THE OUTLOOK FOR WOMEN IN OCCUPATIONS IN THE

Medical Services

X-Ray Technicians

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THE OUTLOOK FOR WOMEN IN OCCUPATIONS IN THE MEDICAL SERVICES

This pamphlet is one of a series prepared by the Women's Bureau to present the post-war outlook for women in particular occupational fields. Many of the 13 million women who were working before the war, as well as some of the 5 million who have joined them since, must continue to support themselves and their many dependents. Like their younger sisters in schools and colleges, they are confused by the sometimes glowing and sometimes dark predictions regarding their future opportunity for employment. They want the facts.

Many monographs are available that describe an occupation at a particular time in its pre-war or wartime setting. But no detailed studies have been published that show the considerable changes that have taken place during the war and the effect of these changes on the post-war supply of and demand for women in particular occupational fields. This pamphlet presents such a dynamic study as distinct from a static description. It discusses the pre-war situation, the wartime changes, and the post-war outlook for women in one of the occupations in the field of medical services, in which women in 1940 composed almost two-thirds of the workers.

Because of the pressing demand for this type of information, some of the occupational discussions in this field are being issued separately as they are completed. An over-all pamphlet will coordinate the series and discuss the general trends affecting the many women employed in these services so important to the Nation whether at peace or at war.
LETTER OF TRANSMITTAL

U. S. DEPARTMENT OF LABOR,
   WOMEN'S BUREAU,
Washington, April 30, 1945.

MADAM: I have the honor of transmitting a summary of the outlook for women as X-ray technicians in medical services, an occupation in which they are serving during the war and will continue to serve in the years to come. This report presents the pre-war situation of women in this type of work, reviews the wartime changes and discusses the future outlook for women as it can be projected from the experiences of the past and the present.

The study is one of a series prepared by Marguerite Wykoff Zapoleon with the assistance of Elsie Katcher of the Bureau's Research Division. I wish to express my appreciation to the many persons who have contributed to this bulletin by what they have written or said. To those listed below who read all or part of the manuscript or contributed considerably to its content, special acknowledgment is made.

Respectfully submitted.

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Representatives of Organizations and Agencies Whose Special Assistance Is Gratefully Acknowledged

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A WAC X-ray technician adjusts equipment to take chest X-ray of soldier in Army hospital.
X-ray Technician as Defined in the Dictionary of Occupational Titles (12)\(^1\)

X-ray Technician (I) (medical ser.) radiographer; skiagrapher 0-50.04. Assists medical practitioners by operating X-ray equipment; prepares patient for X-ray treatment, fixing lead plates to patient to protect portions not to be exposed to the X-ray; manipulates switches to time length and regulates intensity of exposure; develops films photographically and dries them; avoids exposing himself to X-rays as far as possible. May specialize in X-rays of certain parts of body, such as chest, abdomen, or feet, and be designated accordingly, as X-ray technician, chest; X-ray technician, abdomen; X-ray technician, orthopedics.

\(^1\)References in parentheses throughout this report are to Appendix B—"Sources to Which Reference Is Made in the Text," p. 13.
OUTLOOK FOR WOMEN AS X-RAY TECHNICIANS

The X-ray has become an important tool in medicine. By making possible the early diagnosis of tuberculosis, pneumonia, and many other diseases and by attacking cancer and various other conditions, X-rays can save life. But they can also destroy living tissues if they are not properly controlled. So the radiologists (physicians who are specialists in the use of X-rays and radium) and the technicians who assist them with their X-ray work carry not only the life-and-death responsibility of all those who work in the medical services but the hazard that goes with specialization in the operation of a useful but complicated and dangerous tool. Women have demonstrated their ability to use this tool well. Though there are only a few women among the 2,500 radiologists in the United States, 80 percent of the registered X-ray technicians are women.

Like some of the other occupations in the medical services, that of the X-ray technician is of relatively recent origin. X-rays first came into use at the close of the last century, and, at first, physicists, engineers, and other technically trained persons operated the complicated machines which generated them. A few physicians ultimately became skilled in their use and employed the X-ray primarily for the diagnosis of fractures and foreign bodies. However, it was not until the period of the World War of 1914-18, which greatly accelerated the demand for X-ray service, that medical schools began to offer graduate courses in radiology and a recognized medical specialty developed (3). With the increase in the number of physicians demanding X-ray service and the number of specialists qualified to give it, came a demand for technical assistants to relieve the radiologist of the actual operation of the apparatus and the development of the radiographs, so that the physician would be free to concentrate on the diagnosis and treatment of the patient. An American Society of X-ray Technicians was organized in 1920 with 14 members, 6 of whom were women. When the first registry was established in 1923, only a few technicians were qualified. But the increasing demand for X-ray service and the discovery of additional uses of X-rays in the treatment, as well as the diagnosis of disease, has multiplied the demand for X-ray technicians in the medical services.

The adaptation of medical X-ray equipment to other uses was quickly discovered and subsequent research has resulted in its ever-widening use in industry. Employed for a variety of purposes, X-rays are used, for example, to reveal flaws in castings and in welds, to measure thicknesses without mechanical contact with the object to be measured, to inspect the composition
and structure of certain materials, to distinguish imitation from genuine products, to locate hidden or missing objects (3) (6).

X-ray work in industry, however, has not become a well-defined occupation requiring specific knowledge and training as that of the X-ray technician in the medical services is fast becoming. The physicist and the engineer in industry may be compared to the radiologist in the highly professional knowledge they must have of the objects and processes involved; those in industry responsible for the actual operation of the equipment and the developing of films correspond most nearly to the X-ray technician in the medical services. But in industrial processes, where materials rather than individuals are examined, automatic and mass methods are more feasible and it is possible on some types of work to utilize factory operatives who have little knowledge of the equipment but who are highly specialized in observation and in knowledge of the object X-rayed. There is in industry, therefore, a wider range of occupations associated with the use of the X-ray and, so far, less standardization in duties, qualifications, and training of those at the technician level, than for X-ray technicians in the medical services, about whom this discussion is centered.

Pre-war Number and Distribution of X-ray Technicians

Classified with laboratory technicians of all types by the United States Bureau of the Census, X-ray technicians have not been counted separately and only estimates of their pre-war number are available. Excluding those in industry, there were probably about 15,000 just before the war, of whom almost 3,000 were certified as to qualifications and competency by the American Registry of X-ray Technicians, an examining board sponsored by the American College of Radiology and the American Society of X-ray Technicians. (For requirements for registration, see Appendix A, III.) Approximately 80 percent of those registered were women.

The majority of the X-ray technicians in the medical services are employed in hospitals. In 1941, registered hospitals in the United States reported the employment of 5,500 full-time X-ray technicians and an additional 1,500 part-time (5). There were about the same number of full-time technicians in hospitals in the South as there were in those in the Northeastern and North Central States, approximately 1,600. The West had roughly half this number. X-ray technicians not employed in hospitals work in the offices of radiologists and of dentists or in laboratories which serve physicians, dentists, and others using X-rays for medical purposes. In many Catholic hospitals the X-ray technicians are Sisters, who together form about one-sixth of the women who are registered.

Although no statistics are available on withdrawals, among women the principal cause is marriage or family responsibilities; among men, transfer
X-RAY TECHNICIANS

to jobs as salesmen, service men, and educational representatives. Additions to the supply of X-ray technicians in medical services are mainly from approved training courses at various hospitals, which graduate from 500 to 700 a year. Until recently more than 100 training courses, which varied in capacity from 1 to 30 students a year, were listed as approved by the American Registry of X-ray Technicians (1). In 1944, the Council on Medical Education and Hospitals of the American Medical Association set up criteria for approval essentially the same as those of the registry and arranged for regular inspection of the schools similar to that undertaken by the Council for certain other types of technicians in the medical services. The first inspection completed in 1944 found 6 schools fulfilling all essentials, 63 with minor deficiencies, and 62 which needed further reorganization to meet existing requirements (9). In January 1945, 102 schools were on the first list of schools approved by the Council. (For requirements for entrance to and completion of an approved course, see Appendix A, I and II.)

Wartime Changes

The X-raying of millions of men examined for Selective Service and the X-ray service required by a wartime Army and Navy accelerated the demand for personnel trained in this technique. The Civil Service Commission as early as 1942 urged women to apply for its examinations for medical technician with option in roentgenology primarily to fill vacancies in Army station hospitals. (For requirements for beginning Federal Civil Service position, see Appendix A, V.) As many of the men technicians left the hospitals to go into the Army or to take industrial jobs, the Veterans’ Administration for the first time called for women technicians and found them most satisfactory.

Unable to obtain enough trained X-ray technicians, the Army, like the Navy, began to prepare its own. At first only enlisted men were admitted to training, but in September 1943 the Army began to train WACs as X-ray technicians in a 12-week course at the Army-Navy Hospital School at Hot Springs, Ark. Between July 1, 1940 and November 1944, 6,503 men and 320 women were trained under this program. An additional number have received training on the job sufficient to be given an Army classification as X-ray technician. The Navy has trained Corpsemen and WAVES for similar work in a 5-month training course, 918 being trained during the year ending July 1, 1944. Statistics by sex are not available for the entire Navy, but of the 467 trained in X-ray techniques at the National Naval Medical Center at Bethesda, Md., from July 1, 1941 to November 1944, including those at present in training, 42, or less than 10 percent, were women. As the war continues, the military need for X-ray technicians increases since X-rays are used not only for routine chest and other examinations but to locate shrapnel and other foreign bodies in wounded men, and to diagnose and treat a wide variety of conditions.
With higher individual incomes and wider recognition of its uses, civilian demands for medical X-ray service have increased likewise and there is a steady increase in the civilian use of X-rays in diagnosis and treatment. The industrial demand, especially in war industries, drew a few of the men X-ray technicians away from the medical field. Of the approximately 1,300 members of the American Society of X-ray Technicians in 1940 about 10 transferred to industrial work not necessarily in the X-ray field; it is possible that more potential members shifted fields, but in any case the shift from the medical to the industrial field has so far been small. By 1944, membership in the American Society of X-ray Technicians for which only registered technicians are eligible (see Appendix A, IV) had increased more than 25 percent, reaching 1,600. The total number of registered X-ray technicians increased 70 percent during the same period and totaled more than 5,000 in 1944. Registered hospitals in 1944 employed 8,100 full-time X-ray technicians, an increase of 47 percent over 1941. They also reported 1,800 part-time X-ray technicians, 17 percent more than in 1941. The total number of X-ray technicians in hospitals, physicians' offices, and other medical establishments in 1945 is estimated at 20,000.

Besides the medical X-ray technicians, some 8,000 to 9,000 are believed to be employed in industry, compared with an estimated 1,000 before the start of the war.

Outside of the armed forces, no special attempt was made to increase the number of X-ray technicians to meet the increased demand during the war. In fact, the need for standardization of the occupation through training and registration comparable to that in other medical services, and for insuring the quality of performance of those trained, took precedence over efforts to increase their number. Because of the lack of comparable data, it is not possible to estimate how many completed their training during the war period. No full scholarships have been announced in this field, but the cost of training has not been prohibitive. Tuition varies from nothing to $250, with the exception of 2 schools where the tuition is $700 but where the student earns a considerable stipend. Most schools charge no tuition and many offer maintenance; some even pay the student during the latter part of the training period. This is in return for service the student performs in the laboratories. College-degree courses have the usual college tuition and fees; non-degree training is often free but the student must take care of his maintenance and other expenses.

Earnings, Hours, and Advancement

The war has increased the earnings of X-ray technicians in some places by as much as 50 percent, annual earnings ranging from $1,200 to $3,600.

Most X-ray technicians work in hospitals, where they are on a salary basis.
In 1942 the average monthly salary for hospital X-ray technicians, according to the Hospital Yearbook, was $129 (including an allowance for maintenance), or $1,550 a year (10). Civil Service salaries before the war ranged from $1,620 to $2,000. Overtime pay accompanied the longer wartime hours so that actual salaries in 1944 ranged from $1,970 to $2,433.

Hours have increased also in non-Federal employment. One X-ray technician in a physician's office, for example, who used to work from 9 a. m. to 5:30 p. m., found it necessary in 1944 to work from 8 a. m. to 7 p. m. to keep up with his schedule. Longer hours make it more difficult to get sunshine and exercise needed to counteract the effect of radiation. Because technicians working with X-rays and radium are subject to the effects of radiation which may make them anemic, the National Bureau of Standards has recommended for them: A preemployment physical examination, an annual physical examination, a bimonthly blood count, and an annual vacation of 4 weeks (6 weeks for those working with radium). The Bureau does not specify the maximum number of hours a technician should work but does set the limit of the amount of radiation to which he may be exposed (less than 0.1 r unit per day) (11).

For the X-ray technician, advancement lies in supervisory jobs in large hospitals, institutions, laboratories, or public health agencies where a number of technicians are employed. Obviously, such positions are relatively few, since supervision and direction is always handled by a radiologist or scientist in charge of the laboratory, who may not need assistance in supervision. The increasing use of the X-ray for industrial as well as medical purposes will tend to increase the supervisory jobs available to technicians, which in the past have been for the most part filled by men.

Opportunities for Women with Special Employment Problems

The X-ray technician becomes more valuable with experience, so age itself is no handicap for one already engaged in the occupation. However, most of those who enter the work are between 20 and 30 years of age, many of the women being registered nurses.

Marriage offers no unusual handicap to women engaged in this work.

Opportunities for the training and employment of Negro women have been relatively few. Training for Negro men is available at Freedman's Hospital (Washington, D. C.) and Meharry Medical College (Nashville). A few Negro women have been trained at St. Mary's Infirmary (St. Louis). A few have received training through apprenticeships in other hospitals and at technical schools.

Physical handicaps which interfere with ease and speed of movement would be difficult to overcome in this occupation, which involves the operation of a complicated apparatus. Anyone with a tendency toward anemia should avoid
this work under present conditions, since the technician cannot avoid some exposure to radiation which, as indicated earlier, may cause anemia.

Post-war Outlook

The potentialities of the X-ray in medical service still surpass its recognized uses. With each discovery of a new use, the need for technicians to assist roentgenologists increases in this relatively recent but rapidly growing specialty.

Discovered accidentally and originally used for diagnosis in bone work and in the location of foreign bodies, the X-ray is now employed widely. Broken bones, and bone injuries and diseases, are diagnosed and the results of treatment checked with its help. The X-ray locates such internal formations as gall and kidney stones and calcium deposits, as well as certain foreign objects in the lung, eye, brain, and other parts of the body. The X-ray has in recent years made possible a more thorough examination not only of the lungs but of the digestive system and of certain conditions during pregnancy. Besides its significance in diagnosis, the X-ray has demonstrated its usefulness in treatment. Best known in this field for its power in treating cancers and tumors, it is also used, for example, to treat sinusitis, to remove birthmarks and to correct such skin conditions as boils, acne, and athlete’s foot. More frequent use of the X-ray as a tool in the diagnosis and treatment of patients will probably result from the wartime experience of physicians in military service where they are likely to come in contact with the most modern X-ray equipment and techniques and become better acquainted with the latest developments in the use of the X-ray as a consulting method.

In its original field of usefulness as well as in these newer fields, expansion of X-ray service still is taking place. The tuberculosis program of the United States Public Health Service, which has encouraged the extensive use of the X-ray to locate incipient as well as advanced cases of tuberculosis, is being expanded as a result of the authorization by Congress of a new Tuberculosis Control Division with 10 million dollars for its first year’s appropriation. A new type of X-ray machine has made the X-raying of human chests comparable in speed and in routine to an operation on an assembly line in industry. Thousands of Government workers and employees in industrial plants working on war contracts have availed themselves of these examinations conducted by the Public Health Service with its mobile X-ray units.

A number of industrial establishments have recently introduced a chest X-ray as a part of physical examinations given before or after employment (7). State and local health departments and tuberculosis hospitals and associations in many parts of the country are organizing for the routine X-raying of large groups. Many insurance companies which have seldom included a chest X-ray as part of the routine physical examination before issuing a policy have begun to require one, and some are considering arrangements for a periodic
check-up of policy holders. More and more hospitals are demonstrating the value of routine chest X-rays. The examination of 15,000 patients in 1943 in the out-patient departments of the University of Chicago clinics revealed 4 percent with active tuberculosis previously unsuspected and 8 percent with abnormal heart conditions; of all examined, 22 percent had some previously undiscovered pathological condition (8). These hospital rates are higher
than those found among Army draftees, of whom less than 1 percent were found to require further examination for tuberculosis (2); among 100,000 Federal civilian employees, of whom 1.1 percent showed tuberculosis; and among almost 200,000 war workers, for whom the rate was 1.3 percent. In all the larger groups examined, the majority of the tuberculosis discovered has been in the "minimal" stage when treatment is most effective. That these minimal cases are not discovered without the use of mass X-raying of persons who seem to be in good health is indicated by the fact that they comprise only 10 to 15 percent of the usual tuberculosis case loads in most communities (4). The type of physical examination required for entrance into military service and into most medical schools and schools of nursing now includes a chest X-ray. In the years ahead, periodic chest X-rays, particularly of school children and of young people, will be generally recognized to be as important as periodic dental examinations. Technical improvements which make mass service more feasible are not likely to reduce the demand for X-ray technicians; they rather increase the demand by lowering the per capita cost, bringing a needed service within the reach of larger numbers of people.

In connection with orthopedic cases, the demand for X-ray service likewise will continue to grow. Orthopedic injuries resulting from the war, both on the battlefields and in expanding war industries, already have increased the demand for X-ray technical service for veterans and for injured workers provided for through workmen's compensation and vocational rehabilitation. Services to crippled children, which have expanded with the Federal aid to State programs provided under the Social Security Act of 1935, are steadily increasing the use of the X-ray in diagnosis and treatment.

As more emphasis continues to be placed on dental care, more X-ray service will be required in dentistry, where it is used to locate infections and to reveal the pattern of tooth structure below the gums. However, the small demand for X-ray technicians in this field will continue to decrease since X-ray work is usually incidental and handled by the dentist with the help of a dental hygienist or a dental assistant.

The general trend in the medical services is toward an increasing need for X-ray technicians. In this relatively new field, the large number of technicians trained each year have been quickly absorbed. Just before the war, however, there appeared to be enough technicians to fill peacetime needs. The shortage created by the war is being overcome for the most part through training in the military services.

Following the war, those who have been thoroughly trained in an approved school or have had sufficiently broad training on the job will be in demand in the medical field. Since X-ray work is still incidental in many medical situations, there is likely to be a preference for women X-ray technicians who have related training or experience in nursing, in medical laboratory
Technical work, or in secretarial work. Those who have received only partial or limited training in military service may have difficulty in qualifying for positions in civilian medical services, but high school graduates who have worked under a radiologist for 2 years or another type of physician for 4 years in military service will meet the requirements for full registration. The opportunities for further training available to women as well as men veterans under the "G.I. Bill" make it possible for WAC or WAVE X-ray technicians or an Army or Navy nurse to obtain training in X-ray work at an approved school at Government expense.

Some of the men who have been trained in the Army and Navy may find outlets in industrial X-ray work, in the technical phases of which men have been consistently preferred. However, X-ray work in industry may be curtailed with production, unless low-cost methods are developed.

Women in military service who have received training in X-ray procedures and young women who are considering entering this occupation, before undertaking to complete an approved training course would do well to assess their health; their interest in and knowledge of the fundamentals of physics and chemistry; their liking for electrical and mechanical details; their accuracy, thoroughness, and precision; their ability to work with individuals who are likely to be worried about themselves and fearful of the X-ray process. These combined with adequate training are among the important qualifications for X-ray work in the medical services. As more persons enter this gradually expanding field, basic preparations and related skills and knowledge will play an increasingly important part in selection. The advantage among the newcomers without long experience in X-ray work will be with those who have some background in physics and chemistry, or those who possess nursing skills and knowledge, or training in other medical laboratory techniques or in secretarial work.
OUTLOOK FOR WOMEN IN MEDICAL SERVICES

APPENDIX A

I. Minimum Requirements for Entrance to an Approved School for Training X-ray Technicians

Pre-war

Previous to June 1944, standards and minimum requirements were set by the American Registry of X-ray Technicians, as follows:

Candidates must be graduates from an accredited high school with courses in physics, algebra, geometry, physiology, and chemistry, and satisfy one of the following requirements, preference to be given the candidates in the order named—

(a) Graduate nurses.
(b) Successful completion of the first 2 years of training in an accredited nurses' training school.
(c) Successful completion of the first 2 years of a college course in science.

Minimum age: 21 years.
Must be in good health.

Wartime Changes

Since June 1944, standards and minimum requirements are set by the Council on Medical Education and Hospitals of the American Medical Association, with the cooperation of the American Registry of X-ray Technicians.

Candidates for admission should satisfy one of the following requirements:

(a) Completion of the four years of high school. Courses in physics, algebra, geometry, and chemistry are recommended.
(b) Passing of a college entrance examination for admission to an accredited college or university.
(c) Graduation from a school of nursing recognized by the State board of nurse examiners.

No minimum age.
No change.

II. Minimum Requirements for Completion of Approved Course for X-ray Technicians

Pre-war

Previous to June 1944, standards and minimum requirements were set by the American Registry of X-ray Technicians, as follows:

The course of training should be not less than 12 months.
The following subjects were recommended: Elementary anatomy and physiology, physics, X-ray equip-

Wartime Changes

Since June 1944, standards and minimum requirements are set by the Council on Medical Education and Hospitals of the American Medical Association, with the cooperation of the American Registry of X-ray Technicians, and periodic inspection of courses is provided for.

No change.

The recommended subjects are now required as part of the organized curriculum.
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Pre-war
ment, darkroom chemistry and procedures, X-ray techniques, ethics, record keeping and general office or departmental work.

This course is to be given only in hospitals of at least 100-bed capacity and maintaining an accredited Nurses Training School, or in large medical clinics, approved by both the Council on Education and Registration and by the American Registry of X-ray Technicians.

Wartime Changes

Acceptable schools for training X-ray technicians may be conducted by approved medical schools, general hospitals or X-ray departments affiliated with a general hospital. Adequate hospital experience should be provided. A hospital used for training X-ray technicians should be registered and be otherwise acceptable to the Council on Medical Education and Hospitals of the American Medical Association.

III. Minimum Requirements for Registration by American Registry of X-ray Technicians

Pre-war

High school education or the equivalent thereof.

All applicants shall have had at least two years' of experience, including training in X-ray departments acceptable to the Board of Trustees.

Wartime Changes

No change.

Effective July 1, 1942, applicants who entered X-ray training on or after that date shall have had at least two years' experience and training under a recognized radiologist. After the above date training and experience under a non-radiologist will be considered as only half value compared with that under a radiologist; and the two-year total will be computed on that basis.

No change.

No change.

IV. Minimum Requirements for Membership in American Society of X-ray Technicians

Pre-war

Any Registered Technician in good standing who is willing to abide by the code of ethics maintained by the Society may apply for membership.

Wartime Changes

No change.
V. Minimum Requirements for Beginning Federal Civil Service Position as Assistant Medical Technician (Roentgenology)¹

**Pre-war**

Basic salary, $1,620 a year.

Completion of a 4-year high-school course or 14 units of high-school study. Persons otherwise qualified will be given a general test.

Three years of active experience in an X-ray laboratory engaged in X-ray photography (including developing and solution preparation) and posturing; or

One year of experience and the successful completion of a full 4-year course leading to a bachelor's degree, with major study in either biology, chemistry, physics, or medical technology.

Note: At least 1 year of the required experience must have been secured within the 10-year period immediately preceding the date of receipt of application.

Maximum age: 53. No minimum.

Sound physical health.

**Wartime Changes**

The basic salary is the same but the wartime lengthening of hours brings the actual salary to $1,970.

High-school requirements not specified.

No change up to April 1945, when the Civil Service Commission was considering changes in requirements.

No change up to April 1945, when the Civil Service Commission was considering changes in requirements, but applicants may substitute the successful completion of a full course in a school for clinical laboratory technicians approved by the American Medical Association for 2 years only of the required experience.

No change up to April 1945, when the Civil Service Commission was considering changes in requirements.

No age limits.

Applicants must be physically capable of performing the duties of the position.

¹ A $1,440 position requires 2 years of experience or a bachelor's degree with major study in biology, chemistry, or physics plus 6 months of experience; or completion of a course in an approved school of medical technology. There are relatively few calls for these helpers.
APPENDIX B

Sources to Which Reference Is Made in the Text


Other Selected References


OUTLOOK FOR WOMEN IN MEDICAL SERVICES

Radiology. A monthly journal devoted to Clinical Radiology and Allied Science. Owned and published as its official journal by the Radiological Society of North America, Syracuse, N. Y.