

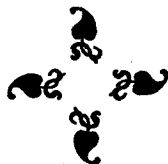
FILE NAME: Metropolitan Life (ML)

DATE: 1949

DOC#: ML252

DOCUMENT DESCRIPTION: Proceedings of First National Cancer Conference

Proceedings
OF THE FIRST
NATIONAL CANCER
CONFERENCE



AMERICAN CANCER SOCIETY
AND
THE NATIONAL CANCER INSTITUTE
OF THE U. S. PUBLIC HEALTH SERVICE
FEDERAL SECURITY AGENCY

1949

high molecular weight some low molecular-weight fractions are produced and some fractions comprised of molecules larger than any that were introduced into the cracker. Some of the latter may be carcinogenic.

The problem of carcinogenic agents in the petroleum industry is not limited to catalytic-cracked fractions. Some thermal-cracked, high boiling-point fractions are known to be carcinogenic, and indeed, some high boiling-point fractions from certain crude petroleum are also carcinogenic. Cancers of the scrotum have been observed, both here and abroad, in petroleum workers who were exposed to wax derivatives of certain types of crude oils. There have been about 1900 skin cancers in Great Britain in certain industries, in which there is exposure to processed shale oils. The occurrence of skin cancers in briquette workers has occurred in this country. A total of about 1700 to 1800 skin cancers from tar or pitch have been reported from various countries.

Arsenic in the form of Fowler's solution has caused carcinoma of the skin in many persons (145) who have taken the solution over a period of years for chronic skin disease. There have been some thirty cases of carcinoma of the skin from industrial exposure to arsenicals; contact with arsenic dust in sheep-dip workers is said to have caused cancer of the skin and lungs. The widespread use of arsenic-containing insecticides is a potential danger yet to be evaluated.

Radiation Carcinoma. Bloch has produced carcinoma of the skin in rabbits with soft roentgen rays. Cutaneous cancers from roentgen rays have occurred in many of the older radiologists as an occupational disease. Skin tumors in rats have been induced with beta rays.

Ionizing radiation, applied in low doses to the whole body over a long period of time, will cause earlier development and increased incidence of spontaneous tumors in experimental animals in some strains that are susceptible to such tumors. In mice, which are susceptible to leukemia, the disease occurs earlier in those that have received radiation than in those not irradiated. Other species tested do not develop leukemia more quickly after irradiation, even though they be susceptible to this form of neoplasm.

PULMONARY CANCER

The work of Machle and Gregorius was discussed and there was general agreement that the increased incidence of carcinoma in the lung in chromate workers is an indictment of *chromium*. There was a feeling that any hexavalent chromium compound might be carcinogenic. Experimental studies on animals, to test this possibility, are being conducted at Johns Hopkins University. A total of more than one hundred cases of cancer of the lung in chromate workers are now on record from American and German sources.

The possibility that *asbestos* might cause cancer of the lung was considered. The only evidence in favor of this was the fact that fourteen cases of carcinoma of the lung have occurred in ninety-two cases of asbestosis which have come to autopsy.

The clinical experience of Lanza and the experimental work by Vorwald have not revealed any carcinogenic properties which can be attributed to asbestos.

It was stated that in nickel refineries using the Mond process, there is a high incidence of carcinoma of the paranasal sinuses and of the lung. It is believed that this is due to the inhalation of vapors of *nickel carbonyl*.

SUSPECTED OR POTENTIAL OCCUPATIONAL AGENTS

The first evidence of *nuclear energy* causing occupational cancer in the United States was obtained by Martland, who proved the relation of osteosarcomas in radium watch-dial painters to their employment. Some twenty years later, this experience led to extreme care in the handling of artificial radioactive isotopes produced by cyclotrons and uranium piles. The carcinogenic potentialities of radioactive elements have been well demonstrated by animal experiments, but it must be admitted that the time is too short for us to draw any conclusions about their effects on man. It is true that the radioactive nature of these dangerous substances permits their ready detection so that proper monitoring should prevent dangerous exposures.

All isotopes that are distributed for commercial purposes by the

Atomic Energy Commission are sent only to people who understand the proper methods for handling them.

One potential source of overexposure to radiation now being investigated is found in certain textile and printing plants. There is a danger of fire starting in such plants as the sheets of cloth or paper move through them, due to the possibility of sparks resulting from static electricity. Bars containing radium are placed strategically near the cloth or paper in order to prevent the accumulation of dangerous electrical charges. There may be a real problem in potential cancer where many of these bars are used, or where they are improperly arranged or handled. This is currently being investigated in the State of New York.

Beryllium has become, during the last ten years, an increasingly important commercial substance and is now used in the manufacture of roentgen-ray apparatus, fluorescent lamps, certain types of radio tubes, and as an important source of neutrons in cyclotrons.

Beryllium is believed to cause two clinical types of pulmonary disease in people who have been exposed to fumes or dusts of its compounds. These consist of acute pneumonitis and chronic pulmonary fibrosis. In addition, the late Dr. L. U. Gardner was able to induce tumors of bone in rabbits by the intravenous injection of certain insoluble compounds of beryllium.

The beryllium-induced tumors have proved to be transplantable to the eyes of guinea pigs, by the method of Greene.

So far, no tumors have developed in man as a result of the exposure to beryllium.

GENERAL CONSIDERATIONS AND DEFINITIONS

The Panel on the Epidemiology of Cancer approached the problem from the point of view of studies of the population as a whole or of selected groups. A concept of the epidemiology of cancer was developed and defined as embracing any and all information that describes the person or group of persons with cancer as compared with the control individual or group of individuals.

It is apparent that such information includes: (1) data on the etiological aspects, i.e., the extent of causative factors and the relationships between cancer and other pathological conditions in-

cluding the so-called "precancerous" lesions; (2) data describing the trends of cancer morbidity and mortality in a given population over a considerable period of time; and (3) control data to be used as indexes of changes in the cancer picture as related to the population. It was considered within the province of this panel to look into the sources and availability of such data with the aim of developing methods for the study and co-ordination of the epidemiological aspects of cancer in relation to existing bodies of clinical and experimental knowledge.

SOURCES OF INFORMATION

Two general types of data were considered appropriate for studying the epidemiological aspects of cancer; namely, bodies of fixed, existing materials, i.e., set systems of records; and data derived from special field studies.

Existing Bodies of Set Data

Under the heading of existing records available for study, the following sources of information were discussed:

Health Department Records. State Health Departments have large existing bodies of data of four specific sorts:

1. Case Records from Cancer Registries

These records can be used to initiate studies of the life experience of cancer patients. They form the starting point for follow-up, and the collection of analytical data relating not only to the cancer patient but to his family and relatives as well.

2. Industrial Health Reports

Records of this sort could be used for studies of occupational and environmental factors, as related to the total cancer picture in an entire state.

3. Illness Data

From morbidity records compiled in a chronic disease study, such as that reported from California, and from reports of absenteeism in industry, the frequency and disability from cancer can be studied.

4. Death Certificates

Recorded deaths can provide leads in studying the epidemiological aspects of cancer. Death rates by site, occupation, etc.,

and studies in cancer mortality trends are possible through a fuller use of death certificates.

Since the State Health Department maintains a stable point of continuity relating to the public health of a relatively large population, it was considered to be the logical place for long-time studies in the epidemiology of cancer.

Life Insurance Material and Facilities. Although the records maintained by life insurance companies have been designed largely for actuarial purposes, they nevertheless yield certain by-products that could be used to advantage in developing new leads in the epidemiological approach to cancer.

Thus, death claim records for Ordinary, Industrial, and Group life insurance often lend themselves to the determination of cancer mortality rates for different sites—by age, race, sex, and state of residence. The death-claim records for Group life insurance may permit the determination of cancer death rates for employees in specific industries.

The medicoactuarial records maintained by many large life insurance companies for special studies (made periodically by the Joint Committee on Mortality of the Actuarial Society of America and the Association of Life Insurance Medical Directors) can be used to calculate cancer mortality rates for persons insured under Ordinary policies with different characteristics, such as a personal history of cancer, family history of cancer, different occupations, abnormal build, and various medical impairments. Cancer mortality rates so derived for persons with particular characteristics can be compared with the average cancer death rates among all insured lives.

Disability claim records available in many life insurance companies for individuals claiming disability because of cancer could be used to determine not only survival rates but also recovery rates and rates of recurrence of cancer after recovery. Similar use could probably be made of the hospitalization and surgical claim records.

It is believed that life insurance companies and the actuarial profession would be willing to co-operate in investigations of the

epidemiological aspects of cancer sponsored by the American Cancer Society. The agencies to approach are the Committee on Mortality and the Committee on Group Mortality and Morbidity of the Society of Actuaries.

Besides being an important source of information regarding cancer death rates, some of the large life insurance companies have a wide range of facilities for medical examinations; such facilities offer an opportunity for experimenting with simple tests for cancer. Life insurance companies may also be consulted in following up those cancer patients who carry life insurance.

Records on Military Personnel and Veterans. It was felt that the military and veterans populations were of sufficient size and importance to lend themselves to studies in the epidemiology of cancer. The nature of these populations is such that their characteristics are known, they are relatively easy to follow, and they could provide a useful body of data for study over a considerable period of time. Information from these sources would, of course, be limited in so far as occupational characteristics are concerned, but the age and the medical characteristics, as well as the follow-up information, could easily be obtained for study purposes. Again it was found that the agencies responsible for these sources of data would be willing to co-operate in any research studies that fell within the administrative framework of their activities.

Vital Statistics of the United States. Analyses of the Vital Statistics Records of the United States (which are limited primarily to population and mortality data) have already pointed up certain time trends relative to deaths from cancer of specific sites, as well as considerable geographical variations in reported deaths from cancer of various sites, as presented in the syllabus entitled "Selected Facts and Figures on Cancer" prepared by the Statistical Research Section of the American Cancer Society specifically for this Conference. It is believed that these materials (inadequate as they may be with respect to definitive diagnoses as to the cause of death) can be used to good purpose in developing leads into areas of fruitful investigation relative to the epidemiology of cancer. The subject of cancer mortality statistics according to occupation and industry for the United States, such as those developed by the

English, was discussed, and the need for such data was brought out.

Hospital Records. Hospital records have always been an excellent source of information for morbidity studies, particularly from the standpoint of definitive diagnosis, therapy, follow-up, and subsequent medical history. The only point of emphasis here was that much more basic information could be obtained from hospital records by closer co-ordination between clinical and experimental data, and by the cross-checking of various hospital registries for associated pathology.

Medical Examination Records of Large Corporations and Industrial Concerns. The attention of the Panel was drawn to the fact that many large corporations and industrial concerns have an accumulation of records relative to physical examinations, both pre-employment and periodic examinations while employed. In view of the fact that these sources of information have already been tapped and are believed to be of use in building up knowledge of the natural development of cardiovascular-renal diseases, it was recommended that they be considered as possible sources of information concerning the epidemiology of cancer.

Cancer Detection Center Data. It was pointed out that data in this category fall into a somewhat intermediate class somewhere between the bodies of existing, fixed data, already described, and those developed from field surveys to be discussed in later sections of this report; for example, cancer detection centers are already in possession of extensive records of medical examinations of supposedly well people and, in some instances, these records now include a series of examinations on the same person over a considerable period of time. To this body of fixed data could be added other information of the type usually collected by field-survey methods; namely, by careful questionnaire or interview techniques at the time of examination, numerous factors relative to familial, dietary, smoking, occupational, or industrial characteristics could be elicited for correlation with the presence or absence of any malignant tumor. Since serial examinations are the goal in many instances, detection center records represent an excellent potential source of information, not only on the time lag between the onset of symptoms and the establishment of well-defined

tumors, but also on the relationships between other pathological conditions, including the so-called "precancerous" lesions, and the possible subsequent development of known cancers.

It was found that the detection centers also offer a unique opportunity for controlled field testing of any new screening devices that may be developed for the early diagnosis of cancer. Since many of these centers are now being conducted under the sponsorship of the American Cancer Society, it was felt that the co-operation of many of them could be obtained for the purpose of investigations in the epidemiological aspects of cancer.

Other Sources of Data. Discussions of other sources of material available for possible leads into the study of the epidemiological aspects of cancer included records of other morbidity surveys, i.e., mass chest roentgenograms for tuberculosis, State Employment and Personnel Departments, Prepayment Health Insurance Plans, the National Registry of Twins, Genealogical and Historical Societies, and the existing morbidity and mortality records on cancer in various foreign countries.

It was felt that leads developed from existing bodies of data might be useful not only in determining the approach to certain laboratory and clinical investigations, but also in pointing up the most fruitful avenues of approach in the collection of a second type of data—those developed by the field survey technique.

DATA DERIVED FROM SPECIAL FIELD STUDIES

It was felt that by the careful analysis of existing bodies of data, and by the extension of the leads resulting therefrom into the realm of special field studies, valuable information of many kinds could be developed that would bring pressure to bear in the solution of the cancer problem. The types of studies discussed here were as follows:

The Questionnaire Technique to Extend the Usefulness of Existing Records. It was felt that concise, consistent, and persistent questioning relative to such characteristics as circumcision, the history of nursing (both as a child and as a mother), the use of tobacco and alcohol, family history of cancer and associated path-

ology, and exact occupation over the years, would yield important information, which, in conjunction with the bodies of clinical data now being assembled, could give valuable leads to the epidemiological approach to cancer.

Special Studies on Family Groups. The study of cancer in twins or siblings characterized by differences in place of residence, living, eating, drinking, smoking, and other personal habits, as well as differences in socio-economic status, occupation, and religious and cultural background, was given consideration as an avenue of worth-while endeavor. Family studies relative to the possible inheritance of cancer were also discussed. Emphasis was placed on the fact that in such field studies, many difficulties are encountered, not only in the assessment of diagnoses and causes of death but in the establishment of suitable control series.

Special Studies on Various Ethnic, Religious, and Socio-Economic Groups. Consideration was given to the study of various religious orders and national groups characterized by differences in dietary and other living habits, to determine the possible relationships between such habits and the incidence of cancer. The populations of various state institutions (prisons, reformatories, and mental hospitals) were considered as possible areas for epidemiological investigations. The difficulties here were indicated in terms of inadequacies in medical diagnosis, either because of the customs and mores of certain groups, or because of inadequacies in medical facilities available to others.

Special Long-Time Studies on a Selected, Complete Population Group. It was agreed that the true nature of cancer, as it affects a population, could be revealed only through a careful study of the family groups making up that population, from the standpoint of occupation, living habits, religious customs and mores, and numerous other factors. Also required would be the collection of data on cancer incidence over a long period of time; i.e., twenty to twenty-five years, and a complete follow-up on the entire population with periodic physical examinations over the same period of time. It is immediately apparent that such a study would be extremely costly, but it was felt that any amount of money invested in such a project would be well spent if it elicited important in-

formation (as it undoubtedly would) on the natural history of cancer in a human population.

METHODS OF APPROACH

Various methods of approach to the problem of further exploring present leads and the development of new leads in the epidemiological approach to cancer were considered, and several points of agreement were reached.

First, it was agreed that the life-table technique (i.e., the actual survivors compared with expected survivors) is essential in the consideration of laboratory experiments as well as in human studies in the field of cancer.

Secondly, the importance of co-ordination of laboratory and clinical research with epidemiological field studies was emphasized. It was apparent that both approaches to the advancing of our knowledge of cancer would be enriched if the two approached were related one to the other. The way in which field epidemiological studies might suggest fruitful laboratory or clinical studies was indicated and, conversely, the importance of conducting laboratory and clinical research in such a manner that it could be taken into the field for confirmation, was emphasized.

The need for collaboration between the epidemiologist and the person interested in clinical research led to a discussion of the shortage of individuals having specific interest and training in the methods of conducting epidemiological studies. This shortage of personnel in the field led to one of the formal resolutions of the Panel. This resolution, and two additional ones dealing specifically with methods of approach to problems relative to the epidemiological aspects of cancer are presented verbatim.

RESOLUTION I

In view of the complexity of the problem and methods of analysis of epidemiological factors in human cancer and the importance of following existing leads and observations in this field, the panel recommends to the American Cancer Society that it establish a committee or subcommittee to continue the survey of these factors which was begun at this Conference: to suggest desirable studies in the field; to provide consultation in the design and conduct of such investigations; and where possible, to arrange

for joint or co-operative projects along these lines. It is suggested that the committee have members representing all sections of the country, and national agencies including the Public Health Service and the Actuarial Society of America.

RESOLUTION II

The panel recommends the establishment of a long-time epidemiological study of cancer in a population group, with careful observations over a period of years for evaluation of the familial, dietary, environmental, occupational, and other factors considered as possibly responsible for the development of cancer. *The objectives should be carefully defined and specific questions should be asked.* The committee or subcommittee, recommended in the previous resolution, should be utilized for the guidance of this research program.

RESOLUTION III

The panel recommends that the attention of the American Epidemiological Society be called to the relative lack of sound epidemiological knowledge of cancer, and that its co-operation be elicited in stimulating the application of present methods, and the development of more adequate methods in acquiring such knowledge.

PANEL ON PROFESSIONAL EDUCATION TECHNIQUES AS THEY RELATE TO CANCER

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TEACHING OF CANCER TO SCHOOL AND COLLEGE STUDENTS

Many efforts are being made to bring knowledge of cancer to the public by instruction in biology and health in schools and colleges. This has the advantage that all of the population is reached at an early age and, as some suggested, that parents are educated through their children. Additional gains are expected in that the individual will learn his responsibility, as a citizen of a democracy, to guard his own health and that of his family, and to support research and public-health activities related to cancer. It is further expected that the development of future scientists for the field of cancer research will be accelerated.

Those interested in cancer are fostering the better and earlier teaching of general biology to school children. This is being begun as early as the second grade. It is suggested that the problems of instruction at this level be met by explaining biological facts in terms of familiar analogies and by consultation with experienced writers of books for small children. More elaborate teaching of biology is done at the high-school level, and information related to cancer is fitted into programs that include personal hygiene, mental hygiene, family living, disease, and disease prevention. It was pointed out that the citizen of the future needs to develop a concept of growth and disease including not only states of acute illness and debilitation but also the more subtle bodily changes of insidious disease. The teaching of science can well stand as a cultural subject, and it should replace certain traditional but outdated subjects such as ancient languages and military history. Demon-