degree of exposure to the contaminant or stress, and recommend or design control measures. As a *safety engineer* he may work with industrial physicians to institute nonengineering measures for control and correction of hazards. The occupational health programs in large organizations also may be staffed with chemists, toxicologists, physicists, nurses, and laboratory personnel. Data are available for the staffing of State and local government units (table 54).

Nearly 2,300 industrial hygienists were employed in the United States in 1965 (tables 55 and 56). This represents a four-fold increase since 1950. Most of them work in an industrial setting, but increasing numbers are being employed by transportation companies, public utilities, mining operations, insurance companies, universities, and health and labor departments.

The schools that offer specific graduate training in industrial hygiene are listed in table 57. A master's degree in chemistry,

engineering, or public health is desirable for advancement in the field.

Radiation protection personnel at the professional level include *health physicists, radiological physicists, radiochemists, radiobiologists,* and others with special training in the health aspects of radiation. The radiation exposure problems with which they are concerned are associated with the use of X-ray machines, radioactive materials, nuclear reactors, and particle accelerators, as well as environmental radioactive contamination. Their work is conducted principally in industrial, medical, research, or educational institutions that use radiation sources and in health agencies that have responsibility for protection of the public health. *Health physics technicians* trained in radiation monitoring or other supportive services constitute an important radiological protection role.

Approximately 4,600 radiation protection personnel were employed in 1965 (table 58). They are divided almost equally between professional and technical workers.

Several professional associations and societies serving radiation protection objectives provide opportunity for membership, such as the Health Physics Society, the Radiological Health Section of the American Public Health Association, and the American College of Radiology. Closely associated with these organizations, the American Board of Health Physics has awarded the Health Physicist Certificate to a total of some 400 persons. The American College of Radiology has awarded the Radiological Physicist Certificate to about 200.

The schools that offer specific graduate training in radiological health are listed in table 46. Identified on the table are eight programs for technicians. The technicians require training in the characteristics of radiation, methods of calculating exposure, and the use of radiation detection instruments. The training may be on the job or through formal apprenticeship for those who do not attend technical institutes or junior colleges that offer a radiological technology curriculum.

Table 45. STIPENDS AWARDED UNDER PUBLIC HEALTH SERVICE TRAINEESHIP PROGRAM FOR GRADUATE STUDY IN ENVIRONMENTAL HEALTH: 1964 AND 1965

Type of program	Environmental health engineers		Sanitarians		Environmental health scientists and specialists	
	1964	1965	1964	1965	1964	1965
All programs	304	267	45	54	356	470
Air pollution	55	73	—	—	60	80
Radiation protection	40	43	—	—	160	164
Water supply [1]	----	----	----	----	----	----
General environmental health [2]	146	51	45	54	44	56
Environmental health sciences research	63	100	—	—	92	170

[1] Data are not available.

[2] Includes occupational health, food protection, solid wastes, vector control, and other areas.

Source: U.S. Department of Health, Education, and Welfare, Public Health Service, Bureau of State Services (Environmental Health), Office of Resource Development, Research and Training Grants Branch.

Table 46. LOCATION OF SCHOOLS OFFERING GRADUATE TRAINING PROGRAMS IN ENVIRONMENTAL HEALTH, SUPPORTED BY THE U.S. PUBLIC HEALTH SERVICE: JUNE 30, 1966

Location	School	Type of program				
		Air pollution	Radiation protection	Water supply	General environmental health	Environmental health sciences research
	Total, 81 schools	18	[1] 43	42	28	37
Ala.	Auburn University, Auburn		x			
Ark.	University of Arkansas, Little Rock		x	x		
Calif.	California Institute of Technology, Pasadena				x	x
	San Jose State College, San Jose			x		
	Stanford University, Palo Alto			x	x	x
	University of California, Berkeley		x		x	x
	University of California, Davis			x		x
	University of California, Los Angeles		x			x
	University of California, Riverside					x
	University of Southern California, Los Angeles	x				x
Colo.	Colorado State University, Fort Collins		x			
Conn.	Yale University, New Haven		x			
Fla.	Central Florida Junior College, Ocala		xx			
	University of Florida, Gainesville	x	x		x	x
	University of Miami, Coral Gables		x			x
Ga.	Emory University, Atlanta		x			
	Georgia Institute of Technology, Atlanta		x	x		
Hawaii	University of Hawaii, Honolulu			x		
Ill.	Illinois Institute of Technology, Chicago					x
	Northwestern University, Evanston		x		x	x
	University of Illinois, Urbana	x	x	x		x
Ind.	Purdue University, Lafayette		x	x	x	x
	University of Notre Dame, Notre Dame				x	
Iowa	Iowa State University, Ames		x	x		
	University of Iowa, Iowa City				x	
Kans.	Kansas State University, Manhattan				x	
	University of Kansas, Lawrence			x		
Ky.	University of Kentucky, Lexington			x		
La.	Tulane University of Louisiana, New Orleans	x			x	x
Maine	University of Maine, Orono			x		
Md.	Johns Hopkins University, Baltimore		x	x		x
	Montgomery Junior College, Takoma Park		xx			
Mass.	Harvard University, Cambridge	x	x		x	x
	Lowell Technological Institute, Lowell		xx			
	Massachusetts Institute of Technology, Cambridge					x
	Tufts University, Medford			x		
	University of Massachusetts, Amherst			x		
Mich.	Michigan State University, East Lansing		x			x
	University of Michigan, Ann Arbor	x	x	x	x	x
	Wayne State University, Detroit		x		x	
Minn.	University of Minnesota, Minneapolis	x	x	x		x
Mo.	University of Missouri, Columbia				x	x
	Washington University, St. Louis				x	x
Mont.	Montana State College, Boxeman			x		
N.J.	Rutgers, The State University, New Brunswick		x	x	x	x
N.Mex.	New Mexico State University, University Park			x	x	

Table 46. LOCATION OF SCHOOLS OFFERING GRADUATE TRAINING PROGRAMS IN ENVIRONMENTAL HEALTH, SUPPORTED BY THE U.S. PUBLIC HEALTH SERVICE: JUNE 30, 1966—Continued

Location	School	Type of program				
		Air pollution	Radiation protection	Water supply	General environmental health	Environmental health sciences research
N.Y.	Columbia University, New York		x			
	Cornell University, Ithaca			x	x	x
	Hudson Valley Community College, Troy		xx			
	Manhattan College, New York		xx	x		
	New York University, New York	x	x	x		x
	Rensselaer Polytechnic Institute, Troy		x			
	Syracuse University, Syracuse				x	
N.C.	North Carolina State University, Raleigh			x		x
	University of North Carolina, Chapel Hill	x	x	x		x
N.Dak.	North Dakota State University, Fargo		x			
Ohio	Ohio State University, Columbus			x		x
	University of Cincinnati, Cincinnati	x	x	x	x	x
Okla.	Oklahoma State University, Oklahoma City		xx	x		
	University of Oklahoma, Norman		x, xx	x	x	x
	University of Oklahoma, Oklahoma City				x	x
Oreg.	Oregon State University, Corvallis	x	x	x	x	x
Pa.	Drexel Institute of Technology, Philadelphia	x			x	
	Murrell Dobbins Technical High School, Philadelphia		xx			
	Pennsylvania State University, University Park	x			x	
	Temple University, Philadelphia		x			
	University of Pennsylvania, Philadelphia		x			
	University of Pittsburgh, Pittsburgh		x	x		
R.I.	University of Rhode Island, Kingston					x
S.C.	Clemson University, Clemson			x		
S.Dak.	South Dakota State University, Brookings			x		
Tenn.	University of Tennessee, Knoxville		x			
	Vanderbilt University, Nashville	x		x		
Tex.	Rice University, Houston			x		
	Texas A & M University, College Station	x		x		
	University of Texas, Austin		x	x	x	x
Utah	University of Utah, Salt Lake City	x		x		
Va.	Virginia Polytechnic Institute, Blacksburg			x		x
Wash.	University of Washington, Seattle	x	x		x	x
	Washington State University, Pullman		x	x	x	
W.Va.	West Virginia University, Morgantown	x		x		
Wis.	University of Wisconsin, Madison			x		x

[1] Includes 8 programs for technicians, indicated by xx.

Source: U.S. Department of Health, Education, and Welfare, Public Health Service, Bureau of State Services (Environmental Health), Office of Resource Development, Research and Training Grants Branch.

Table 47. LOCATION OF SANITARY ENGINEERS: 1960 AND 1962

Location	National Science Foundation 1960	National Science Foundation 1962	Public Health Service 1962
All locations	5,226	[1] 4,923	[1] 5,507
United States	5,083	4,838	5,507
Alabama	51	51	61
Alaska	17	15	12
Arizona	42	50	44
Arkansas	32	32	30
California	515	511	485
Colorado	53	54	69
Connecticut	71	74	80
Delaware	18	21	17
District of Columbia	148	97	181
Florida	148	148	172
Georgia	110	94	99
Hawaii	33	39	25
Idaho	14	14	16
Illinois	332	315	336
Indiana	103	97	102
Iowa	76	70	89
Kansas	57	43	88
Kentucky	42	47	52
Louisiana	46	37	47
Maine	23	26	25
Maryland	126	110	154
Massachusetts	188	167	210
Michigan	191	178	218
Minnesota	90	82	95
Mississippi	18	15	30
Missouri	161	149	151
Montana	11	15	15
Nebraska	37	36	37
Nevada	9	11	28
New Hampshire	14	11	14
New Jersey	145	145	209
New Mexico	25	25	35
New York	519	503	504
North Carolina	76	83	103
North Dakota	21	15	18
Ohio	311	306	367
Oklahoma	69	53	63
Oregon	67	83	96
Pennsylvania	312	290	292
Rhode Island	17	18	22
South Carolina	35	32	33
South Dakota	19	22	25
Tennessee	63	57	70
Texas	241	211	248
Utah	19	19	27
Vermont	6	9	10
Virginia	109	106	144
Washington	108	112	110
West Virginia	30	29	30
Wisconsin	108	103	110
Wyoming	7	8	9
Foreign	110	85	----------
No report	33	----------	----------

[1] Data based on reports to the National Register of Scientific and Technical Personnel, 1962, as tabulated by NSF and PHS. The PHS figure includes late returns to a postcard followup. PHS estimates that the total number of sanitary engineers employed in this country in 1962 was about 8,000.

Sources: National Science Foundation: Summary characteristics of scientists reporting to the national register of scientific and technical personnel, 1960. NSF 62–11. *Scientific Manpower Bulletin No. 17.* Apr. 1962. Table 4.
National Science Foundation: *American Science Manpower, 1962.* NSF 64–16. Washington. U.S. Government Printing Office, 1964. Table A–14.
Pennell, M. Y. and Baker, K. I.: Location of manpower in 8 health occupations. *Health Manpower Source Book 19.* PHS Pub. No. 263, Section 19. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1965. Table 1.

Table 48. EMPLOYMENT STATUS, TYPE OF EMPLOYER, WORK ACTIVITY, AND HIGHEST ACADEMIC DEGREE OF SANITARY ENGINEER SURVEY RESPONDENTS: 1962

Item	Number	Percent
Employment status		
Total	4,923	100.0
Full-time employed	4,641	94.2
Part-time employed	43	0.9
Students	107	2.2
Employed outside profession	53	1.1
Unemployed	30	0.6
No report	49	1.0
Type of employer		
Total	4,923	100.0
Educational institution	362	7.4
Military and Public Health Service	366	7.4
Other Federal Government	296	6.0
State and local government	1,644	33.4
Nonprofit organizations	36	0.7
Industry and business	1,622	32.9
Self-employed	431	8.8
Other	77	1.6
No report	89	1.8
Work activity		
Total	4,923	100.0
Research, development, or design	812	16.5
Management or administration	1,421	28.9
Teaching	247	5.0
Production and inspection	737	15.0
Other	1,640	33.3
No report	66	1.3
Highest academic degree		
Total	4,923	100.0
Less than bachelor's	175	3.6
Bachelor's	2,761	56.1
Master's	1,660	33.7
Professional medical	2	0.0
Doctorate	227	4.6
No report	98	2.0

Source: National Science Foundation: *American Science Manpower, 1962.* NSF 64-16. Washington. U.S. Government Printing Office, 1964.

Table 49. EARNED GRADUATE DEGREES CONFERRED IN SANITARY ENGINEERING: SELECTED YEARS, 1950-51 THROUGH 1964-65

Academic year	Master's	Doctor's
1964-65 [1]	133	13
1963-64	126	22
1962-63	95	10
1961-62	79	13
1960-61	74	12
1959-60	85	6
1954-55	75	6
1950-51	69	4

[1] In 1964-65 master's degrees were reported by 24 schools, and the doctor's degrees by 5 schools.

Source: U.S. Department of Health, Education, and Welfare, Office of Education, National Center for Educational Statistics, Division of Data Processing Services, Research Services Branch.

Table 50. LOCATION OF 59 SCHOOLS OFFERING GRADUATE TRAINING IN SANITARY ENGINEERING: 1966

Location	School
Arizona	University of Arizona, Tucson
Arkansas	University of Arkansas, Fayetteville
California	California Institute of Technology, Pasadena
	San Jose State College, San Jose
	Stanford University, Palo Alto
	University of California, Berkeley
	University of California, Davis
	University of Southern California, Los Angeles
Colorado	Colorado State University, Fort Collins
	University of Colorado, Boulder
Connecticut	University of Connecticut, Storrs
Florida	University of Florida, Gainesville
Georgia	Georgia Institute of Technology, Atlanta
Illinois	Illinois Institute of Technology, Chicago
	Northwestern University, Evanston
	University of Illinois, Urbana
Indiana	Purdue University, Lafayette
	University of Notre Dame, Notre Dame
Iowa	Iowa State University, Ames
	University of Iowa, Iowa City
Kansas	University of Kansas, Lawrence
Kentucky	University of Kentucky, Lexington
Maine	University of Maine, Orono
Maryland	Johns Hopkins University, Baltimore
Massachusetts	Harvard University, Cambridge
	Tufts University, Medford
	University of Massachusetts, Amherst
Michigan	University of Michigan, Ann Arbor
Minnesota	University of Minnesota, Minneapolis
Mississippi	Mississippi State University, State College
Missouri	University of Missouri, Rolla
	Washington University, St. Louis
New Jersey	Rutgers, The State University, New Brunswick
New Mexico	New Mexico State University, University Park
New York	Cornell University, Ithaca
	Manhattan College, New York
	New York University, New York
	Rensselaer Polytechnic Institute, Troy
	Syracuse University, Syracuse
North Carolina	North Carolina State of the University of North Carolina, Raleigh
	University of North Carolina, Chapel Hill
Ohio	Ohio State University, Columbus
	University of Akron, Akron
	University of Cincinnati, Cincinnati
Oklahoma	Oklahoma State University, Stillwater
	University of Oklahoma, Norman
Oregon	Oregon State University, Corvallis
Pennsylvania	Drexel Institute of Technology, Philadelphia
	Pennsylvania State University, University Park
	University of Pittsburgh, Pittsburgh
South Carolina	Clemson University, Clemson
Tennessee	Vanderbilt University, Nashville
Texas	Rice University, Houston
	University of Houston, Houston
	University of Texas, Austin
Washington	University of Washington, Seattle
	Washington State University, Pullman
West Virginia	West Virginia University, Morgantown
Wisconsin	University of Wisconsin, Madison

Source: American Association of Professional Sanitary Engineers. 1966 Registry.

Table 51. LOCATION OF SANITARIANS: 1962

Location	Number	Location	Number
United States	10,674		
Alabama	204	Montana	43
Alaska	28	Nebraska	73
Arizona	88	Nevada	26
Arkansas	80	New Hampshire	12
California	1,135	New Jersey	185
Colorado	182	New Mexico	69
Connecticut	216	New York	655
Delaware	24	North Carolina	262
District of Columbia	69	North Dakota	34
Florida	546	Ohio	572
Georgia	248	Oklahoma	188
Hawaii	107	Oregon	196
Idaho	61	Pennsylvania	564
Illinois	312	Rhode Island	63
Indiana	332	South Carolina	148
Iowa	127	South Dakota	33
Kansas	84	Tennessee	184
Kentucky	244	Texas	452
Louisiana	280	Utah	97
Maine	67	Vermont	21
Maryland	218	Virginia	333
Massachusetts	236	Washington	298
Michigan	249	West Virginia	83
Minnesota	177	Wisconsin	384
Mississippi	116	Wyoming	47
Missouri	222		

Source: Pennell, M. Y., Light, I., and Taylor, D. W.: Sanitarians. *Health Manpower Source Book 16.* PHS Pub. No. 263, Section 16. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1963.

Table 52. PRINCIPAL EMPLOYER, WORK ACTIVITY, AND SPECIALIZATION OF SANITARIAN SURVEY RESPONDENTS: 1962

Employer, primary activity, and specialty	All sanitarians	College graduates	Non-graduates
Number of respondents [1]	7,263	4,583	2,680
Percent by employer	100.0	100.0	100.0
Government	83.7	81.5	87.4
Federal	5.5	5.4	5.7
State	32.2	32.6	31.6
County	29.2	29.4	28.8
City	16.8	14.1	21.3
Nongovernment	16.3	18.5	12.6
Business	11.1	12.0	9.5
Education	2.3	3.6	0.1
Other	2.9	2.9	3.0
Percent by activity	100.0	100.0	100.0
Inspection, testing, control	50.3	45.6	58.5
Management, administration	22.6	25.7	17.1
General, production, sales, marketing, other	17.4	15.9	20.1
Consulting, research, teaching, writing	9.7	12.8	4.3
Percent by specialty	100.0	100.0	100.0
Milk	33.1	33.4	32.5
Food, meat	35.4	32.9	39.6
Water, refuse, wastes, vectors	16.2	17.4	14.5
Air pollution, radiation, and occupational health	2.8	3.2	1.9
Recreation, housing, other areas	12.5	13.1	11.5

[1] Completed questionnaires were returned by 7,902 sanitarians. These included 7,263 persons employed full time in environmental health activities.

Source: Pennell, M. Y., Light, I., and Taylor, D. W.: Sanitarians. *Health Manpower Source Book 16.* PHS Pub. No. 263, Section 16. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1963. Pages 11–18.

Table 53. LOCATION OF SCHOOLS FROM WHICH 20 OR MORE OF THE 1962 SANITARIAN SURVEY RESPONDENTS WERE GRADUATED WITH A BACHELOR'S DEGREE

Location	School	Sanitarians
	Total schools	4,583
Ala.	Auburn University, Auburn	38
Calif.	California State Polytechnic College, San Luis Obispo	23
	Fresno State College, Fresno	22
	California State College at Los Angeles, Los Angeles	21
	San Jose State College, San Jose [1]	33
	University of California [1]	236
Colo.	Colorado State University, Fort Collins	32
	University of Denver, Denver	52
Conn.	University of Connecticut, Storrs	52
Fla.	University of Florida, Gainesville [1]	62
	University of Miami, Coral Gables	28
Ga.	University of Georgia, Athens	69
Hawaii	University of Hawaii, Honolulu	37
Idaho	University of Idaho, Moscow	26
Ill.	University of Illinois, Urbana	63
Ind.	Indiana University, Bloomington [1]	41
	Purdue University, Lafayette	57
Iowa	Iowa State University, Ames	27
	University of Iowa, Iowa City	52
Kans.	Kansas State University, Manhattan	21
Ky.	University of Kentucky, Lexington	32
	Western Kentucky State College, Bowling Green	25
La.	Louisiana State University, Baton Rouge	33
	University of Southwestern Louisiana, Lafayette	26
Md.	University of Maryland, College Park	59
Mass.	University of Massachusetts, Amherst [1]	73
Mich.	Michigan State University, East Lansing	59
	University of Michigan, Ann Arbor	24
Minn.	University of Minnesota, Minneapolis	63
Miss.	University of Southern Mississippi, Hattiesburg	20
	Mississippi State University, State College	28
Mo.	University of Missouri, Columbia [1]	51
Nebr.	University of Nebraska, Lincoln	40
N.J.	Rutgers, The State University, New Brunswick	20
N.Y.	Cornell University, Ithaca	70
N.C.	University of North Carolina, Chapel Hill	25
Ohio	Ohio State University, Columbus	62
Okla.	Oklahoma State University, Stillwater	56
Oreg.	Oregon State University, Corvallis	45
Pa.	Pennsylvania State University, University Park	92
	University of Pittsburgh, Pittsburgh	38
S.C.	Clemson University, Clemson	40
Tenn.	East Tennessee State College, Johnson City [1]	21
	University of Tennessee, Knoxville	29
Tex.	Texas A & M, College Station	27
	Texas Technological College, Lubbock	21
	University of Texas, Austin	22
Utah	Utah State University, Logan [1]	44
Va.	University of Virginia, Charlottesville	20
	Virginia Polytechnic Institute, Blacksburg	39
Wash.	University of Washington, Seattle [1]	56
	Washington State University, Pullman [1]	115
W.Va.	West Virginia University, Morgantown	31
Wis.	University of Wisconsin, Madison	101
	All other schools	2,084

[1] Undergraduate programs in environmental health were offered in 1965–66 in these 10 schools, and also in 3 additional:
Florida State University, Tallahassee, Florida
Ferris State College, Big Rapids, Michigan
University of Oklahoma, Norman, Oklahoma

Source: Pennell, M. Y., Light, I., and Taylor, D. W.: Sanitarians. *Health Manpower Source Book 16*. PHS Pub. No. 263, Section 16. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1963 Table 13.

Table 54. OCCUPATIONAL HEALTH PERSONNEL EMPLOYED BY STATES AND LOCAL GOVERNMENTS: JANUARY 1966

Occupation	Total personnel [1]	State agencies		Local health departments
		Health	Labor	
All occupations	694	431	98	165
Industrial hygienists and engineers	285	161	53	71
Physicians	57	41	8	8
Nurses	54	41	2	11
Chemists, technicians	126	89	23	14
Sanitarians	50	3	—	47
Radiological health staff [2]	83	65	11	7
Air pollution staff [2]	18	14	—	4
All other	21	17	1	3

[1] Full- and part-time employees in 90 occupational health units—42 State (including D.C. and Puerto Rico) and 40 local. Includes radiation, air pollution, and employee health services personnel when part of, or associated with, formal occupational health programs.

[2] Includes radiation protectionists, air pollution specialists, and others listed separately under these segments of programs.

Source: Division of Occupational Health: *Directory of Governmental Occupational Health Personnel: January 1966.* Public Health Service, U.S. Department of Health, Education, and Welfare. 26th annual issue. Analysis based on Directory listing of personnel. Data for United States and Puerto Rico.

Table 55. EMPLOYED INDUSTRIAL HYGIENISTS AND ASSOCIATION MEMBERSHIPS: SELECTED YEARS, 1950 THROUGH 1965

Year	Estimated workers [1]	Association memberships	
		American Industrial Hygiene Association	American Conference of Government Industrial Hygienists
1965	2,300	1,416	[2] 820
1964	----------	1,362	750
1963	2,000	1,324	655
1962	----------	1,260	595
1961	----------	1,196	----------
1960	1,300	1,165	511
1955	----------	946	305
1950	600	621	286

[1] Public Health Service estimates based on members of the 2 associations and nonmembers active in the profession.

[2] The 756 members located in the United States and Puerto Rico were employed by these agencies: Federal, 300; State governments, 288; local governments, 87; universities, 67; other, 14.

Source: U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Occupational Health.

Table 56. LOCATION OF MEMBERS OF THE AMERICAN INDUSTRIAL HYGIENE ASSOCIATION AND THE AMERICAN CONFERENCE ON GOVERNMENTAL INDUSTRIAL HYGIENISTS: 1965

Location	AIHA	ACGIH	Location	AIHA	ACGIH
All locations	1,416	820			
United States	1,330	741			
Alabama	14	13	Nevada	7	4
Alaska	—	1	New Hampshire	3	8
Arizona	1	2	New Jersey	67	18
Arkansas	1	—	New Mexico	41	7
California	149	105	New York	133	44
Colorado	21	13	North Carolina	5	13
Connecticut	30	6	North Dakota	1	—
Delaware	21	—	Ohio	113	75
District of Columbia	28	52	Oklahoma	5	3
Florida	26	17	Oregon	9	4
Georgia	10	5	Pennsylvania	117	64
Hawaii	7	4	Rhode Island	3	3
Idaho	5	1	South Carolina	5	4
Illinois	61	11	South Dakota	—	1
Indiana	20	10	Tennessee	23	8
Iowa	3	4	Texas	44	34
Kansas	4	8	Utah	16	12
Kentucky	7	10	Vermont	1	3
Louisiana	8	5	Virginia	25	11
Maine	2	2	Washington	29	13
Maryland	56	49	West Virginia	10	3
Massachusetts	60	23	Wisconsin	8	10
Michigan	99	37	Wyoming	—	1
Minnesota	12	9			
Mississippi	1	2	Puerto Rico	3	15
Missouri	15	5	Canal Zone	1	—
Montana	1	3	Foreign areas	82	64
Nebraska	3	1			

Sources: American Industrial Hygiene Association: *Membership Book, 1965–66.* Page 31.
American Conference of Governmental Industrial Hygienists. *Membership Book, 1965–66.* Page 63.

Table 57. LOCATION AND OWNERSHIP OF SCHOOLS THAT OFFER GRADUATE PROGRAMS IN INDUSTRIAL HYGIENE: 1964–65

Location	School	Ownership
	Total, 19 schools [1]	
Ala.	University of Alabama, University	Public
Calif.	University of California, Berkeley	Public
	University of California, Los Angeles	Public
Conn.	Yale University, New Haven	Private
Iowa	University of Iowa, Iowa City	Public
Md.	Johns Hopkins University, Baltimore	Private
Mass.	Harvard University, Boston	Private
Mich.	University of Michigan, Ann Arbor	Public
	Wayne State University, Detroit	Public
N.Y.	City University of New York, New York	Public
	University of Rochester, Rochester	Private
N.C.	University of North Carolina, Chapel Hill	Public
Ohio	Ohio State University, Columbus	Public
	University of Cincinnati, Cincinnati	Public
Okla.	University of Oklahoma, Norman	Public
Pa.	Drexel Institute of Technology, Philadelphia	Private
	University of Pittsburgh, Pittsburgh	Private
Tex.	University of Texas, Austin	Public
Wash.	University of Washington, Seattle	Public

[1] Data not available on graduates, but the total probably was 75 to 100.
Source: U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Occupational Health.

Table 58. OCCUPATIONAL LEVEL AND INDUSTRY OF RADIATION PROTECTION PERSONNEL: 1960 AND 1965

Occupational level and industry	1960	1965
Total professionals	1,100	2,200
Nuclear energy industry	600	900
Federal health agency	200	400
State and local health agencies	100	400
Hospitals and universities	200	500
Total technicians	1,200	2,400
Nuclear energy industry	1,100	2,000
Health agencies and institutions	100	400

Sources: U.S. Atomic Energy Commission. 1960–64 occupational surveys, as reported in the Bureau of Labor Statistics' Occupational Outlook Handbook.
Estimates based on the personnel records of the Public Health Service and the following sources:
Bureau of Labor Statistics: *Occupational Outlook Handbook, 1966–67*. Bulletin No. 1450. U.S. Department of Labor. Washington. U.S. Government Printing Office. Also prior biennial editions.
Division of Radiological Health: *Report of State and Local Radiological Health Programs, Fiscal Year 1965*. Public Health Service, U.S. Department of Health, Education, and Welfare. To be published. Also prior reports.

CHAPTER 12

Food and Drug Protective Services

Government and industry share in the efforts to protect health and lives through safeguarding the quality of food and drugs. Protective services are an important part of the work of several of the health manpower categories. Food technologists, government food and drug inspectors, and government food and drug analysts are discussed in this chapter, but the reader should also refer to chapter 23 on pharmacists, chapter 32 on veterinarians, and chapter 11 for sanitarians and other environmental health personnel.

Food Technologist

The *food technologist* applies science and engineering to the production, processing, packaging, distribution, preparation, and utilization of foods. His scientific knowledge and special skills are employed to solve technological problems connected with the development of new products, processes, or equipment; selection of raw materials; fundamental changes in the composition or physical condition of food for industrial processing, or the nutritional value and suitability of such foods for human consumption.

The Institute of Food Technologists (IFT) estimates that approximately 15,000 individuals were employed as food technologists in 1965. While no specific statistics on employment are available, the number has probably doubled in the past 10 years.

The majority of food technologists are employed by private industry. However, a survey of the nearly 10,000 IFT members shows that 16 percent are involved in research and teaching in educational and private research institutions, 7 percent are employed by government, and 7 percent offer consulting services to the food industry.

In terms of work activity, the greatest numbers are engaged in product development. Many others are involved in quality control, basic research, engineering, production, and packaging.

Almost one-fourth of the members of the Institute of Food Technologists have a doctorate. About one-fifth have a master's degree, the balance holding a bachelor's degree.

A bachelor's degree in food science or in a related science such as chemistry, biochemistry, biology, or bacteriology, or in engineering is the minimum educational requirement for entrance into the field. Earned degrees conferred in 1964-65 include 208 bachelor's, 103 master's, and 34 doctor's (table 59). Data for 1964-65 are not yet available for the individual schools, hence table 60 shows the earned degrees conferred in 1963-64.

Government Food and Drug Inspector and Analyst

Both the Federal Government and the States have food and drug laws which are enforced by two units of the Federal Government and by State and local health agencies. The Food and Drug Administration of the U.S. Department of Health, Education, and Welfare has broad responsibilities for food and drug protective services and employs inspectors and analysts who are concerned with the purity and safety of food, drugs, and cosmetics and with the effectiveness of drugs.

In 1955, the Food and Drug Administration had fewer than 900 total employees; in 1960, over 1,500; and by 1966, nearly 5,000. The Meat Inspection Branch of the U.S. Department of Agriculture which regulates all meat food products in interstate commerce also employs food inspectors, most of whom are veterinarians (see ch. 32). The State and local health agencies handle the inspection in various ways.

The *FDA food and drug inspector* tries to provide protection before the product reaches the consumer by checking from raw material to delivery, including the conditions under which it is manufactured and the package labeling. The inspector is usually a college graduate with a science major. In 1965, FDA employed 788 food and drug inspectors.

The *FDA food and drug analyst* provides more intensive checking of the inspector's samples for purity and whether they comply with their labels. These experts engage in research work on the safety and effectiveness of products and on the development of methods for analysis. In 1965, FDA employed 667 food and drug analysts.

The minimum educational requirement for a laboratory analyst is 4 years of college, with a major in chemistry, bacteriology, pharmacology or a related science. A master's or a doctor's degree in the field of specialization is required for the research analyst top positions.

Table 59. EARNED DEGREES CONFERRED IN FOOD SCIENCE AND TECHNOLOGY: 1960–61 THROUGH 1964–65

Academic year	Bachelor's	Master's	Doctor's
1964–65	208	103	34
1963–64	109	84	37
1962–63	121	58	30
1961–62	103	49	19
1960–61	77	45	17

Source: National Center for Educational Statistics: *Summary Report on Bachelor's and Higher Degrees Conferred During the Year 1964–65.* Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office. To be published. Also prior annual issues.

Table 60. LOCATION OF SCHOOLS THAT OFFER TRAINING IN FOOD SCIENCE AND TECHNOLOGY, 1966; AND NUMBERS OF GRADUATES, 1963–64

Location	School [1]	Bachelor's degree	Master's degree	Doctor's degree
	Total	109	84	37
Ark.	University of Arkansas, Fayetteville	4	—	—
Calif.	California State Polytechnic College, San Luis Obispo [2]	2	1	—
	University of California, Berkeley	12	26	—
	University of California, Davis			
Conn.	University of Connecticut, Storrs	2	—	—
Fla.	University of Florida, Gainesville	19	9	7
Ga.	University of Georgia, Athens			
Hawaii	University of Hawaii, Honolulu	6	5	8
Ill.	University of Illinois, Urbana	2	—	—
Ind.	Purdue University, Lafayette	—	—	1
Iowa	Iowa State University, Ames			
Kans.	Kansas State University, Manhattan	—	1	—
La.	Louisiana State University, Baton Rouge	2	—	—
	Southwestern Louisiana College, Hammond [2]			
Md.	University of Maryland, College Park			
Mass.	Massachusetts Institute of Technology, Cambridge	8	6	3
	University of Massachusetts, Amherst	9	15	7
Mich.	Michigan State University, East Lansing	2	—	—
Mo.	University of Missouri, Columbia			
Nebr.	University of Nebraska, Lincoln	2	3	4
N.J.	Rutgers, The State University, New Brunswick	5	3	—
N.Y.	Cornell University, Ithaca			
N.C.	North Carolina State of the University of North Carolina, Raleigh	3	—	—
Ohio	Ohio State University, Columbus	6	—	—
Okla.	Oklahoma State University, Stillwater [2]	—	—	2
Oreg.	Oregon State University, Corvallis	11	9	3
Pa.	Drexel Institute of Technology, Philadelphia			
	Pennsylvania State University, University Park			
	Delaware Valley College, Doylestown [2]	12	—	—
S.C.	Clemson College, Clemson			
Tenn.	University of Tennessee, Knoxville	—	2	—
Tex.	Texas Agricultural & Mechanical College, College Station	2	—	—
Utah	Utah State University, Logan	—	2	1
Va.	Virginia Polytechnic Institute, Blacksburg			
Wash.	University of Washington, Seattle			
	Washington State University, Pullman	—	2	1
Wis.	University of Wisconsin, Madison			

[1] All public institutions except Cornell University and Delaware Valley College.
[2] Not on IFT list for 1966.
Sources: Institute of Food Technologists for list of institutions; and U.S. National Center for Educational Statistics for earned degrees.

CHAPTER 13

Health and Vital Statistics

The growing importance of health and vital statistics is a direct result of the increasing complexity of the activities within the health field. Statistical data are frequently used in administrative planning and evaluation, as well as in research and interpretation of the health needs of the community to the public. The scope of the field includes the collection, processing, analysis, and publication of health statistics including medical and vital statistics. (See also the chapters on administration of health services in health departments, automatic data processing, and medical records.)

Health statisticians — sometimes called biostatisticians — are primarily concerned with the use of statistical theory, techniques, and methods to determine useful measurements or meaningful relationships of quantified information on a particular subject relating to health or disease. They help in identifying and measuring health problems as a basis for evaluating progress and planning, and also in the scientific study of the causes, processes, and cures of disease. Another major function of the health statistician is to devise special studies and analyses for use in planning and evaluating health services.

About 1,000 to 2,000 statisticians are currently active in the health field. The 570 members of the Statistics Section of the American Public Health Association, Inc. probably represent one-fourth to one-third of the total workers. The majority are employed by Federal, State, or local governments (tables 5 and 6, Introduction). Others work in voluntary health agencies, industrial organizations, hospitals, and schools.

A bachelor's degree with courses in mathematics, physical sciences, biological sciences, and social sciences is the usual requirement for beginning positions as health statisticians. Advanced training in statistics and public health leading to a master's or doctor's degree is desirable. In 1964-65, U.S. schools of public health awarded graduate degrees to 54 statisticians, 34 of whom were sponsored by the U.S. Public Health Service (table 4, Introduction). The numbers of earned degrees in statistics are presented in tables 61 and 62.

The less complex and routine statistical functions are performed by *statistical clerks* who usually have a background of high school mathematics. They may abstract material from technical reports and prepare code sheets from which data can be summarized or tabulated. Other duties are to help analyze statistical data, compute and verify statistical tables, draft graphic presentations, and maintain files of records and worksheets. Estimates of the numbers of statistical clerks currently employed in the health field are not available.

Vital record registrars may be public health statisticians or persons with educational backgrounds in business administration, law, science, or arts. Registrars direct and coordinate the registration of births and deaths, and usually marriages and divorces, in large registration systems of States and in some large cities and counties. They recommend changes in record forms, legislation, and regulations, and make final decisions on registration problems and the issuance of certifications. Probably fewer than 300 persons qualify through education and experience for the professional character of the position. Several thousands of persons have subordinate positions in the field of vital records (tables 5 and 6, Introduction).

Health demographers have interests similar to those of health statisticians and vital record registrars, but with greater concentration on the measurement of the elements of population growth such as factors associated with family formation and dissolution, fertility, and death and the relation of these factors to economic development. Demographers are represented in the health field in small numbers.

Table 61. EARNED DEGREES CONFERRED IN MATHEMATICS AND STATISTICS: 1960–61 THROUGH 1964–65

Academic year	Mathematics				Statistics			
	Bachelor's	First professional requiring 5 or more years	Master's	Doctor's	Bachelor's	First professional requiring 5 or more years	Master's	Doctor's
1964–65	19,256	14	3,853	606	294	17	295	76
1963–64	18,391	28	3,346	520	258	----------	257	76
1962–63	15,923	25	3,051	433	173	----------	272	57
1961–62	14,509	1	2,464	348	100	----------	216	48
1960–61	13,047	----------	2,098	292	80	----------	140	52

Source: National Center for Educational Statistics: *Summary Report of Bachelor's and Higher Degrees Conferred During the Year 1964–65.* Office of Education, U.S. Department of Health, Education, and Welfare. To be published. Also prior annual issues. Data for United States, Canal Zone, Guam, and Puerto Rico.

Table 62. LOCATION AND OWNERSHIP OF SCHOOLS CONFERRING DEGREES IN STATISTICS AND NUMBERS OF GRADUATES: 1963–64

Location	School	Ownership	Bachelor's	Master's	Doctor's
	Total, 56 schools		258	257	76
Ala.	University of Alabama, University	Public	2	—	—
Calif.	San Francisco State College, San Francisco	Public	44	—	—
	Stanford University, Stanford	Private	14	53	16
	University of California, Berkeley	Public	11	20	8
	University of California, Los Angeles	Public	8	—	2
Colo.	Colorado State University, Fort Collins	Public	—	2	—
	University of Colorado, Boulder	Public	1	—	—
	University of Denver, Denver	Private	4	3	—
Del.	University of Delaware, Newark	Public	—	1	—
D.C.	George Washington University, Washington	Private	3	3	1
Fla.	Florida State University, Tallahassee	Public	—	9	—
Ga.	Georgia State College, Atlanta	Public	7	1	—
	University of Georgia, Athens	Public	—	2	—
Ill.	University of Chicago, Chicago	Private	2	4	2
	University of Illinois, Urbana	Public	8	4	—
Ind.	Purdue University, Lafayette	Public	—	2	—
Iowa	Drake University, Des Moines	Private	10	—	—
	Iowa State University, Ames	Public	6	5	7
Kans.	Kansas State University, Manhattan	Public	2	6	—
La.	Louisiana Polytechnic Institute, Ruston	Public	4	—	—
Md.	Johns Hopkins University, Baltimore	Private	—	—	3
Mass.	Harvard University, Boston	Private	—	3	4
Mich.	Michigan State University, East Lansing	Public	7	7	2
Minn.	University of Minnesota, Minneapolis	Public	—	16	6
Mo.	University of Missouri, Columbia	Public	1	3	—
Mont.	Montana State University, Bozeman	Public	1	—	—
N.J.	Rutgers, The State University, New Brunswick	Public	—	32	2
N.Y.	City University of New York Hunter College, New York	Public	3	—	—
	Columbia University, New York	Private	1	9	1
	Cornell University, Ithaca	Private	—	1	2
	New York University, New York	Private	6	8	2
	State University of New York, SUNY at Buffalo, Buffalo	Public	1	—	—
	Syracuse University, Syracuse	Private	10	2	—
	University of Rochester, Rochester	Private	—	2	—
N.C.	University of North Carolina, Chapel Hill	Public	—	2	6
	University of North Carolina, Raleigh	Public	6	12	6
Ohio	Bowling Green State University, Bowling Green	Public	4	—	—
	Western Reserve University, Cleveland	Private	2	5	1
Okla.	University of Oklahoma, Norman	Public	8	—	—
Oreg.	Oregon State University, Corvallis	Public	—	3	—
Pa.	Lehigh University, Bethlehem	Private	3	—	—
	Temple University, Philadelphia	Private	—	1	—
	University of Pennsylvania, Philadelphia	Private	4	3	—
	University of Pittsburgh, Pittsburgh	Private	—	4	—
	University of Scranton, Scranton	Private	13	—	—
	Villanova University, Villanova	Private	—	4	—
Tenn.	University of Tennessee, Knoxville	Public	5	—	—
Tex.	Southern Methodist University, Dallas	Private	3	1	—
	University of Texas, Austin	Public	12	—	—
Utah	Brigham Young University, Provo	Private	10	—	—
	Utah State University, Logan	Public	8	1	—
Va.	Hollins College, Hollins	Private	2	—	—
	Virginia Polytechnic Institute, Blacksburg	Public	4	7	2
Wash.	University of Washington, Seattle	Public	—	2	—
Wis.	University of Wisconsin, Madison	Public	8	7	3
Wyo.	University of Wyoming, Laramie	Public	10	7	—

Source: National Center for Educational Statistics: *Earned Degrees Conferred 1963–64*. OE–54013–64. Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1966.

CHAPTER 14

Health Education

Health education is the planned and orderly process through which individuals learn to know and practice those behaviors most consistent with the achievement of optimum individual and community health. The practitioners of health education are public health educators and school health educators and coordinators.

The *public health educator* develops learning opportunities not only for the staff of his organization so that their educational skills are maximized, but also works directly with the public. The Society of Public Health Educators (300 members) estimates that since 1950 the number of public health educators has nearly tripled, from about 600 to approximately 1,700 by 1965. Almost half of these persons are employed by State and local health departments (table 6, Introduction) and a small number, by the U.S. Public Health Service. The balance are active in voluntary health agencies, colleges, hospitals, clinics, and industrial settings.

The public health educator receives his professional preparation in a school of public health. Admission to these schools generally requires a bachelor's degree in health education or an allied field. In the academic year 1964-65, 80 U.S. students and 31 foreign students received master's degrees, and 1 U.S. student a doctor's degree. Since 1941 a total of 1,571 U.S. students have been awarded degrees by schools of public health (table 63). Although many public health educators working in the field today have not had this type of professional preparation, it is being required by an increasing number of employing agencies.

Whereas the public health educator focuses his educational activities on the nonschool community, the *school health educator* is mainly concerned with classroom teaching and the educational impact of school health services. Within a school system, the *school health coordinator* may work with all groups interested in the health of the school child and furnish leadership in developing and maintaining an adequate well-balanced health program.

Since responsibility for the health instruction programs in schools is often shared with other subject areas, it is difficult to identify all school health educators. The number employed in 1965 may be as many as 15,000 or three times the membership of the American Association for Health, Physical Education, and Recreation who have been identified as having primary responsibility for school health or service programs.

The school health educator must meet the regular certification standards for teachers in his State. He needs 4 years of college education leading to a bachelor's degree, with a background in the biological, physical, and social sciences, and in health education. A master's degree in the field of health education is being increasingly required (table 64).

Table 63. LOCATION AND OWNERSHIP OF SCHOOLS OF PUBLIC HEALTH OFFERING CURRICULA IN PUBLIC HEALTH EDUCATION AND NUMBERS OF U.S. STUDENTS SPECIALIZING IN PUBLIC HEALTH EDUCATION AWARDED MASTER'S DEGREES: 1941–64 AND ACADEMIC YEAR 1964–65

Location	School	Ownership	U.S. students specializing in public health education awarded master's degrees	
			1941–64	1964–65
	Total, 10 schools		[1] 1,460	[2] 80
Calif.	University of California, Berkeley	Public	244	16
	University of California, Los Angeles	Public	12	6
Conn.	Yale University, New Haven	Private	86	2
Hawaii	University of Hawaii, Honolulu	Public	—	1
Mass.	Harvard University, Boston	Private	30	1
Mich.	University of Michigan, Ann Arbor	Public	300	18
Minn.	University of Minnesota, Minneapolis	Public	69	2
N.Y.	Columbia University, New York	Private	119	2
N.C.	University of North Carolina, Chapel Hill	Public	395	13
P.R.	University of Puerto Rico, San Juan	Public	205	19

[1] An additional 30 doctor's degrees have been awarded to U.S. students.
[2] 1 U.S. student was awarded a doctor's degree. 31 foreign students also received master's degrees.

Source: Society of Public Health Educators.

Table 64. LOCATION AND OWNERSHIP OF SCHOOLS OFFERING SPECIALIZATION IN HEALTH EDUCATION AT UNDERGRADUATE AND GRADUATE LEVELS: 1965

Location	School	Ownership	Bachelor's program	Master's program	Doctor's program
	Total, 67 schools		48	50	26
Ariz.	Arizona State University, Tempe	Public	x		
	University of Arizona, Tucson	Public	x	x	
Ark.	University of Arkansas, Fayetteville	Public		x	
Calif.	California State College, Long Beach	Public	x		
	California State College, Los Angeles	Public		x	
	Fresno State College, Fresno	Public	x	x	
	Sacramento State College, Sacramento	Public	x	x	
	San Diego State College, San Diego	Public	x	x	
	San Fernando Valley State College, Northridge	Public	x		
	San Francisco State College, San Francisco	Public	x		
	San Jose State College, San Jose	Public	x		
	Stanford University, Palo Alto	Private		x	x
	University of California, Los Angeles	Public	x	x	x
	University of the Pacific, Stockton	Private	x	x	
	University of Southern California, Los Angeles	Private		x	x
Colo.	Colorado State College, Greeley	Public		x	x
Conn.	University of Connecticut, Storrs	Public	x		
Fla.	Florida State University, Tallahassee	Public	x	x	
	University of Florida, Gainesville	Public	x		
Ill.	George Williams College, Chicago	Private		x	
	Northwestern University, Evanston	Private	x	x	
	Southern Illinois University, Carbondale	Public	x	x	x
	University of Illinois, Urbana	Public	x	x	x
Ind.	Ball State University, Muncie	Public	x	x	
	Indiana State University, Terre Haute	Public	x	x	
	Indiana University, Bloomington	Public	x	x	x
	Purdue University, Lafayette	Public	x	x	x
La.	Louisiana State University, Baton Rouge	Public		x	
Md.	Morgan State College, Baltimore	Public	x		
	University of Maryland, College Park	Public	x	x	x
Mass.	Boston University, Boston	Private	x	x	x
	Springfield College, Springfield	Private	x		
Mich.	Michigan State University, East Lansing	Public	x	x	x
	University of Michigan, Ann Arbor	Public		x	x
Minn.	Mankato State College, Mankato	Public	x	x	
	University of Minnesota, Minneapolis	Public		x	x
N.Y.	City University of New York, Brooklyn College, Brooklyn	Public	x		
	City University of New York, City College, New York	Public		x	
	City University of New York, Hunter College, New York	Public	x	x	
	Columbia University, Teachers College, New York	Private		x	x
	New York University, New York	Private	x	x	x
	State University of New York, College at Brockport	Public		x	
	State University of New York, College at Cortland	Public	x	x	
	State University of New York, SUNY at Buffalo	Public		x	x
	Syracuse University, Syracuse	Private	x	x	x
N.C.	North Carolina College, Durham	Public	x		
	University of North Carolina, Chapel Hill	Public	x	x	x
Ohio	Kent State University, Kent	Public	x	x	
	Ohio State University, Columbus	Public	x	x	x
	University of Cincinnati, Cincinnati	Public	x		
Oreg.	Oregon State University, Corvallis	Public	x	x	x
	University of Oregon, Eugene	Public	x	x	x
Pa.	Temple University, Philadelphia	Private		x	x
Tenn.	East Tennessee State University, Johnson City	Public	x	x	
	University of Tennessee, Knoxville	Public	x	x	
Tex.	North Texas State University, Denton	Public	x		
	Sam Houston State College, Huntsville	Public		x	
	Texas Southern University, Houston	Public	x	x	
	Texas Woman's University, Denton	Public		x	x
	University of Texas, Austin	Public		x	x
Utah	Brigham Young University, Provo	Private	x	x	
	University of Utah, Salt Lake City	Public	x		
Va.	Madison College, Harrisonburg	Public	x		
Wash.	University of Washington, Seattle	Public	x		
W.Va.	West Virginia State College, Institute	Public	x		
	West Virginia University, Morgantown	Public		x	x
Wis.	University of Wisconsin, Madison	Public		x	x

Source: American Association for Health, Physical Education, and Recreation.

CHAPTER 15

Health Information and Communication

The importance of making authoritative health information available to the public in an understandable and appealing form is reflected in the increased numbers of writers and graphic arts specialists employed by health organizations. Some of these staff members are also involved with making professional, scientific, and technical information accessible to the health specialists themselves.

Among the occupations concerned with health communications are (a) science writers and health information specialists, (b) technical writers, (c) illustrators, poster and display artists, and draftsmen and (d) medical illustrators. The numbers employed in the health field in 1965 probably exceeded 5,000 and may have been considerably higher.

Science Writer and Health Information Specialist

An estimated 1,000 to 2,000 persons were employed in 1965 as science writers including health information specialists. The distinction between these two careers depends primarily on where they work rather than on what they do. The estimated number was provided by the National Association of Science Writers, Inc. (727 members).

The *science writer* is a journalist who specializes in health or other scientific subjects. He writes for newspapers, magazines, radio, television, or for scientific or professional publications to acquaint the public with developments in the fields of science, including medicine. Science writers are employed by newspapers, serve as editors or writers on magazines and in publishing houses, or have staff positions as information specialists in scientific and health organizations. A substantial proportion are freelance writers, working on their own time.

The *health information specialist* is employed by large health organizations to inform the public of achievements as well as programs of the organization. To accomplish this, he makes use of leaflets and other publications, newspapers, magazines, radio, television, exhibits, and motion pictures.

The minimum education for a science writer is 4 years of college with a bachelor's degree. English or journalism is the usual major, with some science courses advisable.

Technical Writers

The technical writer and the science writer deal with the same general subject matter, but each focuses mainly on a particular group of readers. The technical writer's specialty is writing about scientific and technical developments primarily for professional persons in the field. For this reason and because it is technical in nature, the emphasis is on specifics written in great detail.

Some technical writers specializing in the health sciences work for universities, foundations, Federal agencies, and other organizations with research programs. Others are employed by professional societies, scientific and medical publishers, manufacturers, and other businesses with health-related interests. A few also work on freelance assignments.

An estimated 30,000 *technical writers* and *editors* were employed in 1965; most were in the electronics and aerospace industries. Very few of the 3,000 members of the Society of Technical Writers and Publishers, Inc. are known to be in the health field. The American Medical Writers' Association (1,800 members) made no estimate of the total employment in the health field.

Illustrators, Poster and Display Artists, and Draftsmen

Illustrators, poster and display artists, and *draftsmen* have been drawn into the health field by the increasing emphasis on getting information to the public. Unlike medical art, this kind of work does not require special scientific training. The technical skill of a commercial artist is needed plus a flair for putting abstract ideas into visual form. Training in this field is usually acquired from technical institutes, colleges offering special 2-year programs, vocational and technical high schools, and correspondence schools. Training may also be obtained through apprenticeship programs or on-the-job programs.

Technicians in visual presentation are employed by health departments in cities, counties, States, and the Federal Government. Some also work for large voluntary health agencies. No information is available on the number of draftsmen in the health field, and there is no professional association that represents them.

Medical Illustrators

An estimated 500 persons were employed as *medical illustrators* in 1965 according to the Association of Medical Illustrators (218 members). Medical illustrators, including medical photographers, work with physicians, research scientists, medical educators, authors, and others to graphically record facts and progress in the health field.

For the most part, medical artists work for hospitals, clinics, medical schools, public and private research institutes, large pharmaceutical firms, and medical publishing houses. Medical illustrators may also freelance, and some combine freelancing with a part-time salaried position in a hospital or other medical institution.

Six medical facilities offer courses in medical illustration of not less than 20 months or 2 academic years (table 65). The entrance requirements include 3 to 5 years of scholastic, art, and specialized study after graduation from high school. A total of 33 students were enrolled in 1965, to be graduated over a 3-year period.

Table 65. LOCATION AND OWNERSHIP OF SCHOOLS OFFERING COURSES IN MEDICAL ILLUSTRATION: 1965

Location	School	Ownership	Curricula offered		
			Certificate only	Bachelor's degree	Master's degree
	Total, 6 schools		1	1	4
Ga.	Medical College of Georgia, Department of Art as Applied to Medicine, Augusta	Public			x
Ill.	University of Illinois College of Medicine, Department of Medical and Dental Illustration, Chicago	Public		x	
Md.	Johns Hopkins University School of Medicine, Department of Art as Applied to Medicine, Baltimore	Private			x
Mich.	University of Michigan Medical School, Medical and Biological Illustration, Ann Arbor	Public			x
Ohio	University of Cincinnati College of Medicine, School of Medical Illustration, Cincinnati	Public	x		
Tex.	University of Texas Southwestern Medical School, Department of Medical Art and Visual Education, Dallas	Public			x

Source: Association of Medical Illustrators.

CHAPTER 16

Library Services in the Health Field

Library services in the health field are designed to meet the needs of professional staff—medical, scientific, administrative and others; the needs of professional schools—medical, dental, nursing, and other disciplines; and the needs of hospital patients. The kinds of library services offered vary with the function and size of the institution; for example, research and training programs are factors to be considered.

In this chapter, medical librarians are designated as those who provide library services to meet the needs of professional staff and of professional schools. They may also be responsible for the needs of hospital patients, but librarians concerned only with patients are designated as patients' librarians. Medical record librarians (ch. 17) are not to be confused with library services.

Medical Librarians

The medical library has as its function the acquisition of reports of new scientific knowledge, their indexing, cataloging, and classification, their storage for use, and their dissemination. The primary purpose of these libraries is to assist in education, the communication of health knowledge, and the improvement of health practices.

Medical libraries are located in about 3,200 hospitals; 1,100 schools and colleges of medicine, dentistry, nursing, pharmacy, and other health disciplines; 1,100 research and industrial institutions; and 1,000 Federal Government installations.[28] Of these 6,400 medical libraries, probably only 3 out of 4 have staff employed either full- or part-time.

Medical librarians in educational institutions, departments of public health, pharmaceutical firms, insurance companies, and general biomedical research institutions work with physicians and other health and research workers, as well as with students preparing for a career in the health field. The medical librarian in a hospital may also be concerned with the reading needs of hospitalized patients.

Estimates developed by the National Library of Medicine and the National Center for Health Statistics show that probably 8,000 or more persons were employed in 1965 to staff the specialized health-related libraries in the United States.

Fewer than 3,000 of these persons are professionally trained as differentiated from clerical staff. About 1,000 of the professionals are trained medical librarians, of whom 700 have met the requirements for certification by the Medical Library Association. The Medical Library Association reports 1,200 member librarians; the Association of Hospital and Institution Libraries, 800 member librarians.

Of the 33 approved U.S. schools which offer a master's degree in library science, 10 offer special courses in medical librarianship (table 66). These 10 schools graduate about 100 persons a year. Not all of these graduates are new additions to the health field, since about 60 percent were previously employed in medical libraries.

The basic requirement for certification as a medical librarian is an undergraduate degree plus a master's degree from an accredited library school offering an approved course in medical bibliography. It is now considered desirable to have this 5-year program followed by an internship or other specialized training.

Several associations or institutions conduct short-term (1 week or less) courses for individuals without formal education in library science but having responsibility for library service in hospitals. Sponsors of

[28] The President's Commission on Heart Disease, Cancer, and Stroke: *A National Program to Conquer Heart Disease, Cancer and Stroke: A Program for Developing Medical Libraries.* II: 380-399. Washington. U.S. Government Printing Office, Feb. 1965.

this type of training activity include the American Hospital Association, the Catholic Hospital Association, the University of Florida Medical Center, and the University of Alabama Medical Center.

In addition to librarians and clerical staff, medical libraries may employ other personnel such as indexers, abstractors, translators, and specialists trained in the uses of automatic data processing in the storage and retrieval of information. No employment statistics are available on these occupations.

Patients' Librarians

Differentiated from the medical library is the patients' library which is concerned with meeting the reading needs of individual patients in the hospital. An estimate of the number of hospitals that have a separately administered patients' library staffed by hospital employees is not available. Often volunteers are responsible for whatever service is available to patients. In many instances the city or county public library or the State library agency has librarians on its staff who supply library services to hospital patients.

The *patients' librarian*, also known as the *hospital librarian*, develops library facilities to meet the interests of inbed and ambulatory patients, provides book cart service, and stimulates reading as a part of the therapeutic program for hospitalized persons.

The basic educational requirement for a professional librarian is the master's degree in library science obtainable in any of the 33 schools accredited by the American Library Association.

Table 66. LOCATION AND OWNERSHIP OF APPROVED SCHOOLS OF LIBRARY SCIENCE THAT OFFER SPECIAL COURSES IN MEDICAL BIBLIOGRAPHY: 1965 [1]

Location	School [2]	Ownership
Calif.	University of California, Los Angeles	Public
	University of Southern California, Los Angeles	Private
D.C.	Catholic University of America, Washington	Private
Ill.	University of Chicago, Chicago	Private
	University of Illinois, Urbana	Public
N.Y.	Columbia University, New York	Private
N.C.	University of North Carolina, Chapel Hill	Public
Ohio	Western Reserve University, Cleveland	Private
Pa.	Drexel Institute of Technology, Philadelphia	Private
	University of Pittsburgh, Pittsburgh	Private

[1] Data not available on number of students enrolled in medical bibliography curriculum in these schools.
[2] Emory University at Atlanta, Georgia which formerly offered a course in medical bibliography did not offer its program in 1965.

Source: Medical Library Association.

CHAPTER 17

Medical Records

A medical record in a hospital or clinic is a permanent document of the history and progress of a patient's illness or injury. It is a complete compilation of medical observations and findings from the time a patient is admitted until his discharge. In 1965, upwards of 37,000 medical record librarians and technical and clerical workers were employed in the medical record departments of hospitals, clinics, health departments and agencies, or industrial establishments (table 67).

Medical record librarians are responsible for the coordination of all the medical and surgical information on each patient. Their duties vary greatly with the type and size of institution where employed. In a small hospital additional duties may consist of serving as admitting officer or as bookkeeper or secretary to the administrator and medical staff. In a large hospital their time may be devoted primarily to planning medical record procedures and services, supervising department staff members or in the education and research programs of the hospital.

The minimum educational requirement for professional registration as a medical record librarian is 2 years of general college work and 1 year of study in medical record science in an AMA approved school. The trend is toward higher educational requirements—a bachelor's degree in medical record science or a bachelor's degree supplemented by a 1-year course in medical record science. Fifteen of the approved schools for medical record librarians are college or university based, with affiliated hospitals; 14 are hospital based, many with affiliated colleges or universities. In 1965, these 29 schools graduated 180 medical record librarians (tables 68 and 69).

The American Association of Medical Record Librarians (AAMRL) maintains a list of persons who have successfully completed the national registration examination which qualifies them to use the professional designation of Registered Record Librarian (RRL). Since 1933, a total of 5,478 such persons have been registered. An estimated 3,500 were active in the profession in 1965.

The *medical record technician* assists the medical record librarian and performs the technical tasks associated with the maintenance and use of medical records. Formal training for these technicians was started about 10 years ago. Courses usually last from 9 to 12 months in AMA approved hospital schools or junior colleges. Practical instruction is given in medical terminology, anatomy, physiology and medical record procedures. About 70 medical record technicians were graduated from the 13 approved schools in 1964-65 (tables 70 and 71).

The correspondence course of the AAMRL —open to persons who are employed in medical record work and who are high school graduates—is another avenue to becoming a medical record technician. Those who satisfactorily complete the 25-lesson course are eligible to apply to write the national accreditation examination for designation ART —accredited record technician.

Since 1955, a total of 1,229 persons have successfully completed the qualification examination to become Accredited Record Technicians (ART). About 800 were employed in 1965.

Table 67. ESTIMATED NUMBER OF MEDICAL RECORD PERSONNEL EMPLOYED IN HOSPITALS: SELECTED YEARS, 1950 THROUGH 1965[1]

Year	Medical record librarians	Other medical record personnel
1965	[2] 10,000	[3] 25,000
1960	8,000	20,000
1955	7,000	15,000
1950	4,000	8,000

[1] Probably an additional 2,000 or more are employed in clinics, health departments and agencies or industrial establishments.
[2] Includes about 3,500 Registered Record Librarians.
[3] Includes about 800 Accredited Record Technicians.

Sources: American Association of Medical Record Librarians and National Center for Health Statistics.

Table 68. SCHOOLS OFFERING APPROVED PROGRAMS FOR MEDICAL RECORD LIBRARIANS, STUDENTS, AND GRADUATES: SELECTED YEARS, 1949–50 THROUGH 1964–65

Academic year	Schools	Students [1]	Graduates [2]
1964–65	29	199	[3] 180
1963–64	27	174	161
1962–63	28	150	142
1961–62	27	168	152
1960–61	28	146	139
1959–60	29	144	137
1954–55	21	145	137
1949–50	18	90	83

[1] Enrollment in final year only.
[2] Graduates through August of year concerned.
[3] Includes 60 certificates (less than college level), 118 bachelor's degrees, and 2 master's degrees.

Sources: American Association of Medical Record Librarians. Council on Medical Education: Education Number of the *J.A.M.A.* Chicago. American Medical Association. Annual issues. Data for United States and Puerto Rico.

Table 69. LOCATION AND OWNERSHIP OF APPROVED SCHOOLS FOR MEDICAL RECORD LIBRARIANS AND NUMBERS OF STUDENTS AND GRADUATES: 1964–65

Location	School	Ownership	Students [1]	Graduates [2]		
				Certificate	Bachelor's	Master's
	Total, 29 schools		199	60	118	2
Calif.	Loma Linda University, Loma Linda	Private	9	—	8	—
	University of California, Los Angeles	Public	13	—	8	2
D.C.	George Washington University, Washington	Private	3	—	[3] 3	—
Ga.	Emory University—Emory University Hospital, Atlanta	Private	—	—	[3] —	—
	Medical College of Georgia—Eugene Talmadge Memorial Hospital, Augusta	Public	7	—	7	—
Ill.	Grant Hospital, Chicago	Private	8	7	—	—
	St. Elizabeth Hospital, Danville	Private	11	11	—	—
	University of Illinois College of Medicine, Chicago [4]	Public		—		—
Ind.	Indiana University School of Medicine, Indianapolis	Public	9	—	9	—
La.	University of Southwestern Louisiana, Lafayette	Public	3	—	3	—
Md.	U.S. Public Health Service Hospital, Baltimore	Public	12	—	[3] 12	—
Mich.	Mercy College, Detroit	Private	5	—	5	—
Minn.	College of St. Scholastica, Duluth	Private	11	—	7	—
Miss.	University Hospital, Jackson	Public	5	5	—	—
Mo.	Avila College, Kansas City	Private	—	—	—	—
	Homer G. Phillips Hospital, St. Louis	Public	7	5	—	—
	St. Louis University, St. Louis	Private	9	—	7	—
Nebr.	College of Saint Mary, Omaha	Private	8	—	8	—
N.Y.	Lutheran Medical Center, Brooklyn	Private	5	5	—	—
N.C.	Wake Forest College—North Carolina Baptist Hospitals, Winston-Salem	Private	8	6	—	—
Okla.	Hillcrest Medical Center, Tulsa	Private	4	4	—	—
Pa.	Mount Mercy College—Mercy Hospital, Pittsburgh	Private	7	—	5	—
	University of Pennsylvania, Graduate Hospital, Philadelphia	Private	7	—	[3] 6	—
P.R.	University of Puerto Rico School of Medicine, San Juan	Public	6	—	[3] 6	—
Tenn.	University of Tennessee—Baptist Memorial Hospital, Memphis	Private	9	9	—	—
Tex.	Sacred Heart Dominican College—St. Joseph's Hospital, Houston	Private	8	8	—	—
	Incarnate Word College—Santa Rosa Medical Center, San Antonio	Private	8	—	8	—
Wash.	Seattle University—Providence Hospital, Seattle	Private	12	—	11	—
Wis.	Viterbo College—St. Francis Hospital, La Crosse	Private	5	—	5	—

[1] Enrollment in final year only.
[2] Number of graduates who received a certificate in medical record science (less than collegiate level), a bachelor's degree, or a master's degree.
[3] Graduates of 12-month certificate schools which require a bachelor's degree for entrance.
[4] First senior class enrolled in June 1965.

Source: American Association of Medical Record Librarians.

Table 70. SCHOOLS OFFERING APPROVED PROGRAMS FOR MEDICAL RECORD TECHNICIANS, STUDENTS, AND GRADUATES: SELECTED YEARS, 1954–55 THROUGH 1964–65

Academic year	Schools	Students	Graduates
1964–65	13	77	70
1963–64	14	130	98
1962–63	14	95	81
1961–62	12	74	72
1960–61	12	48	47
1959–60	12	46	46
1954–55	8	35	28

Sources: American Association of Medical Record Librarians. Council on Medical Education: Education Number of the *J.A.M.A.* Chicago. American Medical Association. Annual issues.

Table 71. LOCATION AND OWNERSHIP OF APPROVED SCHOOLS FOR MEDICAL RECORD TECHNICIANS AND NUMBERS OF STUDENTS AND GRADUATES: 1964–65

Location	School	Ownership	Students	Graduates
	Total, 13 schools		77	70
Calif.	East Los Angeles College, Los Angeles	Public	[1] 4	4
Ind.	St. Margaret Hospital, Hammond	Private	—	—
Md.	Sinai Hospital of Baltimore, Inc., Baltimore	Private	8	8
Mass.	St. Joseph Hospital, Lowell	Private	—	—
Mo.	Independence Sanitarium and Hospital, Independence	Private	13	13
N.C.	Charlotte Memorial Hospital, Charlotte	Private	6	6
Ohio	Marymount Hospital, Garfield Heights	Private	4	3
Tenn.	Madison Hospital, Madison	Private	10	10
Tex.	Hendrick Memorial Hospital, Abilene	Private	6	5
Utah	St. Benedict's Hospital, Ogden	Private	6	6
Wash.	Deaconess Hospital, Spokane	Private	7	7
	St. Joseph Hospital, Tacoma	Private	6	6
Wis.	Columbia Hospital, Milwaukee [2]	Private	7	2

[1] Enrollment in final year of 2-year program. [2] Discontinued in June 1965.

Source: American Association of Medical Record Librarians.

CHAPTER 18

Medicine and Osteopathy

The science and art of dealing with the prevention, cure, and alleviation of disease is the province of both doctors of medicine and doctors of osteopathy. As of December 31, 1965, there were 305,115 such doctors in the United States and outlying areas, of whom 292,088 had the degree of *Doctor of Medicine* (M.D.) and 13,027 had the degree *Doctor of Osteopathy* (D.O.). Both kinds of physicians diagnose diseases, treat people who are ill, and in most States use surgery, drugs, and all other accepted methods of medical care.

Included in this count of both types of physicians which is based on individual records, are 282,279 non-Federal physicians —279,050 located in the 50 States and the District of Columbia; 1,807 in Puerto Rico; 188 in other U.S. outlying areas (American Samoa, Canal Zone, Guam, Pacific Islands, and Virgin Islands); and 1,234 with addresses unknown to the American Medical Association. Also included are 22,836 Federal physicians in the United States and abroad. Not included are 1,786 non-Federal physicians temporarily in foreign locations.

The total number of M.D.'s and D.O.'s per 100,000 total population was 149 in 1950, the same in 1963, increasing to 153 by 1965. The ratio of physicians in private practice per 100,000 civilians has declined from 109 in 1950 to 97 in 1963 and continues at that level (table 72).

The ratios of all non-Federal physicians and of those in private practice per 100,000 civilians in 1965 are shown for each State in table 73. The Northeastern States generally have the highest ratios of physicians to population; the Southern States, the lowest.

Fewer than two out of three physicians are in private practice, and the proportion has been dropping over the years. Now, relatively more of the total number of M.D.'s are in internship and residency training or full time in other forms of practice such as hospital service, teaching, preventive medicine, and research. The fact that a physician is not in private practice, however, does not preclude his seeing patients. Indeed many physicians in these other categories do render care to patients. Those who are reported as retired, not in medical practice, or whose status is unknown continue at 5 to 6 percent (table 74).

Specialists outnumber general practitioners about two to one among the active M.D.'s. The 30-some specialties recognized by the profession have been grouped into five major categories in table 75. Of the 244,063 M.D.'s and D.O.'s in private practice or in other forms of practice exclusive of training programs, 160,659 indicated a primary specialty other than general practice. In 1963, slightly more than half of these specialists held certificates awarded by American Specialty Boards.[24] Twenty specialty certifying boards are affiliated with the AMA; 12, with the AOA.

A license to practice is required in all States and the District of Columbia. To qualify for a license, a candidate must have been graduated from an approved school, pass a licensing examination, and—in more than half the States—serve a 1-year hospital internship. In the other States where a physician may be licensed immediately after graduation, an internship is needed for full acceptance by the profession.

The 88 medical schools in the United States and Puerto Rico include 84 that award the M.D. degree to those completing the 4-year course, 3 that offer 2-year programs in the basic sciences to students who could then transfer to one of the 84 schools for the last 2 years of study, and 1 school

[24] Peterson, P. Q. and Pennell, M. Y.: Medical specialists. *Health Manpower Source Book 14*. PHS Pub. No. 263, Section 14. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1962. Tables 9 and 11 (mid-1961 data). Also unpublished data for 1963.

(set up as a 2-year institution) recently established. The five osteopathic colleges award the D.O. degree to those completing the 4-year course. In 1964-65, the 93 schools enrolled 34,089 students and graduated 7,804 physicians (tables 76 and 77).

Training as a physician takes at least 8 years after graduation from high school, and may extend from 10 to 15 years. Three years of college work is the minimum requirement for entry into schools of medicine and osteopathy, but 4 years is preferable. This is followed by 4 years leading to the M.D. or D.O. degree. After graduation, almost all doctors serve a 12-month internship in an approved hospital. Those who wish to become specialists must have 2 to 4 years of advanced hospital training (residency), followed by 2 or more years of supervised practice in the specialty.

Many graduates of foreign medical schools serve as interns and residents in this country. These foreign graduates—citizens of foreign countries as well as U.S. citizens—account for about one-fourth of all physicians in training programs.[25] To be appointed to approved internships or residencies in U.S. hospitals, these graduates must pass the American Qualification Examination given by the Educational Council for Foreign Medical Graduates.

The 292,100 M.D.'s in the United States at the close of 1965 included about 6,000 graduates of Canadian schools and 38,500 graduates of foreign schools. Comparable data for 1959 would indicate that, of the recent additions to the supply of physicians in the U.S., relatively more are foreign trained.[26, 27]

---

[25] Council on Medical Education: Education Number of the *J.A.M.A.* 194(7):781. Chicago. American Medical Association, Nov. 15, 1965. Also prior annual issues.

[26] Stewart, W. H. and Pennell, M. Y.: Medical school alumni. *Health Manpower Source Book 11.* PHS Pub. No. 263, Section 11. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1961. Table 1.

[27] Peterson, *Medical specialists,* table 2.

Table 72. PHYSICIANS IN RELATION TO POPULATION: SELECTED YEARS, 1950 THROUGH 1965

Year [1]	Population in thousands	Number of physicians			Physicians per 100,000 population
		M.D. and D.O.	M.D.	D.O.	
	Total [2]	All physicians, active and inactive [3]			
1965	199,256	305,115	[4] 292,088	13,027	153
1964	196,856	297,136	[4] 284,271	12,865	151
1963	194,169	289,190	276,477	12,713	149
1960	185,369	274,834	260,484	14,350	148
1955	170,499	255,211	241,711	13,500	150
1950	156,472	232,697	219,997	12,700	149
	Civilians	Physicians in private practice			
1965	195,811	190,748	180,752	9,996	97
1964	193,610	188,430	178,528	9,902	97
1963	190,892	184,792	174,974	9,818	97
1960	182,348	179,176	168,142	11,034	98
1955	167,038	169,871	159,371	10,500	102
1950	153,635	168,089	158,189	9,900	109

[1] All data as of December 31.

[2] Includes civilians in 50 States, District of Columbia, Puerto Rico, and other U.S. outlying areas; U.S. citizens in foreign countries; and the Armed Forces in U.S. and abroad.

[3] Includes non-Federal physicians in the 50 States, District of Columbia, Puerto Rico and other U.S. outlying areas (American Samoa, Canal Zone, Guam, Pacific Islands, and Virgin Islands); those with addresses temporarily unknown to the American Medical Association; and Federal physicians in U.S. and abroad.

[4] The net change between 1963 and 1964 was about 2,400 higher than anticipated; between 1964 and 1965, another 2,300. The increase is in numbers of graduates of foreign schools—partly a real gain and partly a result of new procedures instituted by A.M.A. to identify physicians not already in their records.

Sources: A.M.A. Directory Report Service: *Quarterly Tables of Distribution of Physicians, by Professional Activity—by State and County.* Vol 17, Supplement No. 47. Chicago. American Medical Association, Jan. 3, 1966. Also prior reports.
Membership and Statistics Department: *A Statistical Study of the Osteopathic Profession, December 31, 1965.* Chicago. American Osteopathic Association, June 1966. Also prior editions.
U.S. Bureau of the Census: Population estimates. *Current Population Reports.* Series P–25, Nos. 238, 272, 273, 283, 324, and 327.
U.S. Department of State: *Annual Report on U.S. Citizen Personnel and Their Dependents—as of March 31, 1965.* Also prior reports.
Divisions of Public Health Methods, Dental Public Health and Resources, and Nursing: Manpower in the 1960's. *Health Manpower Source Book 18.* PHS Pub. No. 263, Section 18. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1964. Table 12.

Table 73. LOCATION OF NON-FEDERAL PHYSICIANS IN RELATION TO POPULATION: DECEMBER 31, 1965

Location	Civilian population in thousands, July 1	All non-Federal physicians			Physicians in private practice		
		Number		Rate per 100,000 civilians	Number		Rate per 100,000 civilians
		M.D. and D.O.	M.D. only		M.D. and D.O.	M.D. only	
All locations	194,778	[1] 281,045	268,040	144	190,748	180,752	98
United States	191,890	279,050	266,045	145	189,637	179,641	99
Alabama	3,438	2,735	2,733	80	2,119	2,118	62
Alaska	221	157	155	71	134	132	61
Arizona	1,587	2,201	1,941	139	1,641	1,428	103
Arkansas	1,950	1,712	1,691	88	1,315	1,300	67
California	18,299	32,899	32,441	180	23,391	23,220	128
Colorado	1,933	3,524	3,274	182	2,357	2,145	122
Connecticut	2,821	5,121	5,063	182	3,287	3,244	117
Delaware	497	692	651	139	479	442	96
District of Columbia	787	2,937	2,920	373	1,451	1,438	184
Florida	5,713	8,618	8,027	151	5,522	5,098	97
Georgia	4,264	4,362	4,285	102	3,026	2,962	71
Hawaii	648	917	901	142	681	670	105
Idaho	686	651	615	95	571	548	83
Illinois	10,599	14,659	14,306	138	10,029	9,793	95
Indiana	4,877	5,126	4,932	105	3,978	3,819	82
Iowa	2,759	3,303	2,883	120	2,437	2,095	88
Kansas	2,195	2,632	2,427	120	1,861	1,695	85
Kentucky	3,140	3,094	3,054	99	2,231	2,202	71
Louisiana	3,501	3,986	3,973	114	2,753	2,742	79
Maine	975	1,211	999	124	941	784	97
Maryland	3,464	5,780	5,760	167	3,021	3,008	87
Massachusetts	5,309	10,835	10,544	204	6,358	6,172	120
Michigan	8,198	12,038	10,050	147	7,874	6,350	96
Minnesota	3,549	5,356	5,289	151	3,303	3,249	93
Mississippi	2,301	1,714	1,713	74	1,333	1,332	58
Missouri	4,470	6,677	5,522	149	4,354	3,502	97
Montana	696	714	671	103	634	608	91
Nebraska	1,459	1,694	1,643	116	1,269	1,232	87
Nevada	432	439	412	102	372	350	86
New Hampshire	663	894	867	135	651	632	98
New Jersey	6,735	9,689	9,081	144	7,220	6,728	107
New Mexico	1,008	1,011	894	100	773	671	77
New York	18,032	39,169	38,601	217	24,122	23,665	134
North Carolina	4,821	4,976	4,946	103	3,320	3,298	69
North Dakota	640	576	565	90	496	486	78
Ohio	10,227	14,329	13,293	140	9,727	8,894	95
Oklahoma	2,448	2,814	2,399	115	2,188	1,834	89
Oregon	1,894	2,839	2,673	150	2,049	1,915	108
Pennsylvania	11,505	18,108	16,602	157	12,176	10,973	106
Rhode Island	867	1,384	1,299	160	1,018	949	117
South Carolina	2,489	2,009	2,002	81	1,539	1,534	62
South Dakota	696	572	534	82	492	458	71
Tennessee	3,817	4,333	4,267	114	2,894	2,843	76
Texas	10,387	12,029	11,218	116	9,061	8,391	87
Utah	986	1,323	1,303	134	927	910	94
Vermont	397	718	676	181	431	402	109
Virginia	4,294	4,888	4,850	114	3,302	3,273	77
Washington	2,929	4,471	4,266	153	3,221	3,058	110
West Virginia	1,811	1,861	1,745	103	1,380	1,279	76
Wisconsin	4,140	4,958	4,789	120	3,643	3,496	88
Wyoming	335	315	300	94	285	274	85
Puerto Rico	2,621	1,807	1,807	69	1,077	1,077	41
U.S. outlying areas	267	188	188	70	34	34	13

[1] Excludes 22,836 Federal physicians (22,814 M.D.'s and 22 D.O.'s) and 1,234 M.D.'s with addresses temporarily unknown to the A.M.A.

Sources: A.M.A. Directory Report Service: *Quarterly Tables of Distribution of Physicians, by Professional Activity—by State and County.* Vol. 17, Supplement No. 47. Chicago. American Medical Association, Jan. 3, 1966.
Membership and Statistics Department: *A Statistical Study of the Osteopathic Profession, December 31, 1965.* Chicago. American Osteopathic Association, June 1966.
U.S. Bureau of the Census: Population estimates. *Current Population Reports.* Series P-25, No. 324, Jan. 1966.

Table 74. TYPE OF PRACTICE OF PHYSICIANS: SELECTED YEARS, 1950 THROUGH 1965

Year	Total	Private practice	Other practice [1]		Training [2]	Retired, not in practice, or status not reported
			Non-Federal	Federal		
	Number of physicians (M.D. and D.O.)					
1965	305,115	190,748	34,713	18,934	44,276	16,444
1964	297,136	188,430	32,084	18,345	41,651	16,626
1963	289,190	184,792	29,974	18,562	39,174	16,688
1960	274,834	179,176	27,748	14,218	38,291	15,401
1955	255,211	169,871	----	----	----	----
1950	232,697	168,089	----	----	----	----
	Number of physicians (M.D.)					
1965	292,088	180,752	34,403	18,912	43,508	14,513
1964	284,271	178,528	31,780	18,329	40,964	14,670
1963	276,477	174,974	29,686	18,551	38,519	14,747
1960	260,484	168,142	27,341	14,212	37,562	13,227
1955	241,711	159,371	25,197	12,957	31,028	13,158
1950	219,997	158,189	16,816	12,576	21,416	11,000
	Number of physicians (D.O.)					
1965	13,027	9,996	310	22	768	1,931
1964	12,865	9,902	304	16	687	1,956
1963	12,713	9,818	288	11	655	1,941
1960	14,350	11,034	407	6	729	2,174
1955	13,500	10,500	----	----	----	----
1950	12,700	9,900	----	----	----	----
	Percent of physicians (M.D. and D.O.)					
1965	100	63	11	6	15	5
1964	100	63	11	6	14	6
1963	100	64	10	6	14	6
1960	100	65	10	5	14	6
1955	100	67	10	5	12	6
1950	100	72	7	6	9	'6

[1] Includes full-time staff in hospital service (other than interns, residents, and fellows), full-time medical school faculty, and physicians whose primary activity is administrative medicine, laboratory medicine, preventive medicine, or research.

[2] Includes Federal and non-Federal interns, residents, and fellows.

Sources: A.M.A. Directory Report Service: *Quarterly Tables of Distribution of Physicians, by Professional Activity—by State and County.* Vol. 17, Supplement No. 47. Chicago. American Medical Association, Jan. 3, 1966. Also prior reports.
Membership and Statistics Department: *A Statistical Study of the Osteopathic Profession, December 31, 1965.* Chicago. American Osteopathic Association, June 1966. Also prior editions.

Table 75. TYPE OF PRACTICE AND PRIMARY SPECIALTY OF PHYSICIANS: 1965

Primary specialty	Number of physicians (M.D.)					Number of D.O.'s in private practice
	Total active	Private practice	Other practice		Training programs	
			Non-Federal	Federal		
All specialties	277,575	180,752	34,403	18,912	43,508	9,996
General practice [1]	83,309	65,951	4,260	4,465	8,633	[2] 8,728
Medical specialties	61,860	37,408	8,504	4,671	11,277	307
Allergy	907	811	39	22	35	1
Cardiovascular disease	1,867	1,040	447	118	262	3
Dermatology	3,511	2,666	230	166	449	17
Gastroenterology	626	377	97	57	95	—
Internal medicine	38,115	22,432	4,732	3,356	7,595	234
Pediatrics [3]	15,719	9,726	2,446	770	2,777	52
Pulmonary diseases	1,115	356	513	182	64	—
Surgical specialties	84,351	59,850	5,208	4,147	15,146	773
Anesthesiology	8,621	6,050	1,076	328	1,167	155
Colon and rectal surgery	647	623	8	5	11	46
General surgery	27,466	17,628	1,684	1,679	6,475	254
Neurological surgery	2,038	1,251	212	94	481	4
Obstetrics and gynecology	16,766	12,566	917	660	2,623	73
Ophthalmology	8,380	6,672	324	269	1,115	146
Orthopedic surgery	7,507	5,330	305	493	1,379	66
Otolaryngology	5,307	4,173	203	232	699	[4]
Plastic surgery	1,129	857	50	38	184	—
Thoracic surgery	1,463	957	194	115	197	4
Urology	5,027	3,743	235	234	815	25
Psychiatry and neurology	20,254	9,291	5,024	1,623	4,316	27
Child psychiatry	795	347	235	21	192	—
Neurology	2,152	760	571	225	596	3
Psychiatry	17,307	8,184	4,218	1,377	3,528	24
Other specialties	27,801	8,252	11,407	4,006	4,136	161
Administrative medicine	4,057	—	2,521	1,534	2	—
Aviation medicine	682	41	73	497	71	—
General preventive medicine	826	—	621	177	28	—
Occupational medicine	1,644	389	1,150	80	25	2
Pathology [5]	8,458	1,896	3,737	709	2,116	37
Physical medicine and rehabilitation	1,053	317	321	209	206	11
Public health	1,461	—	1,254	176	31	—
Radiology [6]	9,620	5,609	1,730	624	1,657	111

[1] Includes no specialty and other specialties not recognized.
[2] Includes 938 with practice limited to manipulative therapy.
[3] Includes pediatric allergy and cardiology.
[4] Included in ophthalmology.
[5] Includes forensic pathology.
[6] Includes diagnostic roentgenology and therapeutic radiology.

Sources: A.M.A. Directory Report Service: *Quarterly Tables of Distribution of Physicians, by Professional Activity—by State and County.* Vol. 17, Supplement No. 47. Chicago. American Medical Association, Jan. 3, 1966.
Membership and Statistics Department: *A Statistical Study of the Osteopathic Profession, December 31, 1965.* Chicago. American Osteopathic Association, June 1966.

Table 76. MEDICAL AND OSTEOPATHIC SCHOOLS, STUDENTS, AND GRADUATES: SELECTED YEARS, 1949–50 THROUGH 1965–66

Academic year	Medicine			Osteopathy		
	Schools	Students	Graduates	Schools	Students	Graduates
1965–66	----------	----------	----------	5	1,681	[1] 369
1964–65	88	32,428	7,409	5	1,661	395
1963–64	87	32,001	7,336	5	1,594	354
1962–63	87	31,491	7,264	5	1,581	362
1961–62	87	31,078	7,168	5	1,555	362
1960–61	86	30,288	6,994	6	1,944	506
1959–60	85	30,084	7,081	6	1,915	427
1954–55	81	28,583	6,977	6	1,867	459
1949–50	79	25,103	5,553	6	1,778	373

[1] Preliminary.

Sources: Council on Medical Education: Education Number of the *J.A.M.A.* 194(7). Chicago. American Medical Association, Nov. 15, 1965. Also prior annual issues.
Mills, L. W.: *Educational Supplement.* 18(1). Chicago. Office of Education, American Osteopathic Association, Jan. 1966. Also prior annual issues.
Data for United States and Puerto Rico.

Table 77. LOCATION AND OWNERSHIP OF MEDICAL AND OSTEOPATHIC SCHOOLS AND NUMBERS OF STUDENTS AND GRADUATES: 1964–65

Location	School	Ownership	Students	Graduates
	Total, 93 schools		34,089	7,804
	4-year medical schools			
Ala.	Medical College of Alabama, Birmingham	Public	300	67
Ark.	University of Arkansas School of Medicine, Little Rock	Public	361	80
Calif.	Loma Linda University School of Medicine, Loma Linda, Los Angeles	Private	352	78
	Stanford University School of Medicine, Palo Alto	Private	286	46
	University of California—California College of Medicine, Los Angeles	Public	371	88
	University of California School of Medicine, Los Angeles	Public	287	71
	University of California School of Medicine, San Francisco	Public	436	100
	University of Southern California School of Medicine, Los Angeles	Private	274	65
Colo.	University of Colorado School of Medicine, Denver	Public	318	80
Conn.	Yale University School of Medicine, New Haven	Private	321	76
D.C.	Georgetown University School of Medicine, Washington	Private	430	95
	George Washington University School of Medicine, Washington	Private	388	89
	Howard University College of Medicine, Washington	Private	392	87
Fla.	University of Florida College of Medicine, Gainesville	Public	224	43
	University of Miami School of Medicine, Coral Gables	Private	302	73
Ga.	Emory University School of Medicine, Emory University, Atlanta	Private	290	71
	Medical College of Georgia, Augusta	Public	383	91
Ill.	Chicago Medical School, Chicago	Private	276	63
	Northwestern University Medical School, Chicago	Private	518	128
	Stritch School of Medicine of Loyola University, Chicago	Private	330	74
	University of Chicago School of Medicine, Chicago	Private	289	67
	University of Illinois College of Medicine, Chicago	Public	746	175
Ind.	Indiana University School of Medicine, Indianapolis	Public	759	163
Iowa	University of Iowa College of Medicine, Iowa City	Public	454	100
Kans.	University of Kansas School of Medicine, Kansas City	Public	427	101
Ky.	University of Kentucky College of Medicine, Lexington	Public	263	46
	University of Louisville School of Medicine, Louisville	Private	344	68
La.	Louisiana State University School of Medicine, New Orleans	Public	512	118
	Tulane University School of Medicine, New Orleans	Private	509	126
Md.	Johns Hopkins University School of Medicine, Baltimore	Private	342	82
	University of Maryland School of Medicine, Baltimore	Public	457	91
Mass.	Boston University School of Medicine, Boston	Private	291	68
	Harvard Medical School, Boston	Private	510	133
	Tufts University School of Medicine, Boston	Private	431	101
Mich.	University of Michigan Medical School, Ann Arbor	Public	759	174
	Wayne State University School of Medicine, Detroit	Public	451	98
Minn.	University of Minnesota Medical School, Minneapolis	Public	611	148
Miss.	University of Mississippi School of Medicine, Jackson	Public	286	59
Mo.	Saint Louis University School of Medicine, St. Louis	Private	430	89
	University of Missouri School of Medicine, Columbia	Public	324	80
	Washington University School of Medicine, St. Louis	Private	335	83
Nebr.	Creighton University School of Medicine, Omaha	Private	288	64
	University of Nebraska College of Medicine, Omaha	Public	328	77
N.J.	New Jersey College of Medicine and Dentistry, Jersey City	Public	301	66
N.Y.	Albany Medical College of Union University, Albany	Private	249	58
	Albert Einstein College of Medicine of Yeshiva University, New York	Private	369	89
	Columbia University College of Physicians and Surgeons, New York	Private	458	114
	Cornell University Medical College, New York	Private	334	83
	New York Medical College, New York	Private	509	125
	New York University School of Medicine, New York	Private	488	122
	State University of New York at Buffalo School of Medicine, Buffalo	Public	360	71
	State University of New York, Downstate Medical Center, Brooklyn	Public	685	148
	State University of New York, Upstate Medical Center, Syracuse	Public	354	73
	University of Rochester School of Medicine and Dentistry, New York	Private	281	73
				105

Table 77. LOCATION AND OWNERSHIP OF MEDICAL AND OSTEOPATHIC SCHOOLS AND NUMBERS OF STUDENTS AND GRADUATES: 1964–65—Continued

Location	School	Ownership	Students	Graduates
N.C.	Bowman Gray School of Medicine of Wake Forest College, Winston-Salem	Private	206	49
	Duke University School of Medicine, Durham	Private	333	85
	University of North Carolina School of Medicine, Chapel Hill	Public	274	63
Ohio	Ohio State University College of Medicine, Columbus	Public	574	144
	University of Cincinnati College of Medicine, Cincinnati	Public	380	86
	Western Reserve University School of Medicine, Cleveland	Private	343	84
Okla.	University of Oklahoma School of Medicine, Oklahoma City	Public	401	95
Oreg.	University of Oregon Medical School, Portland	Public	327	76
Pa.	Hahnemann Medical College of Philadelphia, Philadelphia	Private	406	94
	Jefferson Medical College of Philadelphia, Philadelphia	Private	653	157
	Temple University School of Medicine, Philadelphia	Private	530	124
	University of Pennsylvania School of Medicine, Philadelphia	Private	510	124
	University of Pittsburgh School of Medicine, Pittsburgh	Private	370	84
	Woman's Medical College of Pennsylvania, Philadelphia	Private	217	46
P.R.	University of Puerto Rico School of Medicine, San Juan	Public	202	43
S.C.	Medical College of South Carolina, Charleston	Public	312	80
Tenn.	Meharry Medical College, Nashville	Private	229	47
	University of Tennessee College of Medicine, Memphis	Public	713	156
	Vanderbilt University School of Medicine, Nashville	Private	206	47
Tex.	Baylor University College of Medicine, Houston	Private	330	77
	University of Texas Medical Branch, Galveston	Public	537	124
	University of Texas Southwestern Medical School, Dallas	Public	384	93
Utah	University of Utah College of Medicine, Salt Lake City	Public	216	56
Vt.	University of Vermont College of Medicine, Burlington	Public	187	41
Va.	Medical College of Virginia, Richmond	Public	328	78
	University of Virginia School of Medicine, Charlottesville	Public	295	67
Wash.	University of Washington School of Medicine, Seattle	Public	302	65
W.Va.	West Virginia University School of Medicine, Morgantown	Public	238	58
Wis.	Marquette University School of Medicine, Milwaukee	Private	378	86
	University of Wisconsin Medical School, Madison	Public	387	82
	Approved schools of basic medical sciences			
N.H.	Dartmouth Medical School, Hanover	Private	97	----------
N. Dak.	University of North Dakota School of Medicine, Grand Forks	Public	83	----------
S. Dak.	State University of South Dakota School of Medicine, Vermillion	Public	83	----------
	Developing medical schools—operational			
N. Mex.	University of New Mexico School of Medicine, Albuquerque, (not yet eligible for approval)	Public	24	----------
	4-year osteopathic schools			
Ill.	Chicago College of Osteopathy, Chicago	Private	232	45
Iowa	College of Osteopathic Medicine and Surgery, Des Moines	Private	305	76
Mo.	Kansas City College of Osteopathy and Surgery, Kansas City	Private	403	103
	Kirksville College of Osteopathy and Surgery, Kirksville	Private	380	98
Pa.	Philadelphia College of Osteopathy, Philadelphia	Private	341	73

Sources: Council on Medical Education: Education Number of the *J.A.M.A.* 194(7). Chicago. American Medical Association, Nov. 15, 1965.
Mills, L. W.: *Educational Supplement.* 18(1). Chicago. Office of Education, American Osteopathic Association, Jan. 1966.

CHAPTER 19

Midwifery

Midwifery, or obstetrics, involves assistance to women during pregnancy, labor, delivery, and the post-natal period. Births in the United States are attended by three basic groups of physicians: obstetricians, general practitioners, and house staffs of hospitals (see table 75, ch. 18). In addition there are probably between 500 and 600 nurses trained as midwives.[28] Lay *midwives* numbering about 5,000 provide assistance to women during childbirth in the absence of a medical practitioner.

In 1964, 62,000 live births or 1.5 percent of the total for the United States were reported on the birth certificate as attended by midwives. The proportion has declined from 10.7 percent in 1935 to 4.5 percent in 1950, 2.9 percent in 1955, and 2.0 percent in 1960.[29]

Comparative data on the number of midwives in the 48 States and District of Columbia since 1948 are shown in table 78. In some States lay midwives are licensed; in others, permits to practice are issued annually in an attempt to keep them under supervision. Unlicensed midwives generally practice under the supervision of State health department public health personnel.

Lay midwives are usually women with limited education, serving chiefly in low economic or rural areas. Their deliveries are usually performed in the home. Under the direction of the State health department, public health nurses and others may hold classes to instruct them in the selection of materials and simple procedures.

Table 78. LOCATION OF MIDWIVES: SELECTED YEARS, 1948 THROUGH 1965

Location	1948	1955 or 1956	1963	1965
Total [1]	20,700	11,500	6,900	4,900
Alabama	1,701	1,316	746	662
Arizona	--------	50	16	—
Arkansas	1,137	473	279	245
Florida	455	336	200	179
Georgia	1,560	977	387	319
Kentucky	1,200	604	296	247
Louisiana	1,229	473	232	192
Maryland	160	71	44	35
Mississippi	2,261	1,300	895	768
Missouri	46	(2)	40	26
New Jersey	161	(2)	7	—
New Mexico	268	192	92	62
North Carolina	869	486	175	(2)
Ohio	450	(2)	(2)	(2)
Oklahoma	185	(2)	(2)	30
Pennsylvania	268	172	12	—
South Carolina	1,513	1,028	564	455
Tennessee	1,278	624	319	(2)
Texas	3,262	(2)	1,700	(2)
Virginia	2,000	820	508	486
West Virginia	194	119	93	48
Other 27 States and D.C. [3]	503	250	145	50

[1] Excludes Alaska (200 births attended by midwives in 1964), Hawaii (4 midwives in 1965), and Puerto Rico (740 midwives in 1963).

[2] An estimated 2,209 midwives were practicing in these States in 1955 or 1956; 150 in 1963; and 1,096 in 1965.

[3] Estimated number of midwives; includes estimate for Arizona in 1948.

Sources: Jacobson, P. H.: Hospital care and the vanishing midwife. *Milbank Mem. Fund Quart.* 34(3):256–257, July 1956. Data for 1948.
U.S. Department of Health, Education, and Welfare, Welfare Administration, Children's Bureau. Unpublished data for 1955–56.
Children's Bureau: Maternal and child health services, 1963. *Statistical Series* No. 77, p. 35. Welfare Administration, U.S. Department of Health, Education, and Welfare. Data for 1963.
Information provided to the National Center for Health Statistics by the individual State health departments. Data for 1965.

[28] Thomas, M. W.: *The Practice of Nurse-Midwifery in the United States.* Children's Bureau Pub. No. 436—1965. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1965.

[29] National Center for Health Statistics: *Vital Statistics of the United States, 1964,* Vol I. Public Health Service, U.S. Department of Health, Education, and Welfare. In preparation. Also prior annual editions.

CHAPTER 20

Nursing and Related Services*

Nursing services which contribute to the health and well-being of people are provided today by a wide variety of practitioners. The professional nurse may be complemented and supplemented by other types of nursing personnel whose duties and competencies are carefully delineated.

The several categories of personnel considered in this section are shown below, with recent estimates of the numbers of persons employed at the beginning of 1966:

Occupation	*Number employed*
Professional nurses	621,000
Practical nurses	282,000
Aides, orderlies, attendants	500,000
Home health aides-homemakers	6,000

Not included are *ward clerks*, sometimes called *floor clerks*, who act as receptionists and also relieve the nurse of much of the paper work in the patient-care units of an institution. They receive on-the-job training in relation to the activities delegated to them and hence are not discussed in this chapter.

Professional Nurses

Individuals in this profession may function in a variety of positions within different employment settings. They render nursing care to patients or perform specialized duties in hospitals, infirmaries, nursing homes, sanatoriums, clinics, doctors' offices, industrial plants, schools, or in patients' homes through a public health department or other service agency. They also serve as teachers of nursing. *Professional nurses*—also known as registered nurses, or graduate nurses—are responsible for the nature and quality of all nursing care that patients receive. They are also responsible for carrying out the physicians' instructions and for supervising practical nurses and other nonprofessional personnel who perform routine care and treatment of patients.

Professional nurses in practice in the United States numbered about 621,000 as of January 1, 1966, according to the Interagency Conference on Nursing Statistics. (National estimates of employed nurses for each biennium since 1954 have been compiled from various sources by the Interagency Conference on Nursing Statistics, composed of representatives from the American Nurses' Association, the National League for Nursing, the U.S. Public Health Service, and other agencies. The estimate for January 1966 became available in June 1966.) Between 1950 and 1966, the number of employed professional nurses had increased by 246,000. The effect was not that large since the number of part-time nurses increased at a more rapid rate than those working full time (table 79).

About two-thirds of the employed professional nurses work in hospital nursing services, not including the self-employed private-duty nurses (table 80). Some of these hospital nurses specialize in clinical areas such as obstetrics, pediatrics, or psychiatry. Public health, school, and industrial nurses comprise 10 percent of the total.

A total of 847,531 licensed professional nurses were included in the 1962 Inventory conducted by the American Nurses' Association through the cooperation of the State boards of nursing which are the official licensing agencies for nurses.[30] Included in this total were 532,118 actively employed in nursing, 282,819 not employed in nursing, and 32,594 for whom activity status was not reported. The last group has been prorated to

* The material for this chapter was provided by the Public Health Service, Division of Nursing, Manpower Analysis and Resources Branch–Dr. Eugene Levine, Chief.

[30] Marshall, E. D. and Moses, E. B.: *The Nation's Nurses; The 1962 Inventory of Professional Registered Nurses.* New York. American Nurses' Association, 1965.

arrive at the national estimate of 550,000 nurses in practice in table 81.

A license is required to practice professional nursing in all States, the District of Columbia, Guam, Puerto Rico, and the Virgin Islands.[31] For licensure as a registered nurse (R.N.), an applicant must have graduated from a school approved by the State board of nursing and pass a State board examination.

Graduation from high school is required for admission to all schools of nursing. There are three alternative basic programs of professional nursing education. Diploma programs are conducted by hospital schools, and usually require 3 years of training; associate degree programs in community colleges are approximately 2 years in length; baccalaureate programs usually require 4 years of study in a college or university, although a few require 5 years.[32] In October 1965, 1,191 schools offered 1,193 programs in which 135,702 students were enrolled. The 1964-65 graduates totaled 34,686, of whom 77 percent were graduated from diploma programs. The number of baccalaureates has increased to 5,381 from 3,156 in 1955-56 (tables 82 and 83).

The American Nurses' Association, with 159,101 members, is the professional organization for individuals in this health field.

Practical Nurses

Practical nurses, also known as vocational nurses, provide nursing care and treatment of patients under the supervision of a professional nurse. They are expected to utilize appropriate and safe nursing techniques in providing such treatments as drainage, irrigation, catheterization, routine medication if permitted by the institution, and in taking and recording temperature, pulse, respiration and blood pressure. They may assist with the supervision of nursing aides, orderlies, and attendants.

Practical nurses employed in the United States numbered about 282,000 as of January 1, 1966, according to Public Health Service Division of Nursing estimates. The growth in employment has been rapid, increasing from the census enumerations of 137,500 in 1950 and 206,000 in 1960 (tables 84 and 85).

The majority of practical nurses work in hospitals, clinics, homes for the aged, and nursing homes. In 1964 an estimated 128,800 were employed in AHA registered hospitals, with 114,100 working full-time and 14,700 part-time. Many others are employed in private homes. Most of the remainder work in doctors' offices, schools, and public health agencies. In 1964, 569 licensed practical nurses were employed in public health work under the supervision of public health staff nurses.[31]

Since 1960, licensure of practical nurses has been provided for by law in the 50 States, the District of Columbia, Guam, Puerto Rico, Samoa, and the Virgin Islands. For licensure as a licensed practical nurse (L.P.N.), or licensed vocational nurse (L.V.N.) in California and Texas, an applicant now must graduate from a State-approved school of practical nursing and pass a State board examination. Licensure by waiver of the educational requirements is no longer permitted in most States.

Requirements for admission to a practical nursing school program vary. In most States the applicants are required to have completed at least 2 years of high school; a few States require a high school diploma. The training usually lasts 12 to 18 months and may be obtained in trade, technical, or vocational schools operated by public school systems or in private schools controlled by hospitals, health agencies, or colleges. As of October 15, 1964, 913 programs of practical nursing education were approved by the State agencies.[33] Reports from 881 programs indicated 34,131 admissions and 22,761 graduates in 1963-64 (tables 86 and 87).

The National Federation of Licensed Practical Nurses, with 28,000 members, is the association for individuals in this health field.

[31] American Nurses' Association: *Facts About Nursing; A Statistical Summary.* New York, 1966. Also prior annual editions.

[32] National League for Nursing: *State Approved Schools of Professional Nursing.* New York, 1965. Published annually.

[33] National League for Nursing: *State Approved Schools of Practical and Vocational Nursing.* New York, 1965. Published annually.

Aides, Orderlies, and Attendants

Approximately 500,000 persons were employed as auxiliary nursing workers in hospitals and nursing homes in 1965. They function as assistants to nurses in providing many services related to the comfort and welfare of patients. *Nursing aides*, usually women, assist professional and practical nurses by performing less skilled tasks in the care of patients. *Orderlies* and *attendants*, usually men, assist by performing a variety of duties for male patients and certain heavy duties in the care of the physically ill, mentally ill, and mentally retarded.

Earlier reports of the numbers of attendants in hospitals and other institutions are available from the decennial censuses—205,246 persons employed in 1950 and 391,800 in 1960 (table 88). Based on data from the American Hospital Association, these numbers have been revised to about 221,000 and 375,000, respectively. Data on auxiliary nursing personnel in hospitals have not been collected as a part of the American Hospital Association's Annual Survey of Hospitals since 1959. A survey to provide later data was conducted in 1966.

The number of auxiliary workers employed in 1962 was estimated at 410,000 by the Public Health Service Division of Nursing. Of these, more than 400,000 were employed in hospitals, including as many as 101,000 working as *psychiatric aides* in mental institutions.

On-the-job training programs provided by hospitals and clinics may include classroom instruction, demonstration, and practice taught by a professional nurse. There are no definite educational requirements. The training programs may cover several months, depending on the hospital. Psychiatric aides are licensed in three States—Arkansas, California, and Michigan.

There is no national association that identifies individuals employed as aides, orderlies, and attendants.

Home Health Aides and Homemakers

Home health aides—also called home aides or visiting health aides—provide supportive services which are required to provide and maintain normal bodily and emotional comfort and to assist the patient toward independent living in a safe environment. The services are given under the supervision of a nurse, or, when appropriate, of a physical, speech, or occupational therapist. The home health aide may help the patient with his bath and with the care of mouth, skin, and hair; getting in and out of bed; getting to the bathroom or using a bedpan; with prescribed exercises; to relearn household skills; with eating and preparing meals; and with medications that are ordinarily self-administered. She may perform those household services which will facilitate the patient's health care at home and are necessary to prevent or postpone institutionalization. Most *homemakers* also provide these services, although some provide care and assistance to families and individuals in times of stress resulting from problems other than illness.

The total number of home health aides and homemakers has increased from about 500 employed in 1950, to 2,300 in 1960, to 3,900 in 1963, and probably exceeded 6,000 in 1965. More than 500 public or voluntary nonprofit agencies provide organized community programs with home health aide-homemaker services.[34]

Home health aides are often recruited from persons who have had little formal education and no health training. The employing agency is responsible for on-the-job training, with a nurse providing the basic and on-going training in personal care services and with other health personnel involved in their appropriate aspects. A State license is not required for persons providing homemaker services.

---

[34] Doscher, V.R.: *Report of the 1964 National Conference on Homemaker Services.* New York. National Council for Homemaker Services, 1964. Also correspondence with the Council which is the organization for agencies that provide homemaker services.

Table 79. PROFESSIONAL NURSES IN RELATION TO POPULATION: SELECTED YEARS, 1950 THROUGH 1966

Year	Resident population in thousands	Number of nurses in practice			Nurses per 100,000 population
		Total	Full-time	Part-time	
1966 [1]	194,899	621,000	----------	----------	319
1964 [1]	190,169	582,000	450,000	132,000	306
1962 [1]	184,598	550,000	433,000	117,000	298
1960 [1]	178,729	504,000	414,000	90,000	282
1958	171,922	460,000	----------	----------	268
1956	165,931	430,000	----------	----------	259
1954	159,825	401,600	----------	----------	251
1950	150,697	375,000	335,000	40,000	249

[1] In 50 States and the District of Columbia.

Sources: Interagency Conference on Nursing Statistics for 1954–1966 estimates; U.S. Bureau of the Census for 1950 data on nurses (adjusted). U.S. Bureau of the Census: Population estimates. *Current Population Reports*. Series P–25, No. 327, Feb. 1966.

Table 80. FIELD OF PRACTICE OF PROFESSIONAL NURSES: JANUARY 1, 1964

Field of practice	Number of nurses	Percent of total
Total	582,000	100.0
Hospitals, nursing homes, and related institutions	[1] 390,400	67.1
Private practice	66,000	11.3
Office	47,000	8.1
Public health and school	37,200	6.4
Occupational health	18,700	3.2
Professional nursing education	17,600	3.0
Practical nursing education	3,100	0.5
Other fields	2,000	0.4

[1] Includes about 9,000 nurse anesthetists.

Source: Interagency Conference on Nursing Statistics, 1964.

Table 81. LOCATION OF ACTIVE PROFESSIONAL NURSES IN RELATION TO POPULATION: 1962

Location	Resident population in thousands [1]	Distribution A [2]		Distribution B [3]	
		Number of nurses	Nurses per 100,000 population	Number of nurses	Nurses per 100,000 population
United States	184,598	550,000	298	552,894	298
Alabama	3,317	5,224	157	5,252	158
Alaska	242	694	287	696	288
Arizona	1,486	4,972	335	4,984	335
Arkansas	1,842	2,219	120	2,223	121
California	17,029	55,240	324	55,739	327
Colorado	1,893	7,005	370	7,034	372
Connecticut	2,625	11,537	440	11,565	440
Delaware	467	1,828	391	1,836	393
District of Columbia	789	4,148	526	4,172	529
Florida	5,434	16,432	302	16,809	309
Georgia	4,083	7,924	194	7,942	194
Hawaii	693	1,998	288	2,002	289
Idaho	700	1,932	276	1,935	276
Illinois	10,098	29,371	291	29,450	292
Indiana	4,663	11,575	248	11,632	249
Iowa	2,774	8,874	320	8,926	322
Kansas	2,215	6,281	284	6,293	284
Kentucky	3,084	5,382	175	5,392	175
Louisiana	3,371	6,681	198	6,695	199
Maine	978	3,630	371	3,658	374
Maryland	3,233	7,949	246	7,976	247
Massachusetts	5,188	26,032	502	26,693	514
Michigan	8,029	21,322	266	21,465	267
Minnesota	3,461	13,285	384	13,300	384
Mississippi	2,261	3,203	142	3,213	142
Missouri	4,316	9,505	220	9,562	222
Montana	697	2,433	349	2,438	350
Nebraska	1,446	4,624	320	4,630	320
Nevada	350	917	262	922	263
New Hampshire	622	3,056	491	3,074	494
New Jersey	6,357	22,101	348	22,141	348
New Mexico	997	2,126	213	2,134	214
New York	17,498	67,830	388	67,932	388
North Carolina	4,704	10,876	231	10,889	231
North Dakota	633	2,153	340	2,156	341
Ohio	10,038	29,569	295	29,599	295
Oklahoma	2,448	4,000	163	4,008	164
Oregon	1,807	6,285	348	6,297	348
Pennsylvania	11,382	42,222	371	42,501	373
Rhode Island	878	3,473	396	3,488	397
South Carolina	2,448	5,244	214	5,254	215
South Dakota	721	1,948	270	1,957	271
Tennessee	3,652	6,473	177	6,497	178
Texas	10,122	17,448	172	17,485	173
Utah	958	2,245	234	2,249	235
Vermont	387	1,722	445	1,732	448
Virginia	4,248	9,998	235	10,016	236
Washington	3,010	10,148	337	10,168	338
West Virginia	1,796	4,455	248	4,461	248
Wisconsin	4,019	13,333	332	13,342	332
Wyoming	332	1,078	325	1,080	325

[1] State population as of July 1, from U.S. Bureau of the Census, Population estimates, *Current Population Reports*, Series P–25, No. 273, Oct. 1963; U.S. total as of January 1.

[2] A portion of the 32,594 nurses not answering the question on activity status in the 1962 Inventory were presumed to be active in adjusting the total to conform with the 550,000 national estimate of the Interagency Conference on Nursing Statistics.

[3] All 32,594 nurses not answering the question on activity status in the 1962 Inventory were presumed to be active.

Sources: Divisions of Public Health Methods, Dental Public Health and Resources, and Nursing: Manpower in the 1960's. *Health Manpower Source Book 18*. PHS Pub. No. 263, Section 18. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1964.
Marshall, E. D. and Moses, E. B.: *The Nation's Nurses; The 1962 Inventory of Professional Registered Nurses*. New York. American Nurses' Association, 1965.

Table 82. SCHOOLS OF PROFESSIONAL NURSING, STUDENTS, AND GRADUATES: 1955–56 THROUGH 1965–66

Academic year	Schools	Students [1]	Graduates			
			Total	Diploma	Associate degree	Bachelor's degree
1965–66	1,191	135,702	----------	----------	----------	----------
1964–65	1,153	129,269	34,686	26,795	2,510	5,381
1963–64	1,142	124,744	35,259	28,238	1,962	5,059
1962–63	1,128	123,861	32,398	26,438	1,479	4,481
1961–62	1,118	123,012	31,186	25,727	1,159	4,300
1960–61	1,123	118,849	30,267	25,311	917	4,039
1959–60	1,119	115,057	30,113	25,188	789	4,136
1958–59	1,126	113,518	30,312	25,907	462	3,943
1957–58	1,118	112,989	30,410	26,314	425	3,671
1956–57	1,115	114,674	29,933	26,141	276	3,516
1955–56	1,125	114,423	30,236	26,828	252	3,156

[1] Fall enrollment at beginning of academic year.

Source: American Nurses' Association: *Facts About Nursing; A Statistical Summary*. New York, 1966. Published annually. Data for United States and Puerto Rico.

Table 83. LOCATION OF SCHOOLS OF PROFESSIONAL NURSING AND NUMBERS OF STUDENTS AND GRADUATES: 1964

Location	Schools	Students [1]	Graduates [2]			
			Total	Diploma	Associate degree	Bachelor's degree
All locations	1,153	129,269	35,259	28,238	1,962	5,059
Alabama	14	1,397	328	277	—	51
Alaska	—	—	—	—	—	—
Arizona	7	968	179	97	39	43
Arkansas	6	535	141	131	—	10
California	62	6,770	1,613	615	677	321
Colorado	12	1,320	264	161	24	79
Connecticut	20	2,647	765	665	—	100
Delaware	7	394	116	116	—	—
District of Columbia	7	972	224	156	—	68
Florida	22	2,291	578	239	172	167
Georgia	19	2,457	636	565	34	37
Hawaii	4	392	70	46	—	24
Idaho	4	259	70	16	46	8
Illinois	70	7,722	2,212	2,033	14	165
Indiana	27	3,216	810	644	35	131
Iowa	25	2,461	735	645	—	90
Kansas	19	1,507	478	424	—	54
Kentucky	20	1,413	301	251	—	50
Louisiana	13	1,592	371	264	—	107
Maine	6	654	203	184	—	19
Maryland	20	2,860	659	564	—	95
Massachusetts	60	7,189	1,893	1,694	27	172
Michigan	32	5,090	1,301	922	147	232
Minnesota	27	3,787	1,251	992	—	259
Mississippi	11	603	137	102	19	16
Missouri	28	3,436	919	808	19	92
Montana	5	551	116	58	31	27
Nebraska	14	1,632	413	347	—	66
Nevada	1	86	7	—	—	7
New Hampshire	10	733	189	172	—	17
New Jersey	38	3,991	1,136	1,021	71	44
New Mexico	2	148	48	26	—	22
New York	132	15,201	4,518	3,471	347	700
North Carolina	34	2,995	732	551	21	160
North Dakota	9	825	199	147	—	52
Ohio	58	7,920	2,336	2,006	—	330
Oklahoma	11	793	187	166	—	21
Oregon	5	987	261	150	—	111
Pennsylvania	105	13,078	3,768	3,581	30	157
Puerto Rico	8	840	209	203	—	6
Rhode Island	7	1,022	370	339	—	31
South Carolina	11	1,053	281	245	15	21
South Dakota	11	875	280	233	7	40
Tennessee	17	1,774	487	404	16	67
Texas	34	2,654	747	477	34	236
Utah	7	658	149	66	33	50
Vermont	5	497	141	76	28	37
Virginia	28	2,399	718	591	14	113
Washington	19	1,977	469	284	42	143
West Virginia	16	1,247	302	238	20	44
Wisconsin	23	3,270	923	775	—	148
Wyoming	1	131	19	—	—	19

[1] Fall enrollment 1964. [2] Academic year 1963–64.

Source: National League for Nursing: *State-Approved Schools of Professional Nursing.* New York, 1965. Published annually.

Table 84. PRACTICAL NURSES IN RELATION TO POPULATION: SELECTED YEARS, 1950 THROUGH 1966

Year	Resident population in thousands	Number of nurses in practice		Nurses per 100,000 population
		Total	In A.H.A. registered hospitals	
1966	194,899	282,000	----------	145
1964	190,169	250,000	128,800	131
1962	184,598	225,000	126,825	122
1960	179,323	206,000	----------	115
1950	151,326	137,500	49,800	91

Sources: U.S. Public Health Service Division of Nursing's estimates of practical nurses employed in 1962–66. U.S. Bureau of the Census data for 1950 and 1960.
U.S. Bureau of the Census: Population estimates. *Current Population Reports.* Series P–25, No. 327, Feb. 1966.

Table 85. LOCATION OF ACTIVE PRACTICAL NURSES IN RELATION TO POPULATION: 1960

Location	Resident population in thousands	Number of nurses [1]	Nurses per 100,000 population
United States	179,323	205,974	115
Alabama	3,267	3,617	111
Alaska	226	118	52
Arizona	1,302	1,205	93
Arkansas	1,786	2,010	113
California	15,717	18,619	118
Colorado	1,754	2,603	148
Connecticut	2,535	2,800	110
Delaware	446	471	106
District of Columbia	764	1,749	229
Florida	4,952	5,046	102
Georgia	3,943	4,613	117
Hawaii	633	952	150
Idaho	667	1,017	152
Illinois	10,081	8,440	84
Indiana	4,662	3,896	84
Iowa	2,758	2,863	104
Kansas	2,179	2,527	116
Kentucky	3,038	2,775	91
Louisiana	3,257	3,521	108
Maine	969	1,548	160
Maryland	3,101	2,847	92
Massachusetts	5,149	11,339	220
Michigan	7,823	11,864	152
Minnesota	3,414	3,948	116
Mississippi	2,178	2,592	119
Missouri	4,320	5,862	136
Montana	675	742	110
Nebraska	1,411	1,895	134
Nevada	285	242	85
New Hampshire	607	922	152
New Jersey	6,067	4,870	80
New Mexico	951	770	81
New York	16,782	15,191	91
North Carolina	4,556	3,967	87
North Dakota	632	522	83
Ohio	9,706	11,615	120
Oklahoma	2,328	3,838	165
Oregon	1,769	2,656	150
Pennsylvania	11,319	13,125	116
Rhode Island	859	1,118	130
South Carolina	2,383	1,610	68
South Dakota	681	605	89
Tennessee	3,567	4,381	123
Texas	9,580	13,386	140
Utah	891	801	90
Vermont	390	679	174
Virginia	3,967	3,960	100
Washington	2,853	4,597	161
West Virginia	1,860	1,892	102
Wisconsin	3,952	3,503	89
Wyoming	330	245	74

[1] Census data on employed practical nurses—the latest available by State.

Source: U.S. Bureau of the Census: *U.S. Census of Population: 1960. Detailed Characteristics: United States Summary.* Series PC(1)–1D to 52D. Washington. U.S. Government Printing Office, 1963.

Table 86. PROGRAMS OF PRACTICAL NURSE TRAINING, ADMISSIONS, AND GRADUATES: 1953–54 THROUGH 1963–64

Academic year	Approved programs	Reporting programs	Admissions	Graduates
1963–64	913	881	34,131	22,761
1962–63	851	810	30,585	19,621
1961–62	739	707	26,660	18,106
1960–61	693	660	24,955	16,635
1959–60	661	632	23,060	16,491
1958–59	607	595	23,116	14,573
1957–58	520	511	20,531	12,407
1956–57	439	432	16,843	10,666
1955–56	396	396	15,526	10,641
1954–55	395	361	15,440	9,694
1953–54	296	290	12,075	7,109

Source: American Nurses' Association: *Facts About Nursing; A Statistical Summary.* New York, 1966. Also prior annual editions. Data for United States, Puerto Rico, and other U.S. outlying areas.

Table 87. LOCATION OF PROGRAMS OF PRACTICAL NURSING AND NUMBERS OF ADMISSIONS AND GRADUATES: 1963–64

Location	Approved programs	Admissions	Graduates	Location	Approved programs	Admissions	Graduates
All locations	913	34,131	22,761				
United States	901	33,665	22,510				
Alabama	12	540	400	Nevada	7	104	88
Alaska	1	48	16	New Hampshire	4	89	60
Arizona	5	232	85	New Jersey	24	832	570
Arkansas	14	398	345	New Mexico	5	194	156
California	55	2,354	1,393	New York	77	3,769	2,242
Colorado	14	387	270	North Carolina	26	744	554
Connecticut	6	240	146	North Dakota	3	231	135
Delaware	3	78	35	Ohio	29	1,660	1,098
District of Columbia	5	266	265	Oklahoma	12	313	247
Florida	28	992	647	Oregon	10	283	205
Georgia	32	659	340	Pennsylvania	35	1,829	1,200
Hawaii	1	83	47	Rhode Island	3	150	108
Idaho	17	164	166	South Carolina	18	297	248
Illinois	29	1,535	846	South Dakota	3	112	83
Indiana	11	506	379	Tennessee	9	773	683
Iowa	14	403	349	Texas	138	3,183	2,176
Kansas	5	307	273	Utah	3	168	93
Kentucky	12	443	325	Vermont	3	150	102
Louisiana	13	517	300	Virginia	33	760	461
Maine	4	126	94	Washington	24	986	671
Maryland	14	393	222	West Virginia	8	273	178
Massachusetts	31	1,311	894	Wisconsin	8	615	402
Michigan	28	1,929	1,251	Wyoming	2	40	26
Minnesota	23	882	716				
Mississippi	13	315	244	American Samoa	1	30	13
Missouri	16	642	462	Puerto Rico	9	427	221
Montana	7	157	86	Virgin Islands	2	9	17
Nebraska	4	203	128				

Source: National League for Nursing: *State-Approved Schools of Practical and Vocational Nursing.* New York, 1965. Published annually.

Table 88. LOCATION OF ATTENDANTS EMPLOYED IN HOSPITALS AND OTHER INSTITUTIONS IN RELATION TO POPULATION: APRIL 1, 1960

Location	Number of attendants employed [1]	Rate per 100,000 population	Location	Number of attendants employed [1]	Rate per 100,000 population
United States	391,800	218.5			
Alabama	5,818	178.1	Missouri	10,335	239.2
Alaska	213	94.2	Montana	1,934	286.5
Arizona	2,193	168.4	Nebraska	4,691	332.5
Arkansas	3,473	194.5	Nevada	393	137.9
California	22,887	145.6	New Hampshire	1,314	216.5
Colorado	4,226	240.9	New Jersey	11,314	186.5
Connecticut	6,316	249.2	New Mexico	1,581	166.2
Delaware	1,121	251.3	New York	54,749	326.2
District of Columbia	2,944	385.3	North Carolina	7,111	156.1
Florida	9,531	192.5	North Dakota	2,172	343.7
Georgia	6,557	166.3	Ohio	22,212	228.8
Hawaii	672	106.2	Oklahoma	5,525	237.3
Idaho	1,093	163.9	Oregon	4,615	260.9
Illinois	23,241	230.5	Pennsylvania	21,243	187.7
Indiana	10,590	227.2	Rhode Island	2,034	236.8
Iowa	8,801	319.1	South Carolina	3,407	143.0
Kansas	7,356	337.6	South Dakota	2,137	313.8
Kentucky	5,598	184.3	Tennessee	6,609	185.3
Louisiana	5,938	182.3	Texas	13,560	141.5
Maine	1,958	202.1	Utah	1,841	206.6
Maryland	7,198	232.1	Vermont	1,051	269.5
Massachusetts	10,650	206.8	Virginia	8,076	203.6
Michigan	18,395	235.1	Washington	6,198	217.2
Minnesota	11,252	329.6	West Virginia	3,670	197.3
Mississippi	2,931	134.6	Wisconsin	12,177	308.1
			Wyoming	899	272.4

[1] Census data—the latest available by State; U.S. Bureau of the Census, U.S. Census of Population: 1960, Detailed Characteristics, Series PC (1)-1D to 52D.

Source: Prindle, R. A. and Pennell, M. Y.: Industry and occupation data from the 1960 census, by State. *Health Manpower Source Book 17.* PHS Pub. No. 263, Section 17. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1963.

CHAPTER 21

Occupational Therapy

Occupational therapy is the use of purposeful activity as treatment in the rehabilitation of persons with physical or emotional disability. The occupational therapist, as a vital member of the rehabilitation team, determines the objectives of the treatment program according to the individual needs of each patient. This may include decreasing disability during the patient's initial phases of recovery following injury or illness, increasing the individual's capability for independence and his physical, emotional and social well-being, and developing total function to a maximum level through early evaluation and experimentation for future job training and employment.

The number of persons employed as *occupational therapists* has increased from about 2,000 in 1950 to upwards of 6,000 in 1965 (table 89). About three-fourths of the occupational therapists work in hospitals, with large numbers in Federal installations. Others are employed in rehabilitation centers, nursing homes and homes for the aged, schools and camps for handicapped children, and teaching and research institutions.

Thirty-two colleges and universities offer accredited courses leading to a B.A. or B.S. degree with a major in occupational therapy. Fourteen of these also offer shorter courses for qualified college graduates, leading to a certificate of proficiency in occupational therapy. In the fall of 1965 a total of 594 seniors and post-baccalaureate students were enrolled in their final academic year (tables 90 and 91).

In addition to the academic work, a minimum of 6 months of supervised clinical practice in health facilities or agencies is required to complete professional education and to qualify for admission to the national examination conducted by the American Occupational Therapy Association for professional registration. In the fall of 1965, 434 students were enrolled in clinical practice. During the calendar year 1964, 471 were graduated as occupational therapists and the number is expected to increase to 550 in 1965.

The occupational therapist may have the help of an *occupational therapy assistant* in carrying out the program of rehabilitating patients in hospitals and other health care facilities. The assistant's duties include direct participation in the patient's activities. No estimate of the numbers of assistants (technicians) currently employed is available.

Twelve occupational therapy assistant training programs for high school graduates are now being conducted by hospitals and health agencies (table 92). Graduates are eligible for certification as an occupational therapy assistant and membership in the American Occupational Therapy Association. As of June 1965, 386 persons had been so certified. An additional 485 who were qualified under the "grandfather clause" which expired in 1963 brought the total to 871.

Trained volunteers also play an important part in occupational therapy services. Professional artists, musicians, and others lend their abilities and special talents to assist the therapist in providing a well-rounded program for patients.

Table 89. LOCATION OF REGISTERED OCCUPATIONAL THERAPISTS: 1965

Location [1]	Number of OTR's
All locations	[2] 7,390
United States	7,184
Alabama	29
Alaska	6
Arizona	54
Arkansas	17
California	1,172
Colorado	152
Connecticut	140
Delaware	30
District of Columbia	60
Florida	121
Georgia	47
Hawaii	86
Idaho	9
Illinois	409
Indiana	136
Iowa	69
Kansas	111
Kentucky	45
Louisiana	38
Maine	24
Maryland	189
Massachusetts	307
Michigan	440
Minnesota	271
Mississippi	13
Missouri	149
Montana	16
Nebraska	45
Nevada	7
New Hampshire	54
New Jersey	224
New Mexico	30
New York	785
North Carolina	59
North Dakota	25
Ohio	287
Oklahoma	22
Oregon	71
Pennsylvania	330
Rhode Island	21
South Carolina	18
South Dakota	18
Tennessee	32
Texas	232
Utah	15
Vermont	12
Washington	191
Virginia	165
West Virginia	18
Wisconsin	378
Wyoming	5
Puerto Rico	43
Armed Forces overseas	45
Foreign	118

[1] Based on mailing addresses of living registered occupational therapists.

[2] Probably 2,000 or more are currently not in practice. This estimate is based on the 1965 membership of the American Occupational Therapy Association which includes 3,312 active and 1,926 nonpracticing OTR's.

Source: American Occupational Therapy Association.

Table 90. SCHOOLS OFFERING ACCREDITED COURSES IN OCCUPATIONAL THERAPY, STUDENTS, AND GRADUATES: 1960 THROUGH 1965

Year	Schools	Seniors and post-baccalaureate students [1]	Students in clinical practice [2]	Graduates [3]
1965	32	594	434	[4] 550
1964	32	537	491	471
1963	32	578	407	364
1962	31	501	332	302
1961	31	439	270	355
1960	31	372	328	414

[1] October enrollment of undergraduate students in 4th year of O.T. degree program and 5th year for students with degree in other than O.T.

[2] October enrollment in internship following 4th year for degree students and 5th year for post-degree students.

[3] Calendar year data on graduates with at least 4 years of academic education and a period of clinical practice which qualified them for professional registration upon successful completion of the national examination conducted by the American Occupational Therapy Association.

[4] Estimated.

Sources: American Occupational Therapy Association.
Council on Medical Education: Education Number of the *J.A.M.A.* Chicago. American Medical Association Annual issues. Data for United States and Puerto Rico.

Table 91. LOCATION AND OWNERSHIP OF SCHOOLS OFFERING ACCREDITED COURSES IN OCCUPATIONAL THERAPY AND NUMBERS OF STUDENTS AND GRADUATES: 1964–65

Location	School	Ownership	Seniors and post-baccalaureate students [1]	Students in clinical practice [2]	Graduates [3]
	Total, 32 schools		594	434	471
Calif.	Loma Linda University, Loma Linda	Private	3	10	8
	San Jose State College, San Jose	Public	56	32	38
	University of Southern California, Los Angeles	Private	19	14	10
Colo.	Colorado State University, Fort Collins	Public	39	21	18
Fla.	University of Florida, College of Health Related Professions, Gainesville	Public	15	16	13
Ill.	University of Illinois, College of Medicine, Chicago	Public	—	28	12
Ind.	Indiana University, School of Medicine, Indianapolis	Public	15	7	6
Iowa	University of Iowa, Iowa City	Public	13	12	9
Kans.	University of Kansas, Kansas City-Lawrence	Public	24	15	16
Mass.	Boston University, Sargent College, Boston	Private	11	5	—
	Tufts University, Boston School of Occupational Therapy, Boston	Private	15	27	18
Mich.	Eastern Michigan University, Ypsilanti	Public	11	10	11
	Wayne State University, School of Medicine, Detroit	Public	28	12	17
	Western Michigan University, Kalamazoo	Public	33	26	31
Minn.	College of St. Catherine, St. Paul	Private	16	13	23
	University of Minnesota, School of Medical Science, Minneapolis	Public	21	—	22
Mo.	Washington University, School of Medicine, St. Louis	Private	11	—	13
N.H.	University of New Hampshire, Durham	Public	23	25	21
N.Y.	Columbia University, College of Physicians and Surgeons, New York	Private	25	24	20
	New York University, School of Education, New York	Private	20	6	8
	State University of New York, SUNY at Buffalo, Buffalo	Public	12	10	5
N. Dak.	University of North Dakota, Grand Forks	Public	10	8	15
Ohio	Ohio State University, College of Medicine, Columbus	Public	27	11	18
Pa.	University of Pennsylvania, School of Allied Medical Professions, Philadelphia School of Occupational Therapy, Philadelphia	Private	19	22	13
P.R.	University of Puerto Rico, School of Medicine, School of Physical and Occupational Therapy, Rio Piedras	Public	12	4	11
Tex.	Texas Woman's University, Denton	Public	20	19	20
Va.	Richmond Professional Institute, School of Occupational Therapy, Richmond	Public	21	15	18
Wash.	University of Puget Sound, School of Occupational Therapy, Tacoma	Private	20	7	16
	University of Washington, School of Medicine, Seattle	Public	12	5	3
Wis.	Lawrence University, Appleton	Private	4	3	5
	Mount Mary College, Milwaukee	Private	22	12	17
	University of Wisconsin, Madison	Public	17	15	16

[1] October 1965 enrollment of undergraduate students in 4th year of O.T. degree program and 5th year for students with degree in other than O.T.

[2] October 1965 enrollment in internship following 4th year for degree students and 5th year for post-degree students.

[3] Calendar year 1964 data on graduates with at least 4 years of academic education and a period of clinical practice which qualifies them for professional registration upon successful completion of the national examination conducted by the American Occupational Therapy Association.

Source: American Occupational Therapy Association.

Table 92. LOCATION AND OWNERSHIP OF TRAINING PROGRAMS FOR OCCUPATIONAL THERAPY ASSISTANTS, TYPE OF PROGRAM, AND NUMBER OF GRADUATES: 1965

Location	Sponsoring agency or institution [1]	Ownership	Type of program	Graduates
	Total, 12 programs			200
Colo.	Colorado State Hospital, Pueblo	Public	Psychiatry	13
Ill.	Senior Centers of Metropolitan Chicago, Occupational Therapy Assistants' Project	Public	General practice	28
Md.	Maryland State Department of Health Program for Occupational Therapy Assistants, Baltimore	Public	General practice	24
Mass.	Boston State Hospital, Boston	Public	Psychiatry	8
Minn.	Occupational Therapy Assistants School, Board of Education of the City of Duluth	Public	General practice	28
	St. Mary's Junior College, Minneapolis [2]	Private	Combined program, all areas	16
N.Y.	Marcy State Hospital, Marcy	Public	Psychiatry	9
	Rockland State Hospital, Orangeburg	Public	Psychiatry	12
Pa.	Mount Aloysius Junior College, Cresson	Private	General practice	7
P.R.	Commonwealth of Puerto Rico, Occupational Therapy Assistants' Course, Rio Piedras	Public	Combined program	15
Wis.	Wisconsin Department of Mental Hygiene, Mendota	Public	Psychiatry	14
	Wisconsin State Board of Health, Occupational Therapy Assistants' Program, Madison	Public	General practice	26

[1] Programs endorsed by American Occupational Therapy Association.
[2] Awaiting endorsement survey.

Source: American Occupational Therapy Association.

CHAPTER 22

Orthopedic and Prosthetic Appliance Making

Orthopedic and prosthetic appliance makers fabricate and fit artificial limb substitutes to replace those lost or disabled through injury or disease. Working from a surgeon's or other physician's prescription, the *prosthetist* makes and fits artificial limbs, while the *orthotist* makes and fits orthopedic braces. The individual who fabricates the prosthesis or the brace may be certified in both prosthetics and orthotics.

Persons in this field work in privately-owned retail facilities, rehabilitation centers or hospital shops, or are employed by a government agency such as the Veterans' Administration. In a small shop the prosthetist and/or the orthotist may fabricate and fit both limbs and braces. In larger facilities, apprentices or technicians do the construction work, as differentiated from the adjustment and fitting by the specialist.

Orthopedic and prosthetic appliance makers generally are craftsmen who have received their training on the job. A 4-year apprenticeship is open to high school graduates in a facility certified by the American Board of Certification in Orthotics and Prosthetics. Completion of this course, passing the Board examination, and recommendations from at least three physicians lead to certification as a prosthetist and/or orthotist.

Special courses are also offered by several universities to persons with work experience in this field. The courses are from 2 to 4 weeks in duration and include the study of anatomy, biomechanics, engineering as related to prosthetic and orthotic appliances, and shop experience in prosthetic and orthotic construction. In addition to these short courses, one university—New York University—offers a 4-year course leading to a Bachelor of Science degree. Two junior colleges—Cerritos in Los Angeles and Chicago City Junior College—offer a 2-year associate degree program in prosthetics.

An estimated 3,300 persons were employed in 1965 as orthopedic and prosthetic appliance makers, according to the Vocational Rehabilitation Administration Division of Training. Included in this figure are 1,113 who have been certified by the American Board for Certification in Orthotics and Prosthetics. The membership of the American Orthotics and Prosthetics Association included 400 persons at the close of 1965.

CHAPTER 23

Pharmacy

Pharmacy is concerned with the discovery, standardization, manufacture, storage, distribution and dispensing of medicinal products and devices used in the prevention, diagnosis, and treatment of disease. Pharmacists are specialists in the science of drugs and regardless of where they practice or the specialty in which they are engaged, professional, legal, ethical, and economic considerations are involved. The manufacture, distribution, and dispensing of drugs and devices is carefully controlled by Federal and State laws and regulations.

About 118,000 *pharmacists* were actively engaged in this health profession in 1965. This estimate is based on State registrations as reported by the individual State boards to the National Association of Boards of Pharmacy. The American Pharmaceutical Association has 32,000 active members.

Pharmacy helpers who work under the direct supervision of the pharmacist are employed in some large hospital pharmacies as well as community pharmacies but no formal programs exist for their training. These persons and others engaged in the manufacture, storage, distribution, and sales of medicinal products and therapeutic devices are not considered in this chapter.

A pharmacist may dispense medicines on the prescription order of medical practitioners and may also provide many medicinal products which can be legally obtained without prescription. He may compound various drugs to form tablets, powders, capsules, ointments, solutions, and other dosage forms. He may serve as a drug information consultant to prescribers and provide the public with information on health matters. Many pharmacists in community pharmacies have sales and managerial duties in addition to their professional functions. Pharmacists in hospitals may also advise the medical staff on the selection and effects of drugs, make sterile solutions, buy medical supplies, teach in schools of nursing, and perform administrative duties. Pharmacists working for drug manufacturers and wholesalers may inform doctors and dentists about new drugs, distribute medicines to other pharmacists, or supervise the manufacture of pharmaceuticals. Others teach in colleges, conduct research, develop new drugs, write for pharmaceutical journals, or do administrative work.

The total number of State registrations as licentiates in pharmacy was 183,832 as of January 1, 1965. Of this number, 118,284 were pharmacists resident in the licensing State and in active practice (table 93). The balance includes 10,057 inactive State residents, about 38,561 out-of-State registrations, and 16,930 unknown as to activity status (in large part accounted for by lifetime certificates issued in the State of Michigan).

The number of practicing pharmacists in the United States was about 101,100 in 1950 and has increased by about 17,000 during the 15 years since then. However, the rate in relation to population has declined from 67.0 per 100,000 civilians in 1950 to 61.6 in 1965.

About 104,400 or 88 percent of the pharmacists who were active as of January 1, 1965 practiced in community pharmacies. Hospital pharmacies account for about 5,700; however, the American Society of Hospital Pharmacists estimates that a total of 9,000 to 10,000 pharmacists are practicing full or part time in hospitals. Pharmaceutical manufacturers and wholesalers account for 4,200; colleges of pharmacy, government, and other activities, the balance.

The requirements for a bachelor's degree from a college of pharmacy include at least 5 years of study beyond high school. Some schools require that as much as 2 years of the program be completed in an accredited college or university prior to admission. In 1965-66, 75 colleges of pharmacy in the

Table 93. LOCATION OF PHARMACISTS IN RELATION TO POPULATION: JANUARY 1, 1965

Location	Civilian population in thousands	Number of active pharmacists	Active pharmacists per 100,000 population
All locations	193,393	118,284	61.2
United States	190,789	117,432	61.6
Alabama	3,403	1,581	46.5
Alaska	220	83	37.7
Arizona	1 595	1,016	63.7
Arkansas	1,934	897	46.4
California	18,042	10,579	58.6
Colorado	1,949	1,725	88.5
Connecticut	2,779	2,396	86.2
Delaware	487	227	46.6
District of Columbia	800	821	102.6
Florida	5,704	3,679	64.5
Georgia	4,239	2,414	56.9
Hawaii	648	175	27.0
Idaho	689	461	66.9
Illinois	10,499	5,795	55.2
Indiana	4,839	2,976	61.5
Iowa	2,756	1,331	48.3
Kansas	2,192	1,284	58.6
Kentucky	3,124	1,474	47.2
Louisiana	3,461	2,308	66.7
Maine	975	407	41.7
Maryland	3,419	2,033	59.5
Massachusetts	5,329	4,500	84.4
Michigan	8,108	5,029	62.0
Minnesota	3,535	2,088	59.1
Mississippi	2,308	1,005	43.5
Missouri	4,389	2,693	61.4
Montana	697	389	55.8
Nebraska	1,467	984	67.1
Nevada	413	323	78.2
New Hampshire	652	355	54.4
New Jersey	6,695	3,631	54.2
New Mexico	999	582	58.3
New York	17,985	14,264	79.3
North Carolina	4,795	1,777	37.1
North Dakota	634	337	53.2
Ohio	10,134	6,287	62.0
Oklahoma	2,448	1,917	78.3
Oregon	1,875	1,226	65.4
Pennsylvania	11,459	8,225	71.8
Rhode Island	893	684	76.6
South Carolina	2,509	1,131	45.1
South Dakota	712	489	68.7
Tennessee	3,796	2,242	59.1
Texas	10,331	5,524	53.5
Utah	999	630	63.1
Vermont	409	158	38.6
Virginia	4,268	1,746	40.9
Washington	2,944	2,383	80.9
West Virginia	1,791	738	41.2
Wisconsin	4,121	2,148	52.1
Wyoming	339	285	84.1
Puerto Rico	2,605	852	32.7

Source: National Association of Boards of Pharmacy: *1965 Proceedings of the National Association of Boards of Pharmacy Licensure Statistics and Census of Pharmacy.* Chicago, 1965. Published annually.
U.S. Bureau of the Census: Population estimates as of Jan. 1, 1965 (special release).

United States and Puerto Rico offered degrees in the profession, 2 of which were not accredited by the American Council on Pharmaceutical Education. Reports from 74 schools indicated that 12,352 students were enrolled in the last three classes in the fall of 1965 and 3,360 were graduated during 1964-65 (tables 94 and 95).

A license to practice pharmacy is required in all States and the District of Columbia. To obtain a license, one must be graduated from an accredited pharmacy college, in most States have 1 year of internship experience, and pass a State board examination.

Table 94. SCHOOLS OF PHARMACY, STUDENTS, AND GRADUATES: 1958–59 THROUGH 1965–66

Academic year	Schools	Students [1]	Graduates
1965–66	[2] 75	12,352	----------
1964–65	[3] 76	11,968	3,360
1963–64	77	10,291	2,195
1962–63	77	10,632	4,163
1961–62	77	10,827	3,699
1960–61	77	13,606	3,438
1959–60	77	12,506	3,497
1958–59	77	12,273	3,686

[1] Enrollment data for the last 3 classes are shown because some colleges accept students only after 1 or 2 years of preprofessional education, hence only the last 3 years provide valid statistics for trends.

[2] Includes Hampden College and Ohio Northern which are not listed by the accrediting body, and the University of Puerto Rico for which data on students and graduates are not available for any years.

[3] Includes Loyola University of the South which was not listed by the accrediting body, had no graduates in 1965, and was closed June 30, 1965.

Source: American Association of Colleges of Pharmacy: Report on enrollment in schools and colleges of pharmacy first semester. Term or quarter 1965–66. Also, Report of degrees conferred . . . 1964–65. *Am. J. Pharmaceutical Ed.* 30(1), Feb. 1966. Published annually. Data for United States and Puerto Rico.

Table 95. LOCATION AND OWNERSHIP OF SCHOOLS OF PHARMACY, AND NUMBERS OF STUDENTS AND GRADUATES: 1965

Location	School	Ownership	Students	Graduates
	Total, 75 schools		12,352	3,360
Ala.	Auburn University School of Pharmacy, Auburn	Public	160	41
	Samford University (Howard College) Division of Pharmacy, Birmingham	Private	210	47
Ariz.	University of Arizona College of Pharmacy, Tucson	Public	151	32
Ark.	University of Arkansas School of Pharmacy, Little Rock	Public	131	29
Calif.	University of California School of Pharmacy, San Francisco	Public	238	65
	University of the Pacific School of Pharmacy, Stockton	Private	174	66
	University of Southern California School of Pharmacy, Los Angeles	Private	313	111
Colo.	University of Colorado School of Pharmacy, Boulder	Public	72	26
Conn.	University of Connecticut School of Pharmacy, Storrs	Public	174	62
D.C.	Howard University College of Pharmacy, Washington	Private	98	13
Fla.	Florida Agricultural and Mechanical University School of Pharmacy, Tallahassee	Public	38	8
	University of Florida College of Pharmacy, Gainesville	Public	224	56
Ga.	Southern College of Pharmacy of Mercer University, Atlanta	Private	114	27
	University of Georgia School of Pharmacy, Athens	Public	347	66
Idaho	Idaho State University College of Pharmacy, Pocatello	Public	101	27
Ill.	University of Illinois at the Medical Center College of Pharmacy, Chicago	Public	293	109
Ind.	Butler University College of Pharmacy, Indianapolis	Private	100	27
	Purdue University School of Pharmacy and Pharmacal Sciences, Lafayette	Public	329	100
Iowa	Drake University College of Pharmacy, Des Moines	Private	178	57
	University of Iowa College of Pharmacy, Iowa City	Public	139	33
Kans.	University of Kansas School of Pharmacy, Lawrence	Public	136	38
Ky.	University of Kentucky College of Pharmacy, Lexington	Public	130	24
La.	Northeast Louisiana State College School of Pharmacy, Monroe	Public	328	81
	Xavier University of Louisiana College of Pharmacy, New Orleans	Private	37	5
Md.	University of Maryland School of Pharmacy, Baltimore	Public	101	25
Mass.	Hampden College School of Pharmacy, Williamansett [1]	Private	----------	----------
	Massachusetts College of Pharmacy, Boston	Private	339	98
	Northeastern University College of Pharmacy, Boston	Private	96	—
Mich.	Ferris State College School of Pharmacy, Big Rapids	Public	257	59
	University of Michigan College of Pharmacy, Ann Arbor	Public	79	19
	Wayne State University College of Pharmacy, Detroit	Public	100	33
Minn.	University of Minnesota College of Pharmacy, Minneapolis	Public	185	63
Miss.	University of Mississippi School of Pharmacy, University	Public	198	53
Mo.	St. Louis College of Pharmacy, St. Louis	Private	223	81
	University of Missouri at Kansas City School of Pharmacy, Kansas City	Public	104	33
Mont.	University of Montana School of Pharmacy, Missoula	Public	97	23
Nebr.	Creighton University School of Pharmacy, Omaha	Private	126	26
	University of Nebraska College of Pharmacy, Lincoln	Public	147	37
N.J.	Rutgers, The State University College of Pharmacy, Newark	Public	158	58
N. Mex.	University of New Mexico College of Pharmacy, Albuquerque	Public	86	8
N.Y.	Albany College of Pharmacy of Union University, Albany	Private	241	81
	Brooklyn College of Pharmacy of Long Island University, Brooklyn	Private	274	83
	Columbia University College of Pharmacy of the City of New York, New York	Private	162	50
	Fordham University College of Pharmacy, Bronx	Private	133	55
	St. John's University College of Pharmacy, Jamaica	Private	153	55
	State University of New York School of Pharmacy, SUNY at Buffalo, Buffalo	Public	135	45
N.C.	University of North Carolina School of Pharmacy, Chapel Hill	Public	199	45
N. Dak.	North Dakota State University College of Pharmacy, Fargo	Public	222	51

Table 95. LOCATION AND OWNERSHIP OF SCHOOLS OF PHARMACY, AND NUMBERS OF STUDENTS AND GRADUATES: 1965—Continued

Location	School	Ownership	Students	Graduates
Ohio	Ohio Northern University School of Pharmacy, Ada [1]	Private	93	44
	Ohio State University College of Pharmacy, Columbus	Public	175	53
	University of Cincinnati College of Pharmacy, Cincinnati	Public	154	56
	University of Toledo College of Pharmacy, Toledo	Public	73	25
Okla.	Southwestern State College School of Pharmacy, Weatherford	Public	277	46
	University of Oklahoma College of Pharmacy, Norman	Public	208	31
Oreg.	Oregon State University School of Pharmacy, Corvallis	Public	190	67
Pa.	Duquesne University School of Pharmacy, Pittsburgh	Private	108	28
	Philadelphia College of Pharmacy and Science, Philadelphia	Private	325	92
	Temple University School of Pharmacy, Philadelphia	Private	184	66
	University of Pittsburgh School of Pharmacy, Pittsburgh	Private	104	42
P.R.	University of Puerto Rico College of Pharmacy, Rio Piedras [2]	Public	----------	----------
R.I.	University of Rhode Island College of Pharmacy, Kingston	Public	71	12
S.C.	Medical College of South Carolina School of Pharmacy, Charleston	Public	68	10
	University of South Carolina School of Pharmacy, Columbia	Public	128	31
S. Dak.	South Dakota State University College of Pharmacy, Brookings	Public	150	37
Tenn.	University of Tennessee College of Pharmacy, Memphis	Public	254	85
Tex.	Texas Southern University School of Pharmacy, Houston	Public	124	18
	University of Houston College of Pharmacy, Houston	Public	286	57
	University of Texas College of Pharmacy, Austin	Public	335	92
Utah	University of Utah College of Pharmacy, Salt Lake City	Public	106	28
Va.	Medical College of Virginia School of Pharmacy, Richmond	Public	197	32
Wash.	University of Washington College of Pharmacy, Seattle	Public	185	39
	Washington State University College of Pharmacy, Pullman	Public	94	26
W. Va.	West Virginia University School of Pharmacy, Morgantown	Public	101	25
Wis.	University of Wisconsin School of Pharmacy, Madison	Public	280	72
Wyo.	University of Wyoming College of Pharmacy, Laramie	Public	52	15

[1] Not listed by the accrediting body.
[2] Data are not available.
Source: American Association of Colleges of Pharmacy.

CHAPTER 24

Physical Therapy

Physical therapy is concerned with the restoration of function and the prevention of disability following disease, injury, or loss of a bodily part. The goal is to help the patient reach his maximum performance and to assume his due place in society while learning to live within the limits of his capabilities. The therapeutic properties of exercise, heat, cold, electricity, ultrasound, and massage are used to achieve this goal. Upon referral by a physician, the physical therapist evaluates the patient and plans the program which will be most effective.

The number of persons employed as *physical therapists* has increased from about 4,600 in 1950 to nearly 9,000 in 1960 and perhaps as many as 12,000 in 1965. This estimate of 12,000 persons employed in 1965 assumes that the 7,947 members of the American Physical Therapy Association who are in active practice constitute two-thirds of the labor force in this field (table 96). The majority work in hospitals while others are employed by rehabilitation centers, schools or societies for crippled children, and public health agencies.

A license is required to practice physical therapy in 48 States and the District of Columbia. To obtain a license, an applicant must have a degree or certificate from a school of physical therapy and pass a State board examination.

Forty-two colleges and universities offer programs leading to professional qualification in physical therapy under three plans of education: 39 have a 4-year bachelor's degree course for high school graduates and transfer students, 22 have a 12- or 16-months certificate course for students who hold a bachelor's degree in other than physical therapy, and 5 have a 2-year graduate program leading to a master's degree for students with bachelor's degrees and the requisite background. Within all plans, a minimum of 4 months of clinical education is scheduled during which physical therapy students are in clinical installations participating in the care of patients under the supervision of qualified physical therapists.

In the fall of 1964, a total of 955 students —680 seniors and about 275 post-baccalaureate students—were enrolled in their final academic year. During the calendar year 1964, 891 were graduated as clinical physical therapists (tables 97 and 98). An increased number of graduates are anticipated in the near future due to expanded college enrollment and to new courses in physical therapy now being developed at seven institutions.

The physical therapist may have the help of a *physical therapy aide* who works directly under supervision in carrying out the program of rehabilitating patients in hospitals and other health care facilities. The aide's duties include limited participation in the patient's activities. In-service training programs for aides are conducted by some hospitals and health agencies. Information on the number of aides (technicians) currently employed is not available.

Table 96. LOCATION OF PHYSICAL THERAPISTS WHO ARE MEMBERS OF THE AMERICAN PHYSICAL THERAPY ASSOCIATION: 1965

Location	Members active in practice	Members with part-time or no practice
All locations	7,947	2,454
United States	7,792	2,377
Alabama	55	15
Alaska	19	9
Arizona	69	29
Arkansas	23	6
California	1,211	385
Colorado	135	60
Connecticut	191	100
Delaware	32	9
District of Columbia	114	18
Florida	223	81
Georgia	81	23
Hawaii	50	7
Idaho	20	4
Illinois	433	102
Indiana	119	34
Iowa	111	21
Kansas	77	18
Kentucky	74	16
Louisiana	79	23
Maine	34	20
Maryland	123	56
Massachusetts	344	174
Michigan	273	77
Minnesota	148	42
Mississippi	32	4
Missouri	177	45
Montana	22	6
Nebraska	48	8
Nevada	21	3
New Hampshire	29	27
New Jersey	221	104
New Mexico	36	16
New York	730	210
North Carolina	152	29
North Dakota	21	3
Ohio	376	112
Oklahoma	73	14
Oregon	97	21
Pennsylvania	474	132
Rhode Island	40	19
South Carolina	47	16
South Dakota	25	2
Tennessee	76	19
Texas	372	69
Utah	36	8
Vermont	24	5
Virginia	142	43
Washington	201	49
West Virginia	38	7
Wisconsin	231	67
Wyoming	13	10
Puerto Rico	45	9
Armed Forces overseas	41	30
Foreign areas	69	38

Source: American Physical Therapy Association.

Table 97. INSTITUTIONS OFFERING APPROVED COURSES IN PHYSICAL THERAPY, STUDENTS, AND GRADUATES: 1960 THROUGH 1965

Year	Institutions	Seniors and post-baccalaureate students [1]	Graduates [2]
1965	42	----------	----------
1964	42	955	891
1963	42	930	757
1962	42	814	689
1961	42	727	----------
1960	41	767	----------

[1] October enrollment of undergraduate students in 4th year of P.T. degree program and 5th year for students with degree in other than P.T.

[2] Calendar year data on graduates with at least 4 years of academic education and a period of approximately 4 months of clinical practice.

Sources: American Physical Therapy Association.
Council on Medical Education: Education Number of the *J.A.M.A.* Chicago, American Medical Association. Annual issues.
Data for United States and Puerto Rico.

Table 98. LOCATION AND OWNERSHIP OF INSTITUTIONS OFFERING APPROVED COURSES IN PHYSICAL THERAPY, AND NUMBERS OF STUDENTS AND GRADUATES: 1964

Location	Institution	Ownership	Seniors [1]	Post-baccalaureate [2]	Graduates [3]
	Total, 42 institutions		680	275	[4] 891
Calif.	Childrens Hospital, School of Physical Therapy, Los Angeles	Private	x	x	13
	Loma Linda University, School of Physical Therapy, Loma Linda	Private	x		33
	Stanford University School of Medicine, Division of Physical Medicine, Palo Alto	Private	x	x	16
	University of California Medical Center, Curriculum in Physical Therapy, San Francisco	Public	x	x	30
	University of Southern California, Department of Physical Therapy, Los Angeles	Private	x	([5])	33
Colo.	University of Colorado School of Medicine, Curriculum in Physical Therapy, Denver	Public	x	x	21
Conn.	University of Connecticut, School of Physical Therapy, Storrs	Public	x		53
Fla.	University of Florida, College of Health Related Professions, Department of Physical Therapy, Gainesville	Public	x		8
Ill.	Northwestern University Medical School, Course in Physical Therapy, Chicago	Private	x	x	18
Ind.	Indiana University School of Medicine, Physical Therapy Program, Indianapolis	Public	x		26
Iowa	University of Iowa, Children's Hospital, Physical Therapy, Iowa City	Public		x[5]	20
Kans.	University of Kansas Medical Center, Section of Physical Therapy Education, Kansas City	Public	x	x	29
Md.	University of Maryland School of Medicine, Department of Physical Therapy, Baltimore	Public	x		10
Mass.	Boston University, Sargent College, Division of Physical Therapy, Boston	Private	x		32
	Northeastern University, Boston-Bouvè College, Department of Physical Therapy, Medford	Private	x		30
	Simmons College, Program in Physical Therapy, Boston	Private	x	x	15
Mich.	University of Michigan, Medical Center, Curriculum in Physical Therapy, Ann Arbor	Public	x	x	16
Minn.	Mayo Clinic, School of Physical Therapy, Rochester	Private	x	x	30
	University of Minnesota, Course in Physical Therapy, Minneapolis	Public	x		21
Mo.	St. Louis University, Department of Physical Therapy, St. Louis	Private	x		25
	University of Missouri, Medical Center, Curriculum in Physical Therapy, Columbia	Public	x	([6])	
	Washington University School of Medicine, Department of Physical Therapy, St. Louis	Public	x		13
N.Y.	Columbia University, College of Physicians and Surgeons, Courses in Physical Therapy, New York	Private	x	x	25
	Ithaca College, Albert Einstein College of Medicine, Division of Physical Therapy, Ithaca	Private	x		21
	New York University, School of Education, Physical Therapy Curriculum, New York	Private	x	x[5]	25
	Russell Sage College, Albany Medical College, School of Physical Therapy, Albany	Private	x	x	7
	State University of New York, SUNY at Buffalo, Program in Physical Therapy, Buffalo	Public	x	x	17
N.C.	Duke University, Medical Center, Durham	Private	x	x[5]	13
	University of North Carolina, School of Medicine, Division of Physical Therapy, Chapel Hill	Public	x		11
					129

Table 98. LOCATION AND OWNERSHIP OF INSTITUTIONS OFFERING APPROVED COURSES IN PHYSICAL THERAPY, AND NUMBERS OF STUDENTS AND GRADUATES: 1964—Continued

Location	Institution	Ownership	Seniors [1]	Post-baccalaureate [2]	Graduates [3]
Ohio	Ohio State University, Curriculum in Physical Therapy, Columbus	Public	x	x	40
	Western Reserve University, Physical Therapy Curriculum, Cleveland	Private		([5])	2
Okla.	University of Oklahoma, Medical Center, School of Physical Therapy, Oklahoma City	Public	x		8
Pa.	D. T. Watson School of Physiatrics, Division of Physical Therapy, Leetsdale	Private	x	x	34
	University of Pennsylvania, Division of Physical Therapy, Philadelphia	Private	x	x	33
P.R.	University of Puerto Rico, School of Medicine, School of Physical Therapy and Occupational Therapy, Rio Piedras	Public	x		19
Tex.	Baylor University, Medical Center, School of Physical Therapy, Dallas	Private	x	x	14
	Medical Field Service School, Brooke Army Medical Center, Physical Therapy Course, Fort Sam Houston	Public		x	19
	University of Texas, Medical Branch, School of Physical Therapy, Galveston	Public	x	x	([7])
Va.	Medical College of Virginia, School of Physical Therapy, Richmond	Public	x	x	14
Wash.	University of Washington, Curriculum in Physical Therapy, Seattle	Public	x		7
Wis.	Marquette University, School of Medicine, Curriculum in Physical Therapy, Milwaukee	Private	x		20
	University of Wisconsin, Course in Physical Therapy, Madison	Public	x		37

[1] October 1964 enrollment of undergraduate students in 4th year of P.T. degree program. Data not available for individual institutions.
[2] October 1964 enrollment in 5th year for students with degree in other than P.T. Data not available for individual institutions.
[3] Calendar year 1964 data on graduates with at least 4 years of academic education and a period of approximately 4 months of clinical practice
[4] Includes 33 graduates of Hermann School of Physical Therapy, (Hermann Hospital, Houston, Texas) which was closed in 1965.
[5] Master's degree offered.
[6] First graduating class in 1965.
[7] Data are not available.

Source: American Physical Therapy Association.

CHAPTER 25

Podiatry

Podiatry, formerly known as chiropody, is that profession which deals with the examination, diagnosis, prevention, treatment, and care of conditions and functions of the human foot. Podiatrists fit corrective and supportive devices, perform surgical and other operative procedures on the foot, prescribe proper footgear, and administer and prescribe drugs and physical therapy for patient care.

About 7,600 *podiatrists* located in the United States were actively engaged in their profession in 1965 according to the American Podiatry Association. This estimate is based on 9,092 State registrations as licentiates in podiatry which, with the elimination of duplications, become 8,008 podiatrists registered in 1964. Probably 95 percent of these registered podiatrists are active practitioners. The number of active podiatrists has increased from about 6,400 in 1950 to nearly 7,600 in 1960, and has remained at about this level.

The 1964 survey of the profession by the American Podiatry Association (4,800 members) provides the State distribution in table 99 and the information on professional activities in table 100. Nearly all of the

Table 99. LOCATION OF REGISTERED PODIATRISTS: 1964

Location	Number of podiatrists	Location	Number of podiatrists
United States	8,008		
Alabama	28	Montana	13
Alaska	1	Nebraska	37
Arizona	35	Nevada	12
Arkansas	18	New Hampshire	29
California	756	New Jersey	421
Colorado	70	New Mexico	21
Connecticut	196	New York	1,462
Delaware	21	North Carolina	49
District of Columbia	64	North Dakota	10
Florida	170	Ohio	524
Georgia	49	Oklahoma	46
Hawaii	4	Oregon	40
Idaho	20	Pennsylvania	921
Illinois	813	Rhode Island	66
Indiana	166	South Carolina	15
Iowa	96	South Dakota	17
Kansas	49	Tennessee	42
Kentucky	65	Texas	158
Louisiana	34	Utah	19
Maine	29	Vermont	10
Maryland	78	Virginia	56
Massachusetts	552	Washington	64
Michigan	264	West Virginia	40
Minnesota	89	Wisconsin	153
Mississippi	8	Wyoming	6
Missouri	102		

Source: American Podiatry Association, Special Studies Division: 1964 survey of the podiatry profession. *J.Am.Podiatry A.* Vols. 54 and 55, 1964 and 1965. Reprint No. 1:6601.

active podiatrists are self-employed, with relatively few holding full-time salaried positions in hospitals or schools of podiatry. They tend to practice mainly in large cities in the most heavily populated States.

All States and the District of Columbia require a license for the practice of podiatry. To qualify for a license an applicant must have been graduated from a college of podiatry and must pass a State board (or the National Board) examination. In addition, a few States require a period of internship or practice.

The five colleges of podiatry in the United States admit students who have already completed at least 2 years of college. The subsequent 4 years of training lead to a degree of Doctor of Podiatry (Pod. D. or D.P.) or Doctor of Podiatric Medicine (D.P.M.).

In the academic year 1964-65, the five colleges enrolled 625 students and graduated 112 podiatrists (tables 101 and 102).

Table 100. TYPE OF PRACTICE OF PODIATRISTS: 1964

Type of practice	Number of respondents	Percent of respondents
Total	[1] 3,290	100.0
Private practice	3,093	94.0
Institutional practice	49	1.5
Administration, teaching, or research	12	0.4
Other	63	1.9
Retired	73	2.2

[1] The questionnaire was mailed to all known registered podiatrists (8,006).

Source: American Podiatry Association, Special Studies Division: 1964 survey of the podiatry profession. *J.Am.Podiatry A.* Vols. 54 and 55, 1964 and 1965. Reprint No. 1:6601.

Table 101. PODIATRY COLLEGES, STUDENTS, AND GRADUATES: SELECTED YEARS, 1951–52 THROUGH 1965-66

Academic year	Colleges	Students	Graduates
1965–66	5	713	----------
1964–65	5	625	122
1963–64	5	585	97
1962–63	4	496	114
1961–62	5	472	96
1960–61	5	478	116
1959–60	5	465	112
1955–56	6	700	142
1951–52	8	1,633	476

Source: American Podiatry Association.

Table 102. LOCATION AND OWNERSHIP OF PODIATRY COLLEGES AND NUMBERS OF STUDENTS AND GRADUATES: 1964–65

Location	School [1]	Ownership	Students	Graduates
	Total, 5 schools	----------	625	122
Calif.	California Podiatry College, San Francisco	Private	129	25
Ill.	Illinois College of Podiatry, Chicago	Private	147	26
N.Y.	M. J. Lewi College of Podiatry, New York	Private	117	29
Ohio	Ohio College of Podiatry, Cleveland	Private	190	42
Pa.	Pennsylvania College of Podiatry, Philadelphia	Private	42	([2])

[1] Independent institutions. [2] Will graduate first class in 1967.

Source: American Podiatry Association.

CHAPTER 26

Psychology

Psychology, the science of human behavior, is concerned with how people act and why they act the way they do. It has an important place not only in the health field but in many others, including child development, education, employment counseling, public opinion research, and industrial production.

About one-third of all *psychologists* are engaged in health activities. The number of psychologists in the health field has increased from about 3,000 in 1950, to nearly 8,000 in 1960, and probably as many as 9,000 in 1965 (table 103). The American Psychological Association has about 22,000 members in all fields. In addition, there are qualified psychologists who are not members of the Association.

Two types of specialists are directly concerned with health. Somewhat more than 6,000 *clinical* psychologists practice in hospitals, clinics, or similar medical settings. They work directly with the patient to help him learn new and better habits of behavior. About 2,000 *counseling* psychologists work in schools, industry and community agencies to forestall mental illness. They help the individual understand himself so that he can deal effectively with his own problems.

Not limited to the health field are the *social* psychologists who are concerned with group reactions and the ways in which our social attitudes develop, and the *measurement* psychologists or psychometrists who devise tests for measuring people's mental, emotional, and social characteristics. These last two categories are small in numbers —about 1,000 and 500 persons respectively, with probably fewer than half directly involved in health projects.

Although some of the practicing psychologists have had only 1 or 2 years of graduate study in psychology, the usual requirement is 4 years leading to a Ph. D. degree, together with at least 1 year of internship to provide supervised clinical experience.

Somewhat over 100 universities offer graduate degrees in clinical psychology. Earned degrees conferred in the field of psychology in the United States in 1963-64 included 2,059 master's and 973 doctor's with specialization as follows:

Field of study	*Master's*[35]	*Doctor's*[36]
Clinical psychology	126	324
Counseling and guidance	243	51
Social psychology	18	96
Psychology, all others	1,672	502

Data on master's degrees are from the Office of Education's survey of college and university registrars (table 104). Doctoral data are from the National Academy of Sciences' personal survey of degree recipients.

[35] National Center for Educational Statistics: *Summary Report on Bachelor's and Higher Degrees Conferred During the Year 1963-64*. OE-54010-64. Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1965.

[36] Harmon, L. R.: Production of psychology doctorates. *Am. Psychologist*. 19:629-633, 1964. Updated.

Table 103. LOCATION OF PSYCHOLOGISTS IN THE HEALTH FIELD: 1964

Location [1]	Total	Clinical	Counseling and guidance	Social	Measurement
All locations	[2] 7,852	5,133	1,644	775	300
United States	7,790	5,113	1,629	756	292
Alabama	42	29	11	1	1
Alaska	2	2	—	—	—
Arizona	66	35	20	11	—
Arkansas	29	17	8	1	3
California	1,054	727	194	93	40
Colorado	133	94	26	11	2
Connecticut	145	98	22	19	6
Delaware	21	17	2	2	—
District of Columbia	215	99	39	42	35
Florida	182	126	37	11	8
Georgia	91	55	23	11	2
Hawaii	25	13	10	2	—
Idaho	20	7	13	—	—
Illinois	431	289	94	34	14
Indiana	146	92	29	13	12
Iowa	100	69	20	7	4
Kansas	125	91	19	13	2
Kentucky	58	40	7	9	2
Louisiana	42	34	6	1	1
Maine	23	18	5	—	—
Maryland	153	106	24	23	—
Massachusetts	346	220	68	48	10
Michigan	329	191	65	60	13
Minnesota	177	104	55	13	5
Mississippi	29	20	8	1	—
Missouri	135	88	34	10	3
Montana	9	4	4	—	1
Nebraska	44	28	10	4	2
Nevada	12	8	2	2	—
New Hampshire	16	9	4	3	—
New Jersey	276	189	45	25	17
New Mexico	28	15	12	—	1
New York	1,362	960	245	118	39
North Carolina	110	70	18	18	4
North Dakota	26	10	12	2	2
Ohio	303	198	69	27	9
Oklahoma	60	46	10	4	—
Oregon	107	59	35	9	4
Pennsylvania	462	294	114	37	17
Rhode Island	26	15	6	2	3
South Carolina	27	21	4	1	1
South Dakota	19	10	7	1	1
Tennessee	97	66	20	8	3
Texas	219	125	67	10	17
Utah	53	32	17	2	2
Vermont	15	9	1	5	—
Virginia	93	71	11	11	—
Washington	122	77	31	11	3
West Virginia	26	21	3	2	—
Wisconsin	139	86	33	17	3
Wyoming	20	9	10	1	—
Puerto Rico	13	4	7	—	2
Foreign areas	49	16	8	19	6

[1] Residence as of December 31.

[2] Specialty as indicated by respondents to the Psychology Section of the 1964 Register. Of the psychologists to whom questionnaires were sent, 73 percent (16,804) returned usable data indicating a specialty in the field of psychology. Since Register response was not 100 percent this table contains information on only 7,852 of the approximately 9,000 psychologists in the health field.

Source: National Science Foundation. 1964 National Register of Scientific and Technical Personnel.

Table 104. LOCATION OF SCHOOLS CONFERRING MASTER'S DEGREES IN SELECTED FIELDS OF PSYCHOLOGY: 1963–64

Location	School	Clinical psychology	Counseling and guidance	Social psychology
	Total, all schools	126	243	18
Ariz.	University of Arizona	—	5	—
Calif.	La St Col App Arts & Sci	—	52	—
Fla.	University of Florida	—	13	—
Ill.	Loyola University	8	—	1
Ind.	Ball State Teachers Col	—	4	—
	Indiana State College	4	—	—
Maine	University of Maine	4	—	—
Mass.	Assumption College	—	14	—
	Harvard University	7	—	6
	Springfield College	22	62	—
Mich.	Wayne State University	29	—	—
Minn.	University of Minnesota	1	—	—
Mo.	St Louis University	1	—	—
N. Mex.	Eastern New Mexico Univ	—	8	—
N.Y.	CUNY Queens College	—	3	—
	Columbia University	9	25	7
	Cornell University	—	—	2
	SUNY University Buffalo	—	9	—
	Syracuse University	7	—	—
	Yeshiva University	4	2	—
N.C.	East Carolina College	1	—	—
Okla.	Okla St U Agric & App Sci	—	12	—
Tenn.	George Peabody Col Tchrs	—	5	—
	Memphis State University	7	—	—
Tex.	North Texas State Univ	12	—	—
Va.	Richmond Prof Institute	6	17	—
W. Va.	West Virginia University	—	12	—
Wis.	University of Wisconsin	4	—	2

Source: National Center for Educational Statistics: *Earned Degrees Conferred 1963–64*. OE–54013–64. Office of Education, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1966.

CHAPTER 27

Radiologic Technology

Radiologic technology involves the use of radiant energy in the field of medicine to assist the physician in the diagnosis and treatment of disease. *Radiologic technologists*—also called medical X-ray technologists or technicians—operate X-ray equipment under the general direction of a physician who is usually a radiologist. For diagnostic purposes the technologist prepares opaque solutions for the patient to drink, positions the patient between the X-ray tube and the film, selects the proper exposure, and takes X-ray photographs of parts of the body as prescribed by the physician. For therapeutic purposes the technologist operates special X-ray equipment and assists in the preparation of radium or radioactive materials for controlled application by the physician. The technologist may be responsible for keeping the equipment in working order, processing films, and recording services performed.

Probably more than 70,000 persons were employed as radiologic technologists in 1965. The number so employed was about 30;800 in 1950 and in excess of 60,000 by 1960.

The American Society of Radiologic Technologists lists 12,561 active and associate members in its Official Roster as of October 1965. The American Registry of Radiologic Technologists lists 41,474, of whom an estimated two-thirds or about 28,000 are professionally active. The total number of technologists, registered and nonregistered, employed in 1965 probably is between two and three times the Registry estimate of active personnel.

A State distribution is available for the more than 41,000 persons recognized by the American Registry of Radiologic Technologists (table 105). The three specialties within the field are the more generalized X-ray technology, nuclear medicine technology using radioactive isotopes, and radiation therapy technology using radiation producing devices. The last two were recognized by the Registry in 1962.

About one-fourth of the technologists work in hospitals. The remainder are employed in independent X-ray laboratories, in physicians' and dentists' offices, and by government agencies.

A license to practice as an X-ray technician is required in only one State—New York, based on a 1964 law.

As of June 30, 1965, 901 programs in X-ray technology with an estimated enrollment of 8,970 students had approval of the American Medical Association Council on Medical Education. These programs are conducted by hospitals and medical schools with hospital affiliation. The courses are open to high school graduates, although a few require 1 or 2 years of college or graduation from a school of nursing. The length of the training is usually 24 months, though a few programs extend over a 4-year period and entitle the graduate to a degree as Bachelor of Science in X-Ray Technology. In the academic year 1964-65 the approved schools graduated 3,158 technologists (tables 106 and 107).

After completion of training in an AMA approved program, a technologist may take an examination given by The American Registry of Radiologic Technologists. Successful completion of the examination qualifies the technologist to use the title Registered Technologist—RT(ARRT). As of September 1965, 41,474 persons located in the United States and Puerto Rico had been certified (table 105).

Many of the radiologic technologists now employed were trained on the job rather than through formal education. The Armed Forces through its program of on-the-job training has brought many young men into this field.

Table 105. LOCATION OF REGISTERED RADIOLOGIC TECHNOLOGISTS: 1965 [1]

Location	X-ray technology	Nuclear medicine technology	Radiation therapy technology
All locations	41,137	248	89
United States	41,117	248	89
Alabama	511	9	4
Alaska	46	—	—
Arizona	374	2	—
Arkansas	374	1	—
California	4,127	28	10
Colorado	803	6	—
Connecticut	923	2	—
Delaware	107	—	—
District of Columbia	162	2	1
Florida	1,113	8	5
Georgia	701	5	2
Hawaii	139	—	—
Idaho	174	—	—
Illinois	2,489	10	10
Indiana	1,052	4	3
Iowa	728	1	—
Kansas	578	4	1
Kentucky	514	7	—
Louisiana	610	5	2
Maine	263	1	—
Maryland	667	3	4
Massachusetts	1,396	5	2
Michigan	1,654	16	7
Minnesota	1,284	4	2
Mississippi	235	3	1
Missouri	991	7	2
Montana	170	—	1
Nebraska	389	3	—
Nevada	104	—	1
New Hampshire	186	—	—
New Jersey	1,098	8	3
New Mexico	201	—	—
New York	3,118	13	5
North Carolina	774	6	2
North Dakota	158	1	—
Ohio	2,328	17	3
Oklahoma	427	3	—
Oregon	514	—	—
Pennsylvania	2,607	12	4
Rhode Island	207	—	—
South Carolina	390	1	1
South Dakota	178	—	—
Tennessee	646	8	1
Texas	2,097	21	1
Utah	192	3	—
Vermont	154	—	—
Virginia	723	8	4
Washington	676	—	1
West Virginia	343	2	—
Wisconsin	1,334	9	6
Wyoming	88	—	—
Puerto Rico	20	—	—

[1] Active and inactive.

Source: The American Registry of Radiologic Technologists: *Directory of X-ray Technologists—Nuclear Medicine Technologists—Radiation Therapy Technologists.* Minneapolis, Sept. 1965.

Table 106. APPROVED EDUCATIONAL PROGRAMS IN X-RAY TECHNOLOGY, ENROLLMENT, AND GRADUATES: SELECTED YEARS, 1949–50 THROUGH 1965–66

Academic year	Schools	Enrollment [1]	Graduates
1965–66	901	[3] 8,970	----------
1964–65 [2]	789	7,726	3,158
1963–64 [2]	755	7,415	2,887
1962–63	718	6,231	2,722
1961–62	673	5,512	2,315
1960–61	650	5,049	----------
1959–60	609	4,581	2,285
1955–56	422	2,613	1,966
1949–50	267	1,447	923

[1] Students enrolled in 24 months' program or last 2 years of 3 or 4 year course.

[2] Final figures to replace preliminary estimates published in J.A.M.A.

[3] Estimated.

Source: Council on Medical Education: Education Number of the *J.A.M.A.* Chicago. American Medical Association. Annual issues.

Table 107. LOCATION OF APPROVED SCHOOLS OFFERING PROGRAMS IN X-RAY TECHNOLOGY AND NUMBERS OF STUDENTS AND GRADUATES: 1964–65

Location	Schools	Students	Graduates
Total	[1] 781	7,726	3,158
Alabama	7	81	25
Alaska	—	—	—
Arizona	5	39	16
Arkansas	5	75	36
California	49	337	131
Colorado	16	210	70
Connecticut	[2] 15	224	90
Delaware	2	17	7
District of Columbia	[2] 4	25	6
Florida	13	169	70
Georgia	14	173	66
Hawaii	2	8	4
Idaho	5	27	11
Illinois	53	471	204
Indiana	[2] 17	229	98
Iowa	18	159	72
Kansas	17	123	52
Kentucky	12	127	50
Louisiana	[2] 11	124	52
Maine	8	84	36
Maryland	14	230	116
Massachusetts	44	308	128
Michigan	32	296	113
Minnesota	29	309	128
Mississippi	5	34	12
Missouri	24	227	84
Montana	5	28	8
Nebraska	7	70	30
Nevada	2	10	5
New Hampshire	4	27	10
New Jersey	19	197	91
New Mexico	3	21	14
New York	30	380	151
North Carolina	18	168	66
North Dakota	7	35	11
Ohio	53	574	241
Oklahoma	8	80	28
Oregon	7	58	25
Pennsylvania	59	633	263
Rhode Island	5	45	19
South Carolina	12	118	41
South Dakota	6	39	21
Tennessee	[2] 12	135	47
Texas	38	378	152
Utah	4	29	12
Vermont	4	58	26
Virginia	14	150	62
Washington	5	38	16
West Virginia	13	95	33
Wisconsin	23	240	102
Wyoming	2	14	7

[1] Of the total 789 schools approved as of June 1964, 8 did not submit 1964–65 reports. Of the 781 schools, 5 did not report on graduates, 52 reported none, 210 reported 1 or 2 graduates, and 514 reported 3 or more graduates.

[2] Includes 1 school that did not report on students and graduates.

Source: American Medical Association, Council on Medical Education.

CHAPTER 28

Secretarial and Office Services

Secretarial and office services are usually provided to physicians, dentists, optometrists, and other doctors in clinical practice through duties performed by *receptionists, secretaries, assistants*, and/or *aides*. Excluded from this category, however, are nurses and medical and dental laboratory personnel (technologists, technicians, and assistants), all of whom are considered in other chapters of this report.

Professional offices and admitting offices of hospitals and related institutions usually employ one or more persons to perform many and varied duties such as to schedule appointments, receive patients, record case histories, usher the patient into the consultation or examination room, set out the necessary instruments, and perhaps assist the doctor by handing him instruments or performing other functions. Also there are clerical duties involved with correspondence, payments, monthly statements, supplies, insurance forms, and reports.

The person who prepares the examination room and hands instruments and materials to the doctor as directed is likely to be called an assistant or aide rather than a secretary. Medical assistants who perform laboratory services are included in chapter 7; dental assistants in chapter 8.

The receptionist's office procedures are closely related to those of the secretary. However, secretarial duties play a more important role in the secretary's job which often requires a knowledge of medical or dental terms.

High school graduation is the minimum educational requirement for secretarial and office services. Training in office procedure and skill in typing, shorthand, and bookkeeping enhance opportunities for employment. Courses in biology, chemistry, health education, and medical (or dental) terminology as well as ethics and personal relations are desirable as part of the education of medical (and dental) secretaries. Formal programs are available in some community colleges and in technical or vocational schools, and are supplemented by training and experience on the job.

Information on the employment of *medical assistants, secretaries, and receptionists* by the 191,000 physicians in private practice is not available. Probably the average is between 0.5 and 1.0 per physician.

Some idea of the number of aides might be arrived at from information provided by *Medical Economics*. The September 20, 1965 issue of this journal reported from their new survey that "54% of private medical practices employ at least two full-time aides, 33% employ at least three." It is assumed that nurses and laboratory personnel have been included as aides in this context.

Further information can be obtained from the membership statistics of the American Association of Medical Assistants. The 12,500 members at the close of 1965 included receptionists, secretaries, assistants, nurses, and technicians employed in the offices of Doctors of Medicine and accredited hospitals.

The employment of *dental secretaries and receptionists* by nonsalaried dentists in 1965 is reported by the American Dental Association[37] as follows:

Employment status	*1962*	*1965*
Full-time workers -----	13,600	20,900
Part-time workers -----	5,900	4,200

Optometrists' assistants (secretaries and receptionists) employed in 1965 are estimated at about 6,000 to 7,000. The Optometric Extension Program has enrolled a total of 1,200 students in the 2-day workshops held annually since 1959.

[37] American Dental Association, Bureau of Economic Research and Statistics: 1965 survey of dental practice, IV, professional expenses; auxiliary personnel. *J.Am.Dent.A.* 72(5):1185, May 1966. Also the 1962 survey.

Other doctors in private practice as well as hospitals and related institutions also employ persons to provide secretarial and office services. Taken all together, the total number of secretarial and office personnel employed in 1965 was probably between 150,000 and 250,000. In 1960 the census reported 157,000 receptionists and secretaries employed in the health services industry (table 1, Introduction).

CHAPTER 29

Social Work

Social work programs designed to meet the special needs of persons who are ill, disabled, aged, or crippled are one component of the many types of social services concerned with the serious social problems of individuals and families. Of the 105,351 social workers employed in social welfare settings in the United States in 1960, approximately 11,700 were found in health and related programs. Not included in the 1960 survey were more than 2,000 rehabilitation counselors in vocational rehabilitation agencies (see ch. 33).

By 1965, the total number of *social workers* had increased to at least 125,000.[38] An estimated 17,500 of these persons were in the health field (table 108).

According to the 1960 nationwide study of salaries and working conditions of social welfare manpower, approximately 4,500 persons were employed in medical settings and 7,200 in psychiatric settings. Three-fourths of these social workers were engaged in programs whose primary purpose is health services—in hospitals and their outpatient departments, in clinics which are independent of hospitals but provide outpatient diagnosis and other services, or in public health departments and voluntary organizations not centered in hospitals and clinics (table 109). More recent studies present selected characteristics of an estimated 5,800 social work staff in general and tuberculosis hospitals in 1964 and of 7,500 social workers employed in approximately 2,500 mental health establishments in 1963[39] (table 110).

Two types of social workers in the health field—*medical and psychiatric*—are sometimes grouped as clinical social workers. They work directly with patients and their families, helping them to cope with problems related to severe or long illness, recovery, and rehabilitation. They also contribute an understanding of significant social and emotional factors related to the patient's health problems and thus assist physicians and other health workers in the evaluation and treatment of the individual. They utilize community health agencies and other resources to assist the patient in adjustment to disability and to life in the community. In public health settings and in community mental health centers, social workers with skills in community organization methods are being utilized in programs to develop conditions supportive of physical and mental health.

By the end of 1965, four States had voluntary registration laws to protect the title of social worker; they are California, New York, Oklahoma, and Rhode Island. Puerto Rico requires a license to practice social work.

The educational requirement for full professional status is completion of 2 years of graduate study in an accredited school of social work, leading to a master's degree. Only about one in five of all social workers meets this requirement. The proportion is considerably higher in the health field—in excess of half of the workers employed in medical settings and three-fourths of those in psychiatric settings have a master's degree.[40]

In 1965, 60 graduate schools of social work in the United States were accredited by the Council on Social Work Education, with an additional 4 recently established working towards accreditation. In November 1965,

[38] Departmental Task Force on Social Work Education and Manpower: *Closing the Gap in Social Work Manpower.* Pub. No. 0-795-440. Office of the Undersecretary, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1966.

[39] National Institute of Mental Health: Selected characteristics of social workers. *Mental Health Manpower Current Statistical and Activities Report,* No. 6. Public Health Service, U.S. Department of Health, Education, and Welfare, May 1965.

[40] Stewart, W. H., Pennell, M. Y., and Smith, L. M.: Medical and psychiatric social workers. *Health Manpower Source Book 12.* PHS Pub. No. 263, Section 12. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1961.

8,380 full-time students were enrolled, of whom 8,186 were in the master's degree program (tables 111 and 112).

At least 600 colleges and universities offer courses with social welfare content.[41] Of these, 174 are affiliated with the Council on Social Work Education. In 1964-65, 1,291 bachelor's degrees were identified with social work, social administration, or social welfare as the major subject (table 2, Introduction).

Many of these students go directly to graduate schools of social work, but more than half enter social welfare employment. In some settings, persons with baccalaureates and inservice training for the particular job requirements are considered to be social workers. In health and psychiatric settings they are more apt to be classified as social work assistants. These *social work assistants* with a bachelor's degree usually receive on-the-job training in social work tasks and assignments under the supervision of a graduate social worker. How many are employed in the health field is not known.

Membership in the National Association of Social Workers—45,810 individuals at the close of 1965 — is open only to graduates (and students) of accredited schools of social work. Persons employed in health and related programs may identify with two of the nine councils of NASW—4,100 members of the Medical and Health Services Council, or 5,500 members of the Mental Health and Psychiatric Services Council.

Two years of membership in the NASW and 2 years of paid social work employment under the supervision of a member of the Academy are the eligibility requirements for certification as members of the Academy of Certified Social Workers. The Academy was founded in 1961 and had 28,850 members at the beginning of 1966.[42]

[41] National Commission for Social Work Careers: *What Every Recruiter Should Know: 1965-66 Facts About Social Work Manpower Supply and Demand.* New York. Single sheet.

[42] National Association of Social Workers: *Directory of Professional Social Workers, 1966.* New York. Second edition.

Table 108. SOCIAL WELFARE WORKERS INCLUDING THOSE EMPLOYED IN HEALTH AND RELATED PROGRAMS: SELECTED YEARS, 1950 THROUGH 1965

Year	Total social welfare workers (estimated)	Persons employed in health and related programs		
		Total	Medical settings	Psychiatric settings
1965	125,000	17,500	6,300	11,200
1963	----------	15,000	5,500	9,500
1960	105,000	11,700	4,500	7,200
1950	----------	6,200	3,200	3,000

Sources: U.S. Department of Labor, Bureau of Labor Statistics: National Social Welfare Assembly, Inc.; and U.S. Department of Health, Education, and Welfare: *Salaries and Working Conditions of Social Welfare Manpower in 1960.* New York. National Social Welfare Assembly, Inc., 1961. U.S. Department of Labor, Bureau of Labor Statistics: *Social Workers in 1950. A Report on the Study of Salaries and Working Conditions in Social Work.* New York. American Association of Social Workers, Inc., 1950. Public Health Services estimates for 1963 and 1965.

Table 109. ESTIMATED NUMBER OF FULL-TIME PERSONNEL SPECIALIZING IN MEDICAL AND PSYCHIATRIC SOCIAL WORK BY TYPE OF PROGRAM AND EMPLOYING AGENCY: 1960

Type of program	All agencies	State or local agencies					National agencies				
		Total	Government			Voluntary	Total	Federal			Voluntary
			Total	Public health	Other			Total	Public health	Other	
	Total medical and psychiatric social workers										
All programs	**11,701**	**9,956**	**5,523**	**1,009**	**4,514**	**4,433**	**1,745**	**1,575**	**131**	**1,444**	**170**
Health programs	**8,601**	**6,960**	**4,411**	**1,009**	**3,402**	**2,549**	**1,641**	**1,493**	**131**	**1,362**	**148**
Hospitals and their OPD	5,593	4,403	2,863	3	2,860	1,540	1,190	1,058	76	982	132
Independent clinics [1]	2,080	1,691	1,007	531	476	684	389	385	8	377	4
Other health programs [2]	928	866	541	475	66	325	62	50	47	3	12
Other programs	**3,100**	**2,996**	**1,112**	**—**	**1,112**	**1,884**	**104**	**82**	**—**	**82**	**22**
Rehabilitation services [3]	837	802	244	—	244	558	35	23	—	23	12
Public assistance	232	232	230	—	230	2	—	—	—	—	—
Other family services	544	540	31	—	31	509	4	—	—	—	4
Child welfare work	642	642	240	—	240	402	—	—	—	—	—
Teaching social work	205	205	66	—	66	139	—	—	—	—	—
Other programs [4]	640	575	301	—	301	274	65	59	—	59	6
	Medical social workers										
All programs	**4,494**	**3,752**	**1,880**	**277**	**1,603**	**1,872**	**742**	**590**	**80**	**510**	**152**
Health programs	**3,430**	**2,720**	**1,421**	**277**	**1,144**	**1,299**	**710**	**574**	**80**	**494**	**136**
Hospitals and their OPD	2,646	2,078	1,104	1	1,103	974	568	444	53	391	124
Independent clinics	321	219	97	64	33	122	102	102	2	100	—
Other health programs	463	423	220	212	8	203	40	28	25	3	12
Other programs	**1,064**	**1,032**	**459**	**—**	**459**	**573**	**32**	**16**	**—**	**16**	**16**
	Psychiatric social workers										
All programs	**7,207**	**6,204**	**3,643**	**732**	**2,911**	**2,561**	**1,003**	**985**	**51**	**934**	**18**
Health programs	**5,171**	**4,240**	**2,990**	**732**	**2,258**	**1,250**	**931**	**919**	**51**	**868**	**12**
Hospitals and their OPD	2,947	2,325	1,759	2	1,757	566	622	614	23	591	8
Independent clinics	1,759	1,472	910	467	443	562	287	283	6	277	4
Other health programs	465	443	321	263	58	122	22	22	22	—	—
Other programs	**2,036**	**1,964**	**653**	**—**	**653**	**1,311**	**72**	**66**	**—**	**66**	**6**

[1] Clinics which are independent of hospitals that provide outpatient diagnosis and treatment of the sick.

[2] In public health departments and voluntary health organizations, in programs not centered in hospitals and clinics.

[3] Rehabilitation services of hospitals, clinics, sheltered workshops, rehabilitation centers, and other settings.

[4] Includes work with adult offenders, institutional care for the aged, other services to individuals or families, and community organization.

Source: Stewart, W. H., Pennell, M. Y., and Smith, L. M.: Medical and psychiatric social workers. *Health Manpower Source Book 12.* PHS Pub. No. 263, Section 12. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1961. Based on 1960 Bureau of Labor Statistics survey, including unpublished data.

Table 110. SOCIAL WORK STAFF IN GENERAL AND TUBERCULOSIS HOSPITALS: 1964

Type, ownership, and size of hospital	Total hospitals	Hospitals with social work staff		Estimated number of social work staff		Estimated number of graduate social workers	
		Number	Percent	Total	Per hospital with staff	Total	Percent of social work staff
All hospitals	**6,595**	**1,219**	**18**	**5,822**	**4.8**	**3,960**	**68**
Voluntary	4,514	678	15	2,560	3.8	1,754	69
State and local government	1,679	330	20	2,094	6.3	1,201	57
Federal Government	402	211	52	1,168	5.5	1,005	86
General short-term hospitals	**6,055**	**930**	**15**	**4,803**	**5.2**	**3,354**	**70**
Voluntary	4,290	575	13	2,158	3.8	1,504	70
Under 100 beds	2,561	75	3	162	2.2	110	68
100–199 beds	849	92	11	230	2.5	150	65
200–299 beds	460	157	34	386	2.5	224	58
300–399 beds	235	126	54	468	3.7	318	68
400 beds and over	185	125	68	912	7.3	702	77
State and local government	1,394	174	12	1,642	9.4	999	61
Under 200 beds	1,205	45	4	139	3.1	67	48
200–399 beds	107	59	55	364	6.2	226	62
400 beds and over	82	70	85	1,139	16.3	706	62
Federal Government	371	181	49	1,003	5.5	851	85
Under 200 beds	218	42	19	94	2.2	61	65
200–399 beds	66	55	83	220	4.0	163	74
400 beds and over	87	84	97	689	8.2	627	91
General long-term hospitals	**343**	**189**	**55**	**799**	**4.2**	**501**	**63**
Voluntary	202	98	49	386	3.9	239	62
State and local government	121	71	59	276	3.9	135	49
Federal Government	20	20	100	137	6.8	127	93
Tuberculosis hospitals	**197**	**100**	**51**	**220**	**2.2**	**105**	**48**
Voluntary	22	5	23	16	3.2	11	69
State and local government	164	85	52	176	2.1	67	38
Federal Government	11	10	91	28	2.8	27	96

Source: Pennell, M. Y.: Social work in general and tuberculosis hospitals, 1964. (Unpublished.)

Table 111. SCHOOLS OF SOCIAL WORK, STUDENTS, AND GRADUATES: SELECTED YEARS, 1951–52 THROUGH 1965–66

Academic year	Schools	Enrollment in master's program		Students taking specified field of instruction		Awards granted for completion of program	
		First year	Second year	Medical	Psychiatric	2 years (master's degrees)	Beyond 2 years [1]
1965–66	[2] 60	4,506	3,680	720	1,938	----------	----------
1964–65	59	3,950	3,246	723	1,711	3,206	60
1963–64	58	3,592	2,808	679	1,585	2,815	69
1962–63	56	3,255	2,608	568	1,402	2,505	67
1961–62	56	----------	----------	497	1,252	2,318	59
1960–61	56	----------	----------	473	1,190	2,162	----------
1959–60	56	----------	----------	----------	----------	2,087	----------
1954–55	51	----------	----------	----------	----------	1,655	----------
1951–52	----------	----------	----------	----------	----------	1,946	----------

[1] About half are doctoral degrees and half, certificates or diplomas.

[2] An additional 4 schools, established recently in State universities, are working toward accreditation.

Source: Council on Social Work Education: *Statistics on Social Work Education: November 1, 1965 and Academic Year 1964–65.* New York. Also prior annual publications. Data for United States and Puerto Rico.

Table 112. LOCATION AND OWNERSHIP OF ACCREDITED SCHOOLS OFFERING MASTER'S PROGRAMS IN SOCIAL WORK AND NUMBERS OF STUDENTS AND GRADUATES: 1965

Location	School	Ownership	Students	Graduates
	Total, 60 schools		8,186	3,206
Ariz.	Arizona State University, Tempe	Public	44	15
Calif.	University of California, Berkeley	Public	284	116
	University of California, Los Angeles	Public	112	39
	University of Southern California, Los Angeles	Private	121	70
Colo.	University of Denver, Denver	Private	162	67
Conn.	University of Connecticut, Hartford	Public	127	51
D.C.	Catholic University of America, Washington	Private	110	56
	Howard University, Washington	Private	179	66
Fla.	Florida State University, Tallahassee	Public	190	61
Ga.	Atlanta University, Atlanta	Private	82	22
Hawaii	University of Hawaii, Honolulu	Public	59	21
Ill.	Loyola University, Chicago	Private	113	38
	University of Chicago, Chicago	Private	275	107
	University of Illinois, Urbana	Public	176	52
Ind.	Indiana University, Indianapolis	Public	111	57
Iowa	University of Iowa, Iowa City	Public	66	22
Kans.	University of Kansas, Lawrence	Public	95	29
Ky.	University of Louisville, Louisville	Public	101	39
La.	Louisiana State University, Baton Rouge	Public	122	46
	Tulane University, New Orleans	Private	205	72
Md.	University of Maryland, Baltimore	Public	112	28
Mass.	Boston College, Boston	Private	131	62
	Boston University, Boston	Private	113	51
	Simmons College, Boston	Private	109	63
	Smith College, Northampton	Private	119	59
Mich.	Michigan State University, East Lansing	Public	84	33
	University of Michigan, Ann Arbor	Public	320	117
	Wayne State University, Detroit	Public	183	75
Minn.	University of Minnesota, Minneapolis	Public	113	48
Mo.	St. Louis University, St. Louis	Private	125	47
	University of Missouri, Columbia	Public	124	65
	Washington University, St. Louis	Private	153	55
Nebr.	University of Nebraska, Lincoln	Public	62	25
N.J.	Rutgers, The State University, New Brunswick	Public	148	43
N.Y.	Adelphi University, Garden City	Private	112	50
	City University of New York, Hunter College, New York	Public	125	38
	Columbia University, New York	Private	400	183
	Fordham University, New York	Private	224	113
	New York University, New York	Private	231	91
	State University of New York, SUNY at Buffalo, Buffalo	Public	135	38
	Syracuse University, Syracuse	Private	104	54
	Yeshiva University, New York	Private	59	24
N.C.	University of North Carolina, Chapel Hill	Public	107	49
Ohio	Ohio State University, Columbus	Public	112	42
	Western Reserve University, Cleveland	Private	160	69
Okla.	University of Oklahoma, Norman	Public	97	27
Oreg.	Portland State College, Portland	Public	51	19
Pa.	Bryn Mawr College, Bryn Mawr	Private	83	43
	University of Pennsylvania, Philadelphia	Private	183	83
	University of Pittsburgh, Pittsburgh	Private	183	81
P.R.	University of Puerto Rico, Rio Piedras	Public	142	28
Tenn.	University of Tennessee, Nashville	Public	159	58
Tex.	Our Lady of the Lake College, San Antonio	Private	70	33
	University of Texas, Austin	Public	69	29
Utah	University of Utah, Salt Lake City	Public	137	55
Va.	Richmond Professional Institute, Richmond	Public	97	32
Wash.	University of Washington, Seattle	Public	198	67
W. Va.	West Virginia University, Morgantown	Public	88	17
Wis.	University of Wisconsin, Madison	Public	109	21
	University of Wisconsin, Milwaukee	Public	121	45

Source: Council on Social Work Education: *Statistics on Social Work Education: November 1, 1965 and Academic Year 1964–65.* New York. Annual publication.

CHAPTER 30

Specialized Rehabilitation Services

To help the person who is physically or mentally disabled to regain as much capacity for self-help and independent living as possible may involve several kinds of therapists, each with a specific area of knowledge and skill which may be adapted to the overall purpose of rehabilitation. Information on occupational therapists and on physical therapists is presented in other chapters of this report. The specialists considered here are listed below, with estimates of the numbers of workers employed in 1965.

Occupation	*Number employed*
Corrective therapist	700 to 800
Educational therapist	500
Manual arts therapist	900
Music therapist	1,500
Recreational therapist	1,600 to 2,000
Homemaking rehabilitation consultant	100 to 200

Thus the active manpower in these specialized rehabilitation services ranged between 5,300 and 5,900.

The five kinds of therapists are members of the rehabilitation team and follow specific treatment aims prescribed by the attending physician. Their employment is concentrated in hospitals and rehabilitation centers, usually those operated by the Veterans' Administration (VA) shown in table 113. They also are employed in schools with programs utilizing these specialized services.

The homemaking consultant may serve as a resource person for the rehabilitation team headed by a physician or provide direct counseling with handicapped individuals. Such consultants are likely to be employed by the Federal Extension Service or State departments of health, welfare, or vocational rehabilitation. Relatively few work for private health institutions, centers, or agencies.

Corrective Therapist

Corrective therapy is the treatment of patients by medically prescribed physical exercises and activities designed to strengthen and coordinate functions and to prevent muscular deconditioning resulting from long convalescence or inactivity due to illness. The corrective therapist uses assistive, resistive, and/or free movement exercises. The corrective therapist also may instruct patients in the use of orthopedic and prosthetic appliances.

Corrective therapist is the usual title of those who work in hospitals and rehabilitation centers, while those employed in educational institutions are known as *adapted physical educators.* The Association for Physical and Mental Rehabilitation, Inc. estimates that corrective therapists (C.T.) numbered between 700 and 800 in 1965, having increased by about 200 since 1950; while adapted physical educators (A.P.E.) may total beween 3,000 and 4,000 individuals.

The recommended educational and clinical experience program qualifies the person for responsibilities in a hospital, clinic, or educational institution. The minimum requirement is a baccalaureate in physical education from an accredited school, followed by a period of 6 to 9 months of clinical training at an approved center.

No information is available on the institutions that offer advanced training in corrective therapy—clinical practice, master's degree, or doctorate. Training centers are affiliated with 72 VA hospitals; 129 individuals were trained in 1965.

The Association for Physical and Mental Rehabilitation (with 553 members in 1965) is concerned with standards of education and clinical training. The American Board for Certification of Corrective Therapists passes on the qualifications of therapists

and maintains a national register of those entitled to use the identification of C.C.T. To date, 847 persons have been certified.

Educational Therapist

Educational therapy is the utilization of academic teaching designed to develop the mental and physical capacities of hospitalized patients. The *educational therapist* administers medical treatment through the use of educational activities that are of academic significance to the patient. The instruction given at various educational levels may be accredited by recognized school authorities.

The educational therapist is a college graduate who has majored in education or physical education. In addition, 2 to 7 months of clinical training is required, either as inservice training or at certain training centers affiliated with professional schools. In 1965, 10 persons received clinical training at Veterans' Administration hospitals. No information is available on graduate degrees in educational therapy awarded in 1964-65.

The American Association for Rehabilitation Therapy whose 600 members represent both educational and manual arts therapists estimates that approximately 500 educational therapists were employed in 1965. In 1950, employed E.T.'s numbered about 150.

Manual Arts Therapist

Manual arts therapy is the professional use of industrial arts activities of vocational significance to assist in the restoration of patients to their fullest capacities within the limits of their abilities. The *manual arts therapist* administers a program of actual or simulated work situations that help the patient prepare for an early return to family life and as a productive member of the community.

About 900 manual arts therapists were employed in hospitals and centers in 1965, as estimated by the American Association for Rehabilitation Therapy. In 1950, the number probably was one-third of the current supply.

The minimum qualification for employment is a college education, with a major in industrial arts, agriculture, or a related field. The degree is followed by a period of 2 to 7 months of clinical training, usually given as inservice training or at hospital or rehabilitation centers affiliated with professional schools. In 1965, 56 persons received clinical training at Veterans' Administration centers. No information is available on graduate degrees in manual arts therapy.

Music Therapist

The professional application of the art of music for therapeutic purposes is relatively new, with wider application in the treatment of mental illness than in physical illness. The *music therapist* uses instrumental or vocal music to bring about changes in behavior that can serve as a base for improved mental and physical health.

Approximately 800 hospitals and similar institutions employ music therapists. A few public schools also include music therapy in their special education for exceptional children. In 1965, about 1,500 music therapists were employed, of whom 750 were members of the National Association for Music Therapy. In 1950, the number was about half as large.

Music majors may qualify by taking courses in music therapy. A baccalaureate in music therapy is offered by 11 schools, with 47 graduates in 1964-65 (tables 114 and 115). A master's degree program is offered by five universities. Three universities offer doctoral programs in which the individual may select a major in music therapy.

For employment as a qualified music therapist, the college graduate must complete a 6-months' internship in an approved psychiatric hospital which is affiliated for clinical training with one of the approved schools.

Recreational Therapist

Therapeutic recreation is the specific use of recreation activity in the care, treatment,

and rehabilitation of ill, handicapped, and aged persons within a directed program. Dancing, games, sports, music, dramatics, art, and hobbies are the kinds of programs used by the therapist to provide the person with an opportunity for either physical or psychological improvement. Volunteers are often supervised by the recreational therapist as part of an increasing community involvement in the rehabilitation of patients.

A *recreational therapist* may carry the title of therapeutic recreation specialist, recreator, or activity or adjunctive therapist in those departments that include a wide variety of therapeutic specialists. A person trained in art, music, drama, or physical education, who has through generalized experience or assignment assumed responsibility for a wide variety of activities, is also considered a recreational therapist in a department of recreational therapy.

Colleges and universities offering a degree in recreation are beginning to develop an option in therapeutic recreation for those individuals wishing to work with the ill, handicapped, and aged. Many of these same schools offer graduate degrees up to the doctoral level, often as part of a State scholarship system, and through traineeships provided by the Vocational Rehabilitation Administration.

Membership of recreational therapists in professional organizations such as the National Association of Recreational Therapists and the National Recreation and Park Association stands at about 800 to 1,000. It is estimated that double this number is closer to the total professional persons working in rehabilitation using recreation activity.

Homemaking Rehabilitation Consultant

The specialist with a home economics background and training in occupational therapy can adapt the knowledge of home management, family finance, nutrition, and other home-related subjects to meet the needs of the handicapped person who has housekeeping responsibilities. The *homemaking rehabilitation consultant* may offer direct retraining in homemaking competencies to individuals or indirect counseling as a resource person for the rehabilitation team.

Rehabilitation of the physically handicapped in homemaking activities is of particular concern to the American Home Economics Association (AHEA). This Association administers traineeships provided by the Vocational Rehabilitation Administration (VRA) for home economists to study towards master's and doctor's degrees in the area of rehabilitation. In 1964-65, there were 16 trainees. Since the initiation of the program in 1963, a total of 25 persons have been awarded traineeships.

Homemaking rehabilitation consultants are college graduates, usually with an educational background in home economics or occupational therapy, followed by inservice or graduate training in the special education of the physically or mentally handicapped. Prior professional work experience may be in such fields as occupational therapy, physical therapy, dietetics or nutrition, or home economics. Practical experience in homemaking and child care is needed.

According to AHEA-VRA estimates, the number of persons employed as homemaking rehabilitation consultants in 1965 was between 100 and 200.

Table 113. THERAPISTS EMPLOYED BY THE VETERANS' ADMINISTRATION AND NUMBER OF VA TRAINEES: 1965

Occupation	VA employees as of December 31, 1965		Training center affiliations of VA hospitals	VA trainees during calendar year 1965
	Therapist	Assistant		
Total	[1] 2,774	[2] 938	[3] 133	1,070
Corrective therapy	500	41	72	129
Educational therapy	156	13	15	10
General therapy	—	28	----------	----------
Manual arts therapy	390	314	51	56
Occupational therapy	501	287	56	376
Physical therapy	572	255	62	471
Recreational therapy, including music	655	—	39	28

[1] Includes 30 part-time employees. [2] Includes 10 part-time employees. [3] Total VA hospitals with any training center affiliations.

Source: Veterans' Administration, Department of Medicine and Surgery, Reports and Statistics Service and Education Service.

Table 114. INSTITUTIONS OFFERING MUSIC THERAPY PROGRAMS AND GRADUATES: SELECTED YEARS, 1949–50 THROUGH 1964–65

Academic year	Bachelor's degree		Master's degree		Internship [1]	
	Schools	Graduates	Schools	Graduates	Institutions	Graduates
1964–65	11	47	5	4	30	48
1963–64	11	31	5	2	28	38
1962–63	12	26	5	2	24	29
1961–62	8	18	5	3	20	20
1960–61	8	15	5	3	20	18
1959–60	7	13	5	4	18	17
1954–55	7	6	5	2	15	8
1949–50	3	4	2	3	10	7

[1] 6-months' internship in an approved psychiatric hospital which is affiliated for clinical training with one of the approved schools. These internships are open to college graduates with a baccalaureate in music therapy and to music majors who have taken courses in music therapy.

Source: National Association for Music Therapy.

Table 115. LOCATION AND OWNERSHIP OF SCHOOLS OFFERING MUSIC THERAPY PROGRAMS AND NUMBERS OF GRADUATES: 1964–65

Location	School	Ownership	Graduates		
			Bachelor's degree	Master's degree	Internship
	Total, 11 schools		47	4	48
Calif.	University of the Pacific, Stockton	Private	6	—	6
Fla.	Florida State University, Tallahassee [1]	Public	4	1	4
Ind.	Indiana University, Bloomington [1]	Public	5	—	5
Kans.	University of Kansas, Lawrence [1]	Public	7	1	7
La.	Loyola University, New Orleans	Private	7	—	7
Mich.	Michigan State University, East Lansing	Public	6	2	7
	Western Michigan University, Kalamazoo [2]	Public			
Mo.	Lincoln University, Jefferson City	Public	4	—	4
Ohio	Ohio University, Athens	Public	3	—	3
Tex.	Texas Woman's University, Denton	Public	3	—	3
Wis.	Alverno College, Milwaukee	Private	2	—	2

[1] These 3 universities offer doctoral programs with a major in music therapy.
[2] Data are not available.
Source: National Association for Music Therapy.

CHAPTER 31

Speech Pathology and Audiology

Speech pathologists and audiologists are primarily interested in disorders in the production, reception, and perception of speech and language. They help to identify persons who have such disorders and to determine the etiology, history, and severity of specific disorders through interviews and special tests. They facilitate optimal treatment through speech, hearing, and language remedial or conservational procedures, counseling, and guidance. They also make appropriate referrals for medical or other professional attention.

Trends in numbers of speech pathologists and audiologists are indicated by the growth of membership in the American Speech and Hearing Association (ASHA). Membership increased from about 1,800 in 1950, to 3,700 in 1955, 6,200 in 1960, and nearly 13,000 in 1965 (table 116). In 1965, approximately 10,000 of the ASHA members were active in their profession, in addition to which there were perhaps 4,000 nonmembers, making a total of 14,000 active practitioners.

The 1964 survey of ASHA members indicates the relatively large numbers not active in the profession (table 117). Of those who are active, about one in seven is employed less than full time. More than half of those who are active work in elementary or secondary schools, including schools and classes for the deaf.

Many persons who practice in speech pathology and audiology have only a bachelor's degree—nearly 60 percent of the ASHA members in 1965. However, most of these individuals have taken some graduate work. The equivalence of a master's degree is currently required for obtaining membership in the Association.

Two Certificates of Clinical Competence are presently awarded by ASHA, one in speech pathology and one in audiology. Both require academic training at the master's degree level, 1 year of experience in the field, and the passing of a national examination. At the close of 1965, 3,216 persons held Certificates of Clinical Competence in speech pathology and 712 in audiology.

A total of 240 schools offer programs in speech pathology and audiology. Of these, 80 offer training only at the preprofessional level (bachelor's degree); 5 only a master's degree; 151 both a master's and doctor's degree, and 4 only a doctorate. In the academic year 1964-65, about 3,700 degrees were awarded (tables 118 and 119).

Table 116. LOCATION OF SPEECH PATHOLOGISTS AND AUDIOLOGISTS WHO ARE MEMBERS OF THE AMERICAN SPEECH AND HEARING ASSOCIATION: 1965

Location	Members	Location	Members
All locations	[1] 12,593		
United States	12,358		
Alabama	109	Nebraska	110
Alaska	17	Nevada	25
Arizona	76	New Hampshire	19
Arkansas	39	New Jersey	447
California	1,491	New Mexico	53
Colorado	241	New York	1,322
Connecticut	221	North Carolina	112
Delaware	21	North Dakota	68
District of Columbia	142	Ohio	636
Florida	270	Oklahoma	151
Georgia	171	Oregon	170
Hawaii	44	Pennsylvania	663
Idaho	20	Rhode Island	37
Illinois	939	South Carolina	47
Indiana	348	South Dakota	26
Iowa	255	Tennessee	185
Kansas	244	Texas	548
Kentucky	103	Utah	97
Louisiana	169	Vermont	16
Maine	23	Virginia	175
Maryland	314	Washington	245
Massachusetts	296	West Virginia	40
Michigan	619	Wisconsin	342
Minnesota	259	Wyoming	18
Mississippi	56		
Missouri	271	Puerto Rico	4
Montana	48	Foreign countries, APO	231

[1] The 1964 survey indicates that perhaps as many as one-fifth of these persons are not active in the profession.

Sources: American Speech and Hearing Association.
See also: American Speech and Hearing Association: *1966 Directory*. Washington.

Table 117. EMPLOYMENT CHARACTERISTICS OF MEMBERS OF THE AMERICAN SPEECH AND HEARING ASSOCIATION: 1964 SURVEY

Characteristic	Number	Percent
Total respondents	[1] 9,974	100.0
Active in profession	7,684	77.0
Full time	6,604	66.2
Part time	1,080	10.8
Not active in profession	2,076	20.9
Student	696	7.0
Employed outside profession	137	1.4
Not employed	1,243	12.5
No report on employment status	214	2.1
Place of employment		
Total active in profession	7,684	100.0
College or university	1,289	16.8
Elementary or secondary school	4,340	56.5
Hospital	587	7.6
Rehabilitation center	355	4.6
Other speech-hearing center	485	6.3
Agency or organization	252	3.3
Other	376	4.9
Professional activity		
Total active in profession	7,684	100.0
Clinical (therapy or diagnosis)	3,860	50.2
Supervision of clinical activity	300	3.9
Teaching of the deaf	269	3.5
Teaching other than the deaf	2,605	33.9
Administration	436	5.7
Research	190	2.5
Other	24	0.3

[1] An additional 1,531 persons did not respond.

Source: Ventry, I. M., Newman, P. W., and Johnson, K. O.: The 1964 membership of ASHA—survey results. *Asha*, A Journal of the American Speech and Hearing Association. 7(7):219–230, July 1965.

Table 118. SCHOOLS OFFERING PROGRAMS IN SPEECH PATHOLOGY AND AUDIOLOGY AND GRADUATES: SELECTED YEARS, 1953–54 THROUGH 1964–65

Academic year	Schools	Graduates			
		Total	Bachelor's degree	Master's degree	Doctor's degree
1964–65	240	3,688	2,568	1,020	100
1963–64	-------	3,293	2,416	776	101
1962–63	194	3,133	2,322	730	81
1961–62	194	2,503	1,893	543	67
1960–61	204	2,259	1,662	502	95
1959–60 [1]	-------	2,193	1,630	481	82
1958–59	193	1,935	1,458	421	56
1957–58	-------	1,694	1,281	359	54
1953–54	-------	955	662	260	33

[1] Estimated number of graduates.

Source: The status of professional training in speech pathology and audiology—1963. *Asha*, A Journal of the American Speech and Hearing Association. 5(12):865–1001, Dec. 1963. Updated by the Association.

Table 119. LOCATION OF SCHOOLS OFFERING PROGRAMS IN SPEECH PATHOLOGY AND AUDIOLOGY: 1964–65

Location [1]	Schools	Highest degree offered		
		Bachelor's	Master's	Doctor's
Total	240	80	117	43
Alabama	3	-------	3	-------
Arizona	2	-------	2	-------
Arkansas	2	1	1	-------
California	21	5	15	1
Colorado	4	-------	2	2
Connecticut	2	-------	2	-------
District of Columbia	4	1	3	-------
Florida	5	3	1	1
Georgia	2	-------	1	1
Hawaii	1	-------	1	-------
Idaho	1	-------	1	-------
Illinois	12	5	4	3
Indiana	4	-------	2	2
Iowa	4	2	1	1
Kansas	6	-------	2	4
Kentucky	5	3	2	-------
Louisiana	9	5	2	2
Maryland	4	2	-------	2
Massachusetts	4	-------	3	1
Michigan	8	1	4	3
Minnesota	5	4	-------	1
Mississippi	2	1	-------	1
Missouri	10	6	2	2
Montana	1	1	-------	-------
Nebraska	3	1	2	-------
Nevada	1	1	-------	-------
New Hampshire	1	1	-------	-------
New Jersey	6	1	5	-------
New Mexico	4	1	3	-------
New York	17	3	10	4
North Carolina	6	1	5	-------
North Dakota	3	1	2	-------
Ohio	8	2	3	3
Oklahoma	8	3	4	1
Oregon	4	1	2	1
Pennsylvania	9	5	2	2
South Carolina	4	3	1	-------
Tennessee	5	1	4	-------
Texas	13	1	12	-------
Utah	3	-------	2	1
Vermont	1	-------	1	-------
Virginia	4	3	-------	1
Washington	8	5	2	1
West Virginia	2	1	-------	1
Wisconsin	8	5	2	1
Wyoming	1	-------	1	-------

[1] No schools in Alaska, Delaware, Maine, Rhode Island, and South Dakota.

Source: American Speech and Hearing Association.

CHAPTER 32

Veterinary Medicine

Veterinary medicine deals with the prevention, cure, or alleviation of disease and injury in animals. Veterinarians treat sick and injured animals. They also give advice regarding the care and breeding of animals and help prevent the outbreak and spread of disease among them, by physical examinations, tests, and vaccinations.

The number of *veterinarians* in the United States has increased from 15,800 in 1950, to 20,200 in 1960, and further to 23,700 by the end of 1964 (table 120). Included in the count are Federal and non-Federal veterinarians in active practice as well as those who are retired or not in practice.

More than half of the veterinarians go into private practice. Most of them handle all kinds of domestic animals. An additional number work directly in regulatory and public health aspects of veterinary medicine for Federal, State, or local governments, or are engaged in teaching, research, and other types of practice (table 121).

A license is required for the practice of veterinary medicine in all States and the District of Columbia. To obtain a license, an applicant must be a graduate of an approved veterinary school and pass a State board examination. A few States also require some practical experience under the supervision of a licensed veterinarian.

For positions in public health, research, or teaching, the master's or Ph. D. degree in a field such as pathology, public health, or bacteriology may be required, in addition to the degree of Doctor of Veterinary Medicine (D.V.M.).

The minimum time required to earn the D.V.M. is 6 years beyond high school. This period consists of 2 to 4 years of undergraduate college curricula and 4 years of veterinary medicine in one of the 18 approved schools. In the academic year 1965-66, there were 4,119 students enrolled of whom 910 were expected to graduate that year (tables 122 and 123).

Table 120. LOCATION OF VETERINARIANS AND MEMBERSHIP STATUS IN THE AMERICAN VETERINARY MEDICAL ASSOCIATION: DECEMBER 31, 1964

Location	Total veterinarians	AVMA members	Nonmembers
United States	23,672	16,295	7,377
Alabama	411	261	150
Alaska	10	10	—
Arizona	206	150	56
Arkansas	194	111	83
California	2,236	1,590	646
Colorado	532	392	140
Connecticut	211	177	34
Delaware	70	53	17
District of Columbia	107	84	23
Florida	664	451	213
Georgia	535	344	191
Hawaii	45	40	5
Idaho	167	123	44
Illinois	1,309	919	390
Indiana	787	522	265
Iowa	1,260	837	423
Kansas	584	399	185
Kentucky	329	235	94
Louisiana	271	182	89
Maine	98	80	18
Maryland	487	384	103
Massachusetts	326	269	57
Michigan	840	586	254
Minnesota	777	508	269
Mississippi	193	122	71
Missouri	712	477	235
Montana	186	143	43
Nebraska	472	304	168
Nevada	67	53	14
New Hampshire	80	67	13
New Jersey	485	371	114
New Mexico	135	106	29
New York	1,478	1,012	466
North Carolina	365	271	94
North Dakota	115	85	30
Ohio	1,202	772	430
Oklahoma	369	252	117
Oregon	294	208	86
Pennsylvania	962	638	324
Rhode Island	40	26	14
South Carolina	185	121	64
South Dakota	218	147	71
Tennessee	317	211	106
Texas	1,309	827	482
Utah	129	86	43
Vermont	84	58	26
Virginia	452	318	134
Washington	553	370	183
West Virginia	87	55	32
Wisconsin	647	426	221
Wyoming	80	62	18

Source: American Veterinary Medical Association: *1964 AVMA Directory*. Chicago. Published biennially.

Table 121. TYPE OF PRACTICE OF VETERINARIANS: DECEMBER 31, 1964

Type of practice	Number	Percent
Total veterinarians	**23,672**	**100.0**
Private practice	**13,068**	**55.2**
Large animal	4,513	19.1
Small animal	5,566	23.5
Mixed	2,830	11.9
Poultry (exclusive)	159	0.7
Other practice	**5,310**	**22.4**
Regulatory veterinary medicine [1]	2,176	9.2
Veterinary public health [2]	418	1.8
Military veterinary services	465	1.9
Other including laboratory services [3]	2,251	9.5
Retired, not in practice, or status not reported	**5,294**	**22.4**

[1] Includes inspectors of livestock, meat, poultry and virus serum.
[2] Includes milk and dairy specialists and food and establishment inspectors.
[3] Includes specialists in the basic sciences.

Source: American Veterinary Medical Association.

Table 122. VETERINARY MEDICAL SCHOOLS, STUDENTS, AND GRADUATES: SELECTED YEARS, 1949–50 THROUGH 1965–66

Academic year	Schools	Students	Graduates [1]
1965–66	18	4,119	910
1964–65	18	3,874	815
1963–64	18	3,727	834
1962–63	18	3,632	830
1961–62	18	3,528	819
1960–61	18	3,497	824
1959–60	18	3,464	826
1954–55	17	3,419	817
1949–50	17	3,132	695

[1] Senior students.

Source: *Journal of the American Veterinary Medical Association.* 147(12): 1703, Dec. 15, 1965. Also prior annual December 15 issues of the Journal.

Table 123. LOCATION AND OWNERSHIP OF SCHOOLS OF VETERINARY MEDICINE AND NUMBERS OF STUDENTS AND GRADUATES: 1965–66

Location	School	Ownership	Students	Graduates [1]
	Total, 18 schools		4,119	910
Ala.	Auburn University School of Veterinary Medicine, Auburn	Public	321	58
	Tuskegee Institute School of Veterinary Medicine, Tuskegee Institute	Private	95	17
Calif.	University of California School of Veterinary Medicine, Davis	Public	232	49
Colo.	Colorado State University College of Veterinary Medicine, Fort Collins	Public	263	57
Ga.	University of Georgia School of Veterinary Medicine, Athens	Public	214	51
Ill.	University of Illinois College of Veterinary Medicine, Urbana	Public	214	41
Ind.	Purdue University School of Veterinary Science and Medicine, Lafayette	Public	207	53
Iowa	Iowa State University College of Veterinary Medicine, Ames	Public	281	70
Kans.	Kansas State University School of Veterinary Medicine, Manhattan	Public	304	76
Mich.	Michigan State University College of Veterinary Medicine, East Lansing	Public	220	47
Minn.	University of Minnesota College of Veterinary Medicine, St. Paul	Public	207	41
Mo.	University of Missouri School of Veterinary Medicine, Columbia	Public	140	24
N.Y.	State University of New York, Veterinary College at Cornell University, Ithaca	Public	228	54
Ohio	Ohio State University College of Veterinary Medicine, Columbus	Public	296	72
Okla.	Oklahoma State University College of Veterinary Medicine, Stillwater	Public	180	40
Pa.	University of Pennsylvania School of Veterinary Medicine, Philadelphia	Private	248	48
Tex.	Texas A&M University College of Veterinary Medicine, College Station	Public	288	[2] 70
Wash.	Washington State University College of Veterinary Medicine, Pullman	Public	181	42

[1] 4th-year students. [2] 3d-year students under trimester system.

Source: *Journal of the American Veterinary Medical Association.* 147(12):1703, Dec. 15, 1965.

CHAPTER 33

Visual Services and Eye Care

The responsibility for visual services and eye care is divided among three categories of health personnel. Ophthalmologists and oculists are physicians who specialize in the medical and surgical care of the eyes and may prescribe drugs or other treatment as well as lenses. Optometrists specialize in vision analysis by examining the eyes, prescribing lenses and other vision aids, visual training and orthoptics or other treatment. They do not treat eye diseases or perform surgery. Dispensing opticians fit and adjust eyeglasses according to prescriptions written by ophthalmologists or optometrists; they do not examine eyes or prescribe treatment.

Personnel with special training for safeguarding or improving vision include about 8,500 ophthalmologists (M.D. and D.O.), 17,000 optometrists (O.D.), and 23,000 opticians and optical technicians. In addition, there are about 400 orthoptists who assist ophthalmologists. Statistics on ophthalmologists are included in chapter 18 on medicine and osteopathy; statistics on optometrists, opticians, optical technicians, and orthoptists are given here. (See also ch. 28 for optometrists' assistants.)

Optometrists

Optometry is the profession specifically licensed in all States to care for human vision. A Doctor of Optometry is educated and trained to examine the eyes and related structures to determine the presence of vision problems, eye diseases, or other abnormalities. He prescribes and adapts lenses, contact lenses, or other optical aids, and utilizes vision training to preserve, restore, and enhance vision efficiency.

The number of active *optometrists* in the United States has been relatively constant for many years—at about 17,000. This estimate was provided by the American Optometric Association (13,500 active members). The State distribution in table 124 includes optometrists active in the profession as well as those not in practice.

An estimate based on respondents to a 1965 AOA survey showed that nearly three-fourths of the optometrists are in private practice, either in practice for themselves or associated with other optometrists to form a group. Large numbers of the balance are employed in clinical practice in hospitals or rehabilitation centers. Others are engaged in research and service capacities by government or the ophthalmic industry, or serve as commissioned optometrists in the Armed Forces.

All States and the District of Columbia require a license for the practice of optometry. To qualify for a license, the applicant must be a graduate of an accredited school of optometry and pass a State board examination.

Starting in 1965, all 10 accredited colleges of optometry in the United States required a 6-year curriculum or were authorized to begin this program leading to a Doctor of Optometry degree (O.D.) All require 2 years preoptometry schooling at any accredited college and 4 years of professional optometry training (rather than the earlier requirement of 3 years).

In the fall of 1964, a total of 1,582 students were enrolled in their final 3 or 4 years in the 10 approved colleges. During the academic year 1964-65, 406 graduates were awarded the O.D. degree (tables 125 and 126.).

Opticians and Optical Technicians

A dispensing optician makes and fits eyeglasses prescribed by an ophthalmologist or optometrist to correct a patient's visual defects. The mechanical grinding and polishing of the lenses and assembling in a frame are

done by an optical technician, also known as an optical laboratory mechanic, lens grinder, or polisher. Then the dispensing optician fits and adjusts the glasses or contact lenses to the individual's requirements. Many of the proprietors of retail optical establishments have been trained in these occupations.

Probably upwards of 23,000 *opticians and optical technicians* were employed throughout the country in 1965. The census findings indicated that 19,200 persons in 1950 and 20,300 in 1960 were employed as dispensing opticians and optical technicians (table 127). The Guild of Prescription Opticians estimated that the 8,000 active opticians include upwards of 1,000 proprietors of retail optical establishments, nearly 5,000 dispensers in those shops, about 1,500 employed by eye physicians and optometrists, and more than 500 employed in wholesaling and manufacturing, hospitals, government, and other industries.

The Guild also estimated that of the approximate 15,000 optical technicians, more than 10,000 are employed in prescription departments of wholesale optical laboratories or by manufacturers of ophthalmic goods. Probably as many as 4,000 are employed in retail optical shops, and fewer than 1,000 by eye physicians and optometrists.

Dispensing opticians are required to be licensed in 17 States. Some of these States also require licenses for optical technicians in retail optical shops, or for the retail optical establishment itself.

High school graduates usually prepare for these occupations through formal apprenticeship programs with optical firms. The apprenticeship may last as long as 4 or 5 years. A few schools now offer formal courses in optical technology which meet the educational standards set up by the American Board of Opticianry (table 128).

Orthoptists

Many ophthalmologists have assistants known as orthoptists who work under their supervision in the specialized field of teaching patients certain exercises which help overcome the handicap of crossed eyes. (The optometrist who specializes in visual training may have the similar help of an assistant.)

Approximately 400 individuals were employed as *orthoptists* in 1965. The great majority work in the private offices of ophthalmologists while a few are employed in hospitals and clinics. The estimated number was provided by the American Orthoptic Council. The American Association of Certified Orthoptists has 350 members.

Specialized training in orthoptics is available to persons with at least 2 years of college education. The training may involve enrollment for a year at 1 of the 11 institutions listed in table 129, or a 10- to 12-month period of practical work in a training center under the supervision of a certified orthoptist, combined with the basic 2-month course offered by the American Orthoptic Council. A certificate is issued by the Council to qualified students who successfully pass an examination conducted by the Council.

Table 124. LOCATION OF LICENSED OPTOMETRISTS: MARCH 1, 1966

Location	Number	Location	Number
All locations	[1] 20,668		
United States	20,610		
Alabama	184	Montana	91
Alaska	16	Nebraska	184
Arizona	128	Nevada	37
Arkansas	143	New Hampshire	78
California	2,461	New Jersey	732
Colorado	201	New Mexico	74
Connecticut	279	New York	1,838
Delaware	33	North Carolina	338
District of Columbia	82	North Dakota	82
Florida	514	Ohio	1,056
Georgia	287	Oklahoma	262
Hawaii	65	Oregon	324
Idaho	96	Pennsylvania	1,373
Illinois	1,992	Rhode Island	141
Indiana	547	South Carolina	166
Iowa	359	South Dakota	93
Kansas	245	Tennessee	320
Kentucky	246	Texas	844
Louisiana	248	Utah	86
Maine	123	Vermont	35
Maryland	195	Virginia	285
Massachusetts	852	Washington	400
Michigan	786	West Virginia	159
Minnesota	425	Wisconsin	454
Mississippi	130	Wyoming	38
Missouri	483		
		Puerto Rico	58

[1] An estimated 17,000 of these optometrists are active in the profession.

Source: *The Blue Book of Optometrists.* Chicago. Professional Press, Inc., 1966. Also prior biennial editions of this directory.

Table 125. SCHOOLS OF OPTOMETRY, STUDENTS, AND GRADUATES: SELECTED YEARS, 1950–51 THROUGH 1965–66

Academic year	Schools	Students [1]	Graduates
1965–66	10	----------	----------
1964–65	10	1,582	406
1963–64	10	1,364	346
1962–63	10	1,263	359
1961–62	10	1,180	299
1960–61	10	1,101	316
1959–60	10	1,122	364
1956–57	10	1,175	355
1953–54	12	1,631	674
1950–51	10	2,435	961

[1] Fall enrollment of undergraduate students in last 3 or 4 years of optometric education.

Source: American Optometric Association: Educational Supplement to the *J.A.O.A.* Apr. 1965. Also prior annual issues.

Table 126. LOCATION AND OWNERSHIP OF ACCREDITED SCHOOLS OF OPTOMETRY: 1964–65

Location	School	Ownership	Students[1]	Graduates
	Total, 10 schools		1,582	[2] 406
Calif.	Los Angeles College of Optometry, Los Angeles	Private	138	32
	University of California, School of Optometry, Berkeley	Public	95	23
Ill.	Illinois College of Optometry, Chicago	Private	251	78
Ind.	Indiana University, Division of Optometry, Bloomington	Public	88	26
Mass.	Massachusetts College of Optometry, Boston	Private	103	23
Ohio	Ohio State University, School of Optometry, Columbus	Public	96	27
Oreg.	Pacific University, College of Optometry, Forest Grove	Private	178	45
Pa.	Pennsylvania College of Optometry, Philadelphia	Private	217	42
Tenn.	Southern College of Optometry, Memphis	Private	280	64
Tex.	University of Houston, College of Optometry, Houston	Public	136	46

[1] Fall 1964 enrollment of undergraduate students in last 3 years of optometric education; last 4 years in Pennsylvania College and University of Houston.

[2] Preliminary figure reported in March 1965 survey.

Source: American Optometric Association.

Table 127. LOCATION OF DISPENSING OPTICIANS AND OPTICAL TECHNICIANS IN RELATION TO POPULATION: APRIL 1, 1960

Location	Number employed	Rate per 100,000 population	Location	Number employed	Rate per 100,000 population
United States	[1] 20,349	11.3			
Alabama	154	4.7	Missouri	521	12.1
Alaska	24	10.6	Montana	72	10.7
Arizona	98	7.5	Nebraska	177	12.5
Arkansas	53	3.0	Nevada	16	5.6
California	1,614	10.3	New Hampshire	123	20.3
Colorado	228	13.0	New Jersey	657	10.8
Connecticut	370	14.6	New Mexico	64	6.7
Delaware	36	8.1	New York	3,722	22.3
District of Columbia	64	8.4	North Carolina	269	5.9
Florida	510	10.3	North Dakota	53	8.4
Georgia	236	6.0	Ohio	981	10.1
Hawaii	61	9.6	Oklahoma	169	7.3
Idaho	22	3.3	Oregon	177	10.0
Illinois	1,213	12.0	Pennsylvania	1,364	12.1
Indiana	356	7.6	Rhode Island	229	26.7
Iowa	213	7.7	South Carolina	116	4.9
Kansas	209	9.6	South Dakota	52	7.6
Kentucky	225	7.4	Tennessee	168	4.7
Louisiana	171	5.3	Texas	1,010	10.5
Maine	31	3.2	Utah	124	13.9
Maryland	358	11.5	Vermont	49	12.6
Massachusetts	1,428	27.7	Virginia	550	13.9
Michigan	629	8.0	Washington	304	10.7
Minnesota	488	14.3	West Virginia	148	8.0
Mississippi	74	3.4	Wisconsin	361	9.1
			Wyoming	8	2.4

[1] Many of the 2,500 proprietors of retail optical establishments were also trained as dispensing opticians or optical technicians (lens grinders and polishers and other laboratory mechanics).

Source: Prindle, R. A. and Pennell, M. Y.: Industry and occupation data from the 1960 census. *Health Manpower Source Book 17.* PHS Pub. No. 263, Section 17. Public Health Service, U.S. Department of Health, Education, and Welfare. Washington. U.S. Government Printing Office, 1963.

Table 128. LOCATION AND OWNERSHIP OF INSTITUTIONS OFFERING TRAINING PROGRAMS FOR OPTICIANS AND NUMBERS OF GRADUATES: 1965

Location	Institution	Ownership	Graduates
	Total, 5 institutions		88
Calif.	Los Angeles City College, Los Angeles	Public	18
Mich.	Ferris State College, Technical Terminal Division, Big Rapids	Public	22
Minn.	Eveleth Area Vocational-Technical School, Eveleth [1]	Public	7
N.Y.	City University of New York, New York City Community College of Applied Arts and Sciences, New York City [1]	Public	
	Erie County Technical Institute, Optical Technology Department, Buffalo	Public	41

[1] Not listed by the A.B.O. accrediting body.
Sources: American Board of Opticianry and Guild of Prescription Opticians.

Table 129. LOCATION AND OWNERSHIP OF ACCREDITED TRAINING CENTERS AND PRECEPTORSHIPS IN ORTHOPTICS AND NUMBERS OF STUDENTS: FEBRUARY 1966

Location	Center or preceptorship	Ownership	Students
	10 training centers		26
Ga.	Emory University Orthoptic Training School, Emory University Clinic, Atlanta	Private	3
La.	Tulane University School of Medicine, Orthoptic-Pleoptic Clinic, Department of Ophthalmology, New Orleans	Private	3
Mass.	Harvard Medical School, Massachusetts Eye and Ear Infirmary, Boston	Private	2
Mich.	Wayne State University School of Medicine, Kresge Eye Institute, Detroit	Public-private	2
Mo.	University of Missouri School of Medicine, Section of Ophthalmology, Columbia	Public	2
N.Y.	New York Eye and Ear Infirmary, School of Orthoptics, New York	Private	4
	New York University School of Medicine, Department of Ophthalmology, New York	Private	3
Ohio	Ohio State University Hospital, Department of Ophthalmology, Columbus	Public	1
Okla.	University of Oklahoma Medical Center, Orthoptic Clinic, Oklahoma City	Public	2
Texas	Baylor University College of Medicine, Methodist Hospital, Pleoptic-Orthoptic Unit, Houston	Private	4
	14 preceptorships		24
Calif.	University of California San Francisco Medical Center, University of California Hospital, San Francisco	Public	1
Fla.	University of Florida College of Medicine, Department of Ophthalmology, Gainesville	Public	1
	University of Miami School of Medicine, Bascon Palmer Eye Institute, Miami	Private	2
Iowa	University of Iowa, University Hospitals, Department of Ophthalmology, Iowa City	Public	3
Md.	Johns Hopkins University School of Medicine, Johns Hopkins Hospital, Wilmer Institute, Baltimore	Private	2
Mich.	Office of Edmond L. Cooper, M.D., Royal Oak	Private	1
	University of Michigan Medical Center, University Hospital, Department of of Ophthalmic Surgery, Ann Arbor	Public	1
Mo.	St. Louis Ophthalmic Laboratory, St. Louis	Private	2
	Washington University School of Medicine, Department of Ophthalmology, St. Louis	Private	2
N.Y.	Buffalo Eye and Ear Hospital, Buffalo Orthoptic Clinic, Buffalo	Private	3
	Presbyterian Medical Center, Institute of Ophthalmology, New York	Private	3
	State University of New York, Downstate Medical Center, Division of Ophthalmology, Brooklyn	Public	1
Ohio	Cleveland Clinic Foundation, Cleveland	Private	1
Wis.	Milwaukee Ophthalmic Institute, Milwaukee Curative Workshop, Milwaukee	Private	1

Source: American Orthoptic Council.

CHAPTER 34

Vocational Rehabilitation Counseling

Rehabilitation services are required to help persons with physical or mental disabilities to return as fully as possible to normal living. Primary concern with repairing or compensating for the damage of illness or accident rests with the physician who may have the help of a variety of other health workers. For vocational guidance, training, and placement, however, the major responsibility rests with the rehabilitation counselor.

The vocational *rehabilitation counselor* is concerned with evaluating the vocational potential of the individual. He tries to match the abilities of the client with a job when the time comes for starting work—either in the old job or the one for which job training or retraining becomes a part of rehabilitation. Some counselors specialize in services for the blind, paraplegics, the mentally ill, the retarded, or other particular groups. They not only provide client counseling but engage in community activities to interest prospective employers, educators, and others in the problems of handicapped persons and the benefits of rehabilitation.

All 50 States have rehabilitation programs financed jointly by Federal and State funds. More than 4,500 rehabilitation counselor positions were in existence in these State programs at the close of 1965; however, 300 were vacant (table 130). They are based in the agencies' headquarters or field service stations, in mental hospitals, rehabilitation centers, sheltered workshops, and other special settings.

In addition, an estimated 2,000 rehabilitation counselors were employed in 1965 in Veterans' Administration hospitals and in other public and private hospitals, in special schools, and by voluntary health agencies and other organizations with rehabilitation interests.

The minimum educational requirement for employment as a rehabilitation counselor is generally a bachelor's degree, preferably with a major subject of psychology, social welfare, or education. Specialized professional education is open for college graduates who have had some experience in rehabilitation counseling or in such related fields as vocational guidance, personnel work, or social work. Probably about 80

Table 130. VOCATIONAL REHABILITATION COUNSELORS: SELECTED YEARS, 1950 THROUGH 1965

Year	Estimated number of counselors	Employed in State programs	Employed in hospitals, schools, or other settings [1]
1965	6,200	4,200	2,000
1960	3,000	2,000	1,000
1955	1,800	1,200	600
1950	1,500	1,000	500

[1] Includes those employed by voluntary health agencies and other organizations with rehabilitation interests.

Source: U.S. Department of Health, Education, and Welfare; Vocational Rehabilitation Administration, Division of Training.

Table 131. SCHOOLS OFFERING GRADUATE TRAINING PROGRAMS IN REHABILITATION COUNSELING AND GRADUATES: SELECTED YEARS, 1949–50 THROUGH 1965–66

Academic year	Schools	Students	Graduates
1965–66	39	[1] 1,250	[1] 575
1964–65	39	954	467
1963–64	34	857	415
1962–63	33	738	281
1961–62	32	646	231
1960–61	34	565	241
1959–60	29	566	243
1954–55	4	43	5
1949–50	3	----------	----------

[1] Estimated.

Source: U.S. Department of Health, Education, and Welfare; Vocational Rehabilitation Administration, Division of Training. Data for United States and Puerto Rico.

percent of the 6,200 rehabilitation counselors currently employed have had some graduate training.

In 1965-66, 39 universities offered graduate programs in rehabilitation counseling (tables 131 and 132). The graduate programs generally require 1 to 2 academic years for a master's degree and an additional 2 or 3 years for a doctorate. The courses include human behavior and personality functioning, rehabilitation problems, counseling principles and techniques, occupational information, and methods of developing job resources for the disabled. About 467 persons were graduated in 1965, with a considerable increase anticipated for 1966.

Table 132. LOCATION AND OWNERSHIP OF SCHOOLS OFFERING GRADUATE TRAINING PROGRAMS IN REHABILITATION COUNSELING AND NUMBER OF GRADUATES: 1965

Location	School [1]	Ownership	Graduates [2]
	Total, 39 institutions		467
Ala.	University of Alabama, University	Public	11
Ariz.	University of Arizona, Tucson	Public	11
Calif.	California State College at Los Angeles, Los Angeles	Public	17
	San Francisco State College, San Francisco	Public	17
Colo.	Colorado State College, Greeley	Public	14
Fla.	University of Florida, Gainesville	Public	22
Ga.	University of Georgia, Athens	Public	2
Hawaii	University of Hawaii, Honolulu	Public	4
Ill.	DePaul University, Chicago	Private	—
	Southern Illinois University, Carbondale	Public	11
	University of Illinois, Urbana	Public	8
Iowa	University of Iowa, Iowa City	Public	11
Ky.	University of Kentucky, Lexington	Public	3
Md.	University of Maryland, College Park	Public	1
Mass.	Boston University, Boston	Private	20
	Springfield College, Springfield	Private	12
Mich.	Michigan State University, East Lansing	Public	23
	Wayne State University, Detroit	Public	18
Minn.	University of Minnesota, Minneapolis	Public	18
Mo.	University of Missouri, Columbia	Public	4
N.J.	Seton Hall University, South Orange	Private	11
N.Y.	Columbia University, New York	Private	36
	Hunter College of the City University of New York, New York	Public	11
	New York University, New York	Private	19
	State University of New York, SUNY at Buffalo, Buffalo	Public	18
	Syracuse University, Syracuse	Private	7
Ohio	Kent State University, Kent	Public	8
Okla.	Oklahoma State University, Stillwater	Public	7
Oreg.	University of Oregon, Eugene	Public	18
Pa.	Pennsylvania State University, University Park	Private	23
	University of Pittsburgh, Pittsburgh	Private	8
	University of Scranton, Scranton	Private	—
P.R.	University of Puerto Rico, Rio Piedras	Public	9
Tex.	Texas Technological College, Lubbock	Public	—
	University of Texas, Austin	Public	7
Utah	University of Utah, Salt Lake City	Public	10
Va.	Richmond Professional Institute, Richmond	Public	20
W. Va.	West Virginia University, Morgantown	Public	13
Wis.	University of Wisconsin, Madison	Public	15

[1] Institutions receiving VRA training grants in the field of rehabilitation counseling.
[2] Master's degree in rehabilitation counseling or certificate to those with a master's degree in a related field.

Source: U.S. Department of Health, Education, and Welfare; Vocational Rehabilitation Administration, Division of Training.

CHAPTER 35

Miscellaneous Hospital Services

Hospitals in increasing numbers are employing persons variously called therapists, technicians, assistants, and aides. These individuals are usually high school graduates who may also have had some college courses. They receive inservice training while working under the continuous supervision of physicians and/or professional nurses.

Specifically named in this chapter are inhalation therapist, electro-cardiograph technician, electroencephalograph technician, and a variety of aides—surgical, obstetrical, and pediatric. The hospital-based therapists in specialized rehabilitation services are discussed in chapter 30. For other emerging occupations there is little identifying material at present.

Only for inhalation therapists and electroencephalograph technicians is there an estimate of the numbers currently employed. The 1966 survey of manpower resoures in hospitals referred to in the Introduction is expected to provide employment statistics for all hospital ancillary personnel. A list of educational programs is to be developed from the Office of Education's survey of health occupations curriculum, 1964-65.

Inhalation Therapist

The inhalation therapist uses skills and equipment to attempt to restore normal function to the respiratory system. In a small hospital this service may be provided by nurse-anesthetists, there being about 9,000 employed in hospitals of all sizes in 1964.[48] In larger institutions, however, at least one inhalation therapist works full time to maintain the oxygen service in terms of adequate supply, good equipment, and accurate records.

[48] American Nurses' Association: *Facts About Nursing: A Statistical Summary.* New York, 1966. Page 18.

The majority of the technicians are employed in the anesthesiology departments of hospitals. Others work for firms that provide emergency oxygen service or for municipal organizations.

The number of persons employed as *inhalation therapists* in 1965 was probably in excess of 5,000, according to the American Association of Inhalation Therapists which reports 3,500 members. A registry of persons who have qualified through oral and written examinations is maintained by the American Registry of Inhalation Therapists; 265 persons were registered as of May 1, 1966.

Eighteen schools now offer approved educational programs for inhalation therapists, in accordance with minimal standards initiated in 1963. Training programs that last 10 to 12 months include theoretical instruction and supervised practical experience. The courses are open to high school graduates and graduates of a school of nursing. In 1964-65, 48 students were enrolled and 48 were graduated (table 133).

Electrocardiograph Technician

Electrocardiography involves recording the changes of electrical potential occurring during the heartbeat by use of an electrocardiograph (ECG or EKG) machine. It is used in diagnosing abnormalities of heart action or recording progress of patients with heart conditions, as well as a followup for those patients receiving cardio-toxic medications. The electrocardiograph technician operates the machine and gives the recorded tracings to physicians qualified in cardiology for analysis and interpretation.

Electrocardiograph technicians usually are employed in the cardiology service of a hospital, although a few work for cardiologists in private practice. They perform in a laboratory or at the patient's bedside if the

patient cannot be moved. The technician attaches electrodes to various parts of the patient's body and moves the chest electrodes to successive positions across the patient's chest, obtaining several different tracings of the heart action by the ECG machine.

No specific formal education is required. However, high school graduation with courses in the physical sciences and some college work are desirable. On-the-job training in a hospital usually lasts 3 to 6 months, under the supervision of an experienced technician or cardiologist.

Electroencephalograph Technician

Electroencephalography involves the detecting, measuring, and recording of brain waves by the use of an electroencephalograph (EEG) machine. It is of great importance in the evaluation and treatment of patients with various types of brain disease or trauma. The electroencephalograph technician is trained to use the machine to record brain waves. These tracing are interpreted by a physician, usually a neurologist, with training in encephalography.

An estimated 1,200 *electroencephalograph technicians* were employed full or part time in 1965. They usually work in the neurology service of a large hospital. However, a few give tests in a neurologist's office.

The EEG technician may take on-the-job training in a hospital EEG department, generally serving an apprenticeship lasting 3 to 6 months. The practical experience may be supplemented by lectures on neuroanatomy, neurophysiology, and electronics. A minimum background of high school science courses and an aptitude for working with complicated electrical equipment are needed. Formal training programs are being developed in several junior colleges and hospitals (table 134). For some of these programs a minimum of 2 years of college preparation is required prior to admission.

Professional societies include the American Society of Electroencephalographic Technicians (ASET) which was organized in 1960 and now reports 425 active and associate members. This count includes many but not all members from the regional societies.

An American Board of Registration of Electroencephalographic Technicians (ABRET) was established in 1964. Eleven persons has been registered as of the spring of 1966, upon satisfactory completion of the written and oral examinations. A certificate of registration entitles the technician to the use of the designation RET. There is no grandfather clause for registrants.

Surgical, Obstetrical, and Pediatric Aides

Aides are identified according to the hospital service in which they work. For example, *surgical aides,* also called surgical technical aides or operating room assistants, work under the continuous supervision of the operating room nurses or surgeons. They assist in the care of patients in the operating

Table 133. LOCATION AND OWNERSHIP OF SCHOOLS OFFERING INHALATION THERAPY PROGRAMS AND NUMBERS OF STUDENTS AND GRADUATES: JULY 1, 1964 TO JUNE 30, 1965

Location	School	Ownership
	Total, 11 schools [1]	
Ga.	Crawford W. Long Memorial Hospital, Atlanta	Private
Ill.	Cook County Hospital, Chicago	Public
	Edgewater Hospital, Chicago	Private
	University of Chicago Hospitals, Chicago	Private
N.C.	North Carolina Baptist Hospital, Winston-Salem	Private
Pa.	Hospital of the University of Pennsylvania, Philadelphia	Private
	Presbyterian-University Hospital, Pittsburgh	Private
S.C.	Medical College Hospital, Charleston	Public
S. Dak.	Memorial Hospital, Watertown	Private
Tenn.	Baroness Erlanger Hospital, Chattanooga	Public
Wis.	Bellin Memorial Hospital, Green Bay	Private

[1] The 11 schools had 48 students and 48 graduates. Data were not reported for the individual schools.

Source: American Association of Inhalation Therapists.

room and/or delivery room and in the care, preparation, and maintenance of sterile and unsterile supplies and equipment.

There are no formal educational requirements for persons who receive inservice training in hospitals. In recent years a few programs for high school graduates have been developed in vocational or trade schools operated under public school systems in cooperation with hospitals that have suitable surgical facilities.

Table 134. LOCATION AND OWNERSHIP OF INSTITUTIONS OFFERING TRAINING PROGRAMS IN ELECTROENCEPHALOGRAPHY: SPRING 1966

Location	Institution [1]	Ownership	Length of course
Ga.	Emory University, Atlanta	Private	1 year
Iowa	University of Iowa, Iowa City	Public	1 year
Md.	Johns Hopkins Hospital, Baltimore	Private	----------
Mass.	Massachusetts General Hospital, Boston	Private	6 months
Minn.	Mayo Clinic, Rochester	Private	----------
N.C.	Duke University, Durham	Private	6 months
Tex.	Baylor University, Waco	Private	1 year

[1] This list of 7 institutions is known to be incomplete.

Source: American Society of Electroencephalographic Technicians.

APPENDIX I

Publications in the HEALTH MANPOWER SOURCE BOOK Series: Public Health Service Publication No. 263

Section 1. *Physicians.* By M. Y. Pennell and M. E. Altenderfer. 1952.

Section 2. *Nursing Personnel.* By H. G. Tibbitts and E. Levine. 1953.

Section 2. *Nursing Personnel.* By Division of Nursing. Revised January 1966. 113 pages. 70 cents.

Section 3. *Medical Social Workers.* By L. W. Knott, M. Y. Pennell, L. M. Smith, and R. Wadman. 1953.

Section 4. *County Data from 1950 Census and Area Analysis.* By M. Y. Pennell and M. E. Altenderfer. 1954.

Section 5. *Industry and Occupation Data from 1950 Census, by State.* By M. E. Altenderfer and M. Y. Pennell. 1954.

Section 6. *Medical Record Librarians.* By M. Y. Pennell, M. E. Altenderfer, and O. G. Johnson. 1955.

Section 7. *Dentists.* By E. H. Pennell and M. Y. Pennell. 1955.

Section 8. *Dental Hygienists.* By W. J. Pelton, E. H. Pennell, and H. M. Vavra. 1957.

Section 9. *Physicians, Dentists, and Professional Nurses.* By Divisions of Public Health Methods, Dental Resources, and Nursing Resources. 1959.

Section 10. *Physicians' Age, Type of Practice, and Location.* By W. H. Stewart and M. Y. Pennell. 1960. 199 pages. 55 cents.

Section 11. *Medical School Alumni.* By W. H. Stewart and M. Y. Pennell. 1961. 319 pages. $1.50.

Section 12. *Medical and Psychiatric Social Workers.* By W. H. Stewart, M. Y. Pennell, and L. M. Smith. 1961. 65 pages. 40 cents.

Section 13. *Hospital House Staffs.* By W. H. Stewart and M. E. Altenderfer. 1961. 43 pages. 30 cents.

Section 14. *Medical Specialists.* By P. Q. Peterson and M. Y. Pennell. 1962. 233 pages. $1.25.

Section 15. *Pharmacists.* By P. Q. Peterson and M. Y. Pennell. 1963. 66 pages. 40 cents.

Section 16. *Sanitarians.* By M. Y. Pennell, I. Light, and D. W. Taylor. 1963. 52 pages. 35 cents.

Section 17. *Industry and Occupation Data from 1960 Census, by State.* By R. A. Prindle and M. Y. Pennell. 1963. 104 pages. 55 cents.

Section 18. *Manpower in the 1960's.* By Divisions of Public Health Methods, Dental Public Health and Resources, and Nursing. 1964. 67 pages. 40 cents.

Section 19. *Location of Manpower in 8 Occupations, 1962.* By M. Y. Pennell and K. I. Baker. 1965. 167 pages. $1.00.

NOTE: Although first editions of Sections 1–9 are out of print, copies may be consulted at many major libraries in the United States. Sections 10–19, and the revised edition of Section 2, are available at prices shown from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

APPENDIX II

Health Occupations Within Each Health Field

Table A lists health occupations grouped into health fields corresponding to the chapter headings of this report. The most usual or preferred form of the occupational title is followed by synonyms or designations related to field of practice or place of employment. Thus the list contains more than 300 primary and alternate job titles, without counting cross references between health fields. Even then the inventory is incomplete. Some types of health workers or specialists may have been inadvertently omitted.

Only occupations for which workers are required to have special education or training designed to help them function in a health setting have been included. Many other persons perform the business, clerical, and maintenance services essential to the health services industry even though their occupations are not considered to be unique to the health field. Among such personnel are accountants, admitting officers, business managers, cashiers, controllers, credit managers, directors of office services, directors of volunteer services, employment interviewers, employment managers, hospital engineers, housekeepers and housekeeping workers, job analysts, laundry managers and workers, maintenance workers, personnel directors and office workers, public relations directors, purchasing agents, stationary engineers, and stockroom managers.

Table B summarizes the number of occupations within each health field and shows the distribution of approximately 3 million persons employed in 1965.

Table A. LIST OF HEALTH OCCUPATIONS WITHIN EACH HEALTH FIELD

Primary job title within health field	Alternate job title
1. ADMINISTRATION OF HEALTH SERVICES	Administrator[1]
Health department	
Health officer[2]	
Public health administrator	
Administrative officer	
Program analyst[1]	Analyst[1]
	Program specialist
	Public health analyst
	Public health specialist
Program representative	Public health representative
Institutions	
Hospital administrator	
Hospital administrative assistant	
Nursing home administrator	
Nursing home administrative assistant	
Voluntary health agency	
Health agency administrator	Health agency executive
Field representative	
2. ANTHROPOLOGY AND SOCIOLOGY	
Anthropologist[3]	Cultural anthropologist
	Physical anthropologist
Sociologist[3]	Medical sociologist
3. AUTOMATIC DATA PROCESSING	
Systems analyst[3]	
Computer programer[3]	
Computer operator[3]	
Electronic technician[3]	
4. BASIC SCIENCES IN THE HEALTH FIELD	Research scientist
Anatomist	Cytologist
	Embryologist
	Histologist
Biochemist	
Biologist[4]	
Biophysicist	
Botanist	
Chemist[4]	
Ecologist[4]	
Entomologist	
Geneticist	
Microbiologist[5]	Bacteriologist[5]
	Mycologist
	Parasitologist
	Virologist
Nutritionist[4]	
Pathologist[7]	
Pharmacologist[4]	
Physicist[4]	
Physiologist[4]	
Plant pathologist	
Plant physiologist	
Zoologist	
5. BIOMEDICAL ENGINEERING	
Biomedical engineer	Bioengineer
	Medical engineer
Biomedical engineering technician	Medical engineering technician
6. CHIROPRACTIC AND NATUROPATHY	
Chiropractor	
Naturopath	Drugless healer
	Sanipractor
7. CLINICAL LABORATORY SERVICES	
Clinical laboratory scientist	
Clinical chemist	
Microbiologist[5]	
Clinical laboratory technologist	
Chemistry technologist	
Microbiology technologist	
Medical technologist	Blood banking technologist
	Chemistry technologist
	Microbiology technologist
	Nuclear medical technologist

Table A. LIST OF HEALTH OCCUPATIONS WITHIN EACH HEALTH FIELD—Continued

Primary job title within health field	Alternate job title
Clinical laboratory technician	Clinical laboratory assistant Laboratory technician[8] Medical technician
Cytotechnologist	Cytotechnician
Histologic technician	
Certified laboratory assistant	
8. DENTISTRY AND ALLIED SERVICES	
Dentist[1]	Endodontist Oral pathologist Oral surgeon Orthodontist Pedodontist Periodontist Prosthodontist Public health dentist
Dental hygienist	
Dental assistant[9]	
Dental laboratory technician	Laboratory technician[8]
9. DIETETIC AND NUTRITIONAL SERVICES	Home economist
Dietitian	Administrative dietitian Consultant dietitian Research dietitian Teaching dietitian Therapeutic dietitian
Nutritionist[6]	Public health nutritionist Research nutritionist Teaching nutritionist
Food service supervisor	
Food service clerical worker	
Food service worker	
10. ECONOMIC RESEARCH IN THE HEALTH FIELD	
Economist[3]	Health economist
11. ENVIRONMENTAL HEALTH[10]	
Environmental health engineer and aide	
Engineer	Air pollution engineer Industrial hygiene engineer[11] Public health engineer Radiological engineer Safety engineer[11] Sanitary engineer Other engineers
Engineering aide	
Sanitarian and sanitarian technician	
Sanitarian	
Sanitarian technician	Sanitarian aide Sanitary inspector
Environmental health scientist and specialist	
Bacteriologist[4]	
Biologist[4]	Radiobiologist
Chemist[4]	Radiochemist
Ecologist[4]	
Epidemiologist	
Hydrologist	
Industrial hygienist	Industrial hygiene engineer[11] Safety engineer[11]
Limnologist	
Meteorologist	
Microbiologist[5]	
Pharmacologist[4]	
Physicist[4]	Health physicist Radiological physicist
Physiologist[4]	
Radiation protectionist	Radiological health specialist
Toxicologist	
Environmental health technician	
Health physics technician	Health physics monitor Radiation monitor Radioisotope technician
Sewage plant technician-assistant	
Waterworks technician-assistant	

Table A. LIST OF HEALTH OCCUPATIONS WITHIN EACH HEALTH FIELD—Continued

Primary job title within health field	Alternate job title
12. FOOD AND DRUG PROTECTIVE SERVICES	
Food technologist	
Food and drug inspector	
Food and drug analyst	
13. HEALTH AND VITAL STATISTICS	
Health statistician	Biomathematician Biostatistician Mathematician Public health statistician Statistician[1]
Statistical clerk	
Vital record registrar	
Health demographer	Demographer
14. HEALTH EDUCATION	
Public health educator	Health educator
School health educator	
School health coordinator	
15. HEALTH INFORMATION AND COMMUNICATION	
Science writer	Medical writer
Health information specialist	Information specialist[1]
Technical writer	Editor
Illustrator	
Poster and display artist	
Draftsman	
Medical illustrator	Medical photographer
16. LIBRARY SERVICES IN THE HEALTH FIELD	
Medical librarian	
Patients' librarian	Hospital librarian
17. MEDICAL RECORDS	
Medical record librarian	
Medical record technician	
18. MEDICINE AND OSTEOPATHY	
Doctor of Medicine	Physician[1]
Doctor of Osteopathy	Osteopathic physician
M.D. or D.O.	Intern Resident Allergist Anesthesiologist[12] Aviation medicine specialist Cardiologist[12] Dermatologist Forensic pathologist Gastroenterologist General practioner[13] Gynecologist Industrial physician Internist Neurological surgeon Neurologist[12] Occupational medicine specialist Obstetrician[13] Ophthalmologist[14] Orthopedic surgeon Otolaryngologist Pathologist[7] Pediatrician Physiatrist Plastic surgeon Preventive medicine specialist Proctologist Psychiatrist Public health physician[2] Radiologist[11] Surgeon[12] Thoracic surgeon Urologist Health officer[2]

Table A. LIST OF HEALTH OCCUPATIONS WITHIN EACH HEALTH FIELD—Continued

Primary job title within health field	Alternate job title
19. MIDWIFERY	
Midwife	Lay midwife
Nurse[15]	Nurse midwife[15]
Physician[13]	General practitioner [13] Obstetrician[13]
20. NURSING AND RELATED SERVICES	
Professional nurse[15]	Nurse[1] Registered nurse Graduate nurse Hospital nurse Private-duty nurse Office nurse Public health nurse School nurse Occupational health nurse Industrial nurse Nurse anesthetist[16] Nurse midwife[15] Obstetrical nurse Operating room nurse[16] Pediatric nurse Psychiatric nurse
Practical nurse	Licensed practical nurse Vocational nurse Licensed vocational nurse
Nursing aide Orderly Attendant	Psychiatric aide
Home health aide Homemaker	Home aide Visiting health aide
Ward clerk	Floor clerk
21. OCCUPATIONAL THERAPY	
Occupational therapist	
Occupational therapy assistant	Occupational therapy technician
22. ORTHOPEDIC AND PROSTHETIC APPLIANCE MAKING	
Prosthetist	
Orthotist	
Orthopedic technician	
23. PHARMACY	
Pharmacist	Community pharmacist Hospital pharmacist
Pharmacy helper	
24. PHYSICAL THERAPY	
Physical therapist	
Physical therapy aide	Physical therapy technician
25. PODIATRY	
Podiatrist	Chiropodist
26. PSYCHOLOGY	
Psychologist[3]	Clinical psychologist Counseling psychologist Measurement psychologist Psychometrist Social psychologist
27. RADIOLOGIC TECHNOLOGY	
Radiologic technologist	Medical X-ray technologist X-ray technician Nuclear medical technician Radiation therapy technician
28. SECRETARIAL AND OFFICE SERVICES	
Secretary[3]	Dental secretary Medical secretary
Receptionist[3]	Dental receptionist Medical receptionist
Assistant[3]	Dental assistant[9] Medical assistant Optometrist's assistant Office assistant Office aide

Table A. LIST OF HEALTH OCCUPATIONS WITHIN EACH HEALTH FIELD—Continued

Primary job title within health field	Alternate job title
29. SOCIAL WORK	
Social work[3]	Medical social worker Psychiatric social worker
Social work assistant	
30. SPECIALIZED REHABILITATION SERVICES	
Corrective therapist[17]	
Educational therapist	
Manual arts therapist	
Music therapist	
Recreational therapist	Adjunctive therapist Recreator Therapeutic recreation specialist
Homemaking rehabilitation consultant	
31. SPEECH PATHOLOGY AND AUDIOLOGY	
Speech pathologist	
Audiologist	
32. VETERINARY MEDICINE	
Veterinarian[1]	Public health veterinarian
33. VISUAL SERVICES AND EYE CARE	
Physician[14]	Ophthalmologist[14] Oculist
Optometrist	
Optician	Dispensing optician
Optical technician	Optical laboratory mechanic Lens grinder Lens polisher
Orthoptist	Orthoptic technician
34. VOCATIONAL REHABILITATION COUNSELING	
Vocational rehabilitation counselor	Rehabilitation counselor
35. MISCELLANEOUS HOSPITAL SERVICES	
Anesthesiology service	
Physician[12]	Anesthesiologist[12]
Nurse[16]	Nurse anesthetist[16]
Inhalation therapist	
Cardiology service	
Physician[12]	Cardiologist[12]
Electrocardiograph technician	
Neurology service	
Physician[12]	Neurologist[12]
Electroencephalograph technician	
Other services	
Physician[12]	Surgeon[12] Other
Nurse[16]	Operating-room nurse[17] Other
Aide	Obstetrical aide Operating-room assistant Pediatric aide Surgical aide Surgical technician

[1] Mentioned also in ch. 11.
[2] Mentioned in chs. 1 and 18.
[3] Not all persons with this job title are considered to be health workers; see alternate titles designating those in the health field.
[4] Mentioned in chs. 4 and 11.
[5] Mentioned in chs. 4, 7, and 11.
[6] Mentioned in chs. 4 and 9.
[7] Mentioned in chs. 4, 11, and 18.
[8] Mentioned in chs. 7 and 8.
[9] Mentioned in chs. 8 and 28.
[10] Personnel in addition to those listed include administrators, analysts, dentists, information specialists, nurses, physicians (pathologists, radiologists, and others), statisticians, and veterinarians.
[11] Mentioned as engineer and industrial hygienist.
[12] Mentioned in chs. 18 and 35.
[13] Mentioned in chs. 18 and 19.
[14] Mentioned in chs. 18 and 33.
[15] Mentioned in chs. 19 and 20.
[16] Mentioned in chs. 20 and 35.
[17] Excludes adapted physical educators.

TABLE B. SUMMARY OF NUMBER OF OCCUPATIONS WITHIN EACH HEALTH FIELD AND ESTIMATED PERSONS EMPLOYED: 1965

Health field	Health occupation[1]		Estimated persons employed[1]
	Primary job title	Alternate job title	
All fields	140	175	2,778,900 to 2,898,700
1. Administration of health services[2]	10	7	31,500 to 37,000
2. Anthropology and sociology	2	3	600 to 800
3. Automatic data processing	4	—	[3]300
4. Basic sciences in the health field	16	8	44,200
5. Biomedical engineering	2	3	7,500
6. Chiropractic and naturopathy	2	2	25,000
7. Clinical laboratory services	10	6	85,000 to 95,000
8. Dentistry and allied services	4	9	[4]230,900
9. Dietetic and nutritional services	5	9	[5]30,000
10. Economic research in the health field	1	1	500
11. Environmental health	17	17	[6]32,500 to 35,000
12. Food and drug protective services	3	—	16,500
13. Health and vital statistics	4	6	[7]1,400 to 2,400
14. Health education	3	1	16,700
15. Health information and communication	7	4	5,000
16. Library services in the health field	2	1	[8]8,000
17. Medical records	2	—	37,000
18. Medicine and osteopathy	2	35	[4]305,100
19. Midwifery	1	1	5,000
20. Nursing and related services	8	23	[9]1,409,000
21. Occupational therapy	2	1	[6]6,000
22. Orthopedic and prosthetic appliance making	3	—	3,300
23. Pharmacy	2	2	[4]118,000
24. Physical therapy	2	1	[6]12,000
25. Podiatry	1	1	7,600
26. Psychology	1	5	9,000
27. Radiologic technology	1	4	70,000
28. Secretarial and office services	3	8	150,000 to 250,000
29. Social work	2	2	[6]17,500
30. Specialized rehabilitation services	6	3	5,300 to 5,900
31. Speech pathology and audiology	2	—	14,000
32. Veterinary medicine	1	—	[4]23,700
33. Visual services and eye care	4	6	40,400
34. Vocational rehabilitation counseling	1	1	4,200
35. Miscellaneous hospital services	4	5	[10]6,200

[1] Each occupation is counted only once. For example, all physicians are counted in "18. Medicine and osteopathy" even though certain specialists perform in other health fields.

[2] Excludes business, clerical, and maintenance workers.

[3] Estimates not available for programers, operators, and electronic technicians.

[4] Includes total personnel (active and inactive) for dentists, physicians, and veterinarians.

[5] Estimates not available for food service supervisors, clerical workers, and other workers.

[6] Estimates not available for aides and technicians.

[7] Estimate not available for statistical clerks.

[8] Includes technical and clerical workers in medical libraries. Estimate not available for patients' librarians.

[9] Estimate not available for ward clerks.

[10] Estimates not available for electrocardiograph technicians and hospital aides—obstetrical, pediatric, surgical, and so forth.

INDEX

INDEX

INDEX

INDEX

☆ U.S. GOVERNMENT PRINTING OFFICE: 1966 — O 227-860