The Epidemiology of Cancer

From the Viewpoint of the Health Officer*

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ACTIVITIES in cancer control by public health agencies need not and usually do not rest upon the recognition of any epidemiological peculiarities of the disease, in the strict sense of that term. The necessity for persuading people who have symptoms to seek medical care without delay, as well as the desirability of making it easy for them to secure prompt diagnosis and adequate treatment, are sufficiently well defined to furnish a secure foundation for public health action. It is recognized that to accomplish these objectives with some degree of completeness is an undertaking of considerable magnitude, particularly if all persons who reach adult age must be included in the scope of the cancer program.

Because the task of reaching the entire adult population with any type of control measure is manifestly great, the health officer who plans a cancer control program seeks to make the limited forces he can throw into the field count for more than may be expected of random action directed to the public at large. From experience in the control of infectious disease it is evident that information regarding what people are most apt to develop cancer or certain kinds of cancer would be of value in the application of cancer control measures. The health officer who is interested in cancer control must also take stock of the modern advances in the etiology of cancer and inquire whether these now have any practical significance in the control of human cancer.

To review broadly the salient features regarding the occurrence of cancer in man, the facts to be considered may be classified under four general headings: (1) environmental or exogenous agents causing cancer; (2) the association of cancer with other diseases; (3) evidences regarding intrinsic or constitutional factors affecting cancer incidence; and (4) certain aspects of differential mortality.

It should be stated at the outset that cancer of different parts of the body and of different pathological character in the same part are different diseases. Although for some purposes it is useful to consider all types of cancer together, throughout this discussion differences in etiology and in epidemiological features according to *site* of cancer will appear.

EXOGENOUS AGENTS CAUSING CANCER IN MAN

Attention in the laboratory investigation of cancer is now focused on the rôle of chemical carcinogens, and of x-ray, radium and ultra-violet radiation in the causation of malignant

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tumors. In human cancer such agents have been identified chiefly in the small group of occupational cancers. The first such observation was made in England in 1775 by Percival Pott [1] who noted in chimney sweeps a greatly increased incidence of scrotal epithelioma, caused by exposure to soot or some chemical contained in soot. The substances or agents now known to cause cancer in man include arsenic, tar, pitch, paraffin, petroleum oils and derived products, benzol, aniline dye compounds, roentgen rays, radium rays and ultra-violet rays, possibly asbestos, nickel carbonyl and chromates. What common property of these diverse chemicals and radiations makes them potentially carcinogenic is not clear; possibly all act by interfering with cellular enzymes, as the work of Rhoads [2] suggests. Most of these agents produce skin cancer. Aniline dye compounds cause chiefly cancer of the bladder; excessive exposure to radium salts has been known to cause bone sarcoma and carcinoma of the lung; leukemia may follow chronic benzol poisoning. With but few exceptions, the carcinogenic effect of these agents has been demonstrated in experimental animals as well as in man.

A survey of occupations listed [3] according to exposure to various hazards shows 146 different occupations in this country in which exposure to known carcinogenic agents may occur. However, the number of reported occupational cancers is quite small. Hueper [4] estimates that the total cases reported in the world literature is from 8,000 to 9,000, of which approximately 400 have been reported from the United States.

A partial explanation for the small number of reported cases of occupational cancer may be the fact that, although the period of exposure necessary to produce cancer may be as little as one year, the time from such exposure until the appearance of the tumor may be as long as 30 years, averaging for some agents approximately 16 years, so that the tumor may not appear until long after the worker has changed his occupation. There is also a natural reluctance on the part of industrial management to release information on occupational cancer. Although preventive measures, including periodic examinations, have been adopted in some plants, especially in the aniline dye industry, often the hazards are not recognized or not properly guarded against. Exposure to aniline dye compounds occurs not only in the dye industry but in many others, including plants handling rubber and those manufacturing explosives. It is probable that the number of occupational cancers is greater than indicated by identified cases and that the enormous expansion of certain industries may further increase this number in the future.

Obviously, exposure to the carcinogenic chemicals and radiations need not be occupational. Arsenic cancer of the skin has been observed following prolonged medicinal administration of Fowler's solution and, in the Argentine, from drinking water contaminated by arsenic ores. The influence of ultraviolet radiation is believed responsible for the higher general incidence of skin cancer in the South as compared with the North in this country, as well as for its high incidence among outdoor workers in the North.

The relationship of carcinogenic chemicals and radiations to the common run of malignant tumors in man is a matter of speculation. It has been suggested that part of the increase in cancer mortality of modern times may be attributable to the increased exposure to such substances accompanying the industrial age. The difficulties in the way of testing such a hypothesis may be appreciated from the fact that a chemically induced

tumor does not differ histologically from one arising in the same organ apparently spontaneously, and that such a tumor may appear long after the chemical agent has been eliminated from the body.

We may anticipate that a great deal of future investigations on the causes of cancer in man will center on the possible presence of chemical carcinogens in food, water, and dust. Although the significance of the known carcinogenic agents in the etiology of the vast majority of human cancers is at present unknown, continued medical observation of workers exposed to carcinogenic agents, even after they have left the employment where such exposure occurred, is clearly indicated. This is rarely done now and presents a field for possible public health action.

DIFFERENTIAL CANCER MORTALITY AMONG SOCIAL-ECONOMIC GROUPS

In addition to the small group of identified occupational cancers, a considerable array of statistical evidence points to increased mortality from certain forms of cancer in those economic groups among which industrial workers are largely found.

Stevenson [5] analyzed cancer mortality statistics for males in England and Wales on the basis of social-economic class, dividing the population into professional workers, skilled workers, unskilled workers, and two intermediate groups. A progressive increase in cancer mortality was found in each " lower " social-economic group. This increase was confined to cancer of the skin, lip, larynx, and the alimentary canal from mouth to pylorus. For these sites, the standardized rates in unskilled workers was twice that of professional workers. In married women, classified by husband's occupation, a similar though less marked relationship appeared for the same sites of cancer and also for cancer of the uterus, indicating that factors other than those due directly to occupation must be considered in explaining these facts. In married women also, a reverse relation was found for cancer of the breast, ovary, and thyroid, in which the higher rates were in the higher classes. The same differences appeared among single females, classified by social-economic status.

In this country, broadly similar findings have been reported by Knight and Dublin [6] in life insurance data, and by Whitney,[7] for total cancer not subdivided according to site. In Massachusetts, Lombard and Doering [8] found that the foreign born and those of foreign parentage had higher mortality rates for buccal cavity and stomach cancer, but not for other sites. They concluded that a sufficiently close relationship exists between these nativity groups and the lower social classes of England to justify the opinion that economic social conditions are a factor in the incidence of cancer. It is of interest that the first analysis of cancer mortality by economic status in this country was made by Charles V. Chapin [9] on the mortality returns of Providence, R. I., for 1865. He found the rate twice as high in the lower as compared with the higher economic class.

Greater diagnostic accuracy in the medical care available to the higher income groups does not readily explain these differences in cancer mortality in social classes for the reason that better diagnosis increases rather than decreases the total number of recorded cancers. Also the types of cancer in which the differences are found include both easily diagnosed sites, such as the skin, and poorly diagnosed sites, such as the stomach. Moreover, one of the most accurately diagnosed forms of cancer, that of the breast, shows opposite social selection to that observed for almost equally easily diagnosed sites, such as the lip, the buccal cavity,

and the uterus. Better therapeutic results might explain lower mortality from skin and lip cancer in the higher economic groups, but not lower mortality from esophageal and stomach cancer, and certainly not the higher mortality from breast cancer in these groups. The differences in cure rates for stomach cancer in the best clinics as contrasted with the average would be insufficient to account for differences in cancer mortality as pronounced as those observed.

The findings with respect to the higher cancer mortality in unskilled and industrial economic groups are frequently cited as evidence that the living conditions of these groups involve greater exposure to "exogenous carcinogens." Aside from specific occupational carcinogens, we are unable to identify what these agents may be.

Regardless of the explanations for the higher mortality from certain forms of cancer in unskilled and industrial workers, the need for concentrating attention on such groups in applying cancer control measures is evident.

ASSOCIATION OF CANCER WITH OTHER DISEASES

It has long been noted that cancer occurs more frequently than normal in tissues the seat of the so-called precancerous lesions. The evidence for significant association is often far from conclusive. Precancerous lesions have been described in the skin, lip, liver, mouth, bones, thyroid, gastrointestinal tract, breast, ovary, uterus, and vulva. The greatest number have been described in the skin, where at least twenty-two different precancerous states are said to occur.[10] It should be noted that in most cases of cancer, a specific precancerous lesion cannot be identified.

The subsequent incidence of cancer in persons with precancerous lesions varies greatly, from a few (xeroderma pigmentosum; erythroplasia of Queyrat) in which cancer always supervenes, to many in which it is only an occasional occurrence. For the most part, figures which are reported refer not to secondary incidence but to frequency of association. Where secondary incidence is stated, the factors of age and duration of observation are usually not taken into account. For most precancerous lesions, the available information does not permit accurate estimation of the degree of increased risk of cancer which they carry.

There is adequate evidence that in women with chronic cystic mastitis[11] the subsequent incidence of breast cancer is from 2 to 10 times as great as the average. Epithelioma of the tongue occurs in syphilitic males about 5 times more frequently than would be expected normally, and recently there have been presented data[12] indicating that a similarily high incidence of cervix carcinoma occurs in women who have had syphilis. Other conditions apparently associated with subsequent cancer which may be mentioned are multiple polyposis, with intestinal cancer; cirrhosis of the liver with primary liver cancer; Paget's disease of bone with osteogenic sarcoma; atrophy of the buccal and esophageal mucous membranes, attributed to Vitamin B deficiency, with buccal and esophageal cancer.

Rhoads[13] has stressed the fact that many of the precancerous lesions are atrophic in nature. This is in accord with the observations that in experimental liver cancer produced by the carcinogenic chemical, butter yellow, atrophy of the liver cells precedes the development of cancer. Kensler and his associates[14] have shown further that in experimental animals this process can be prevented by supplying extra quantities of riboflavin and casein in the diet.

From the standpoint of cancer control, the existence of precancerous

lesions presents the possibility of instituting case finding procedures to discover individuals having such lesions, to be followed by treatment where possible, and by continued observation so that if cancer develops, it may be treated early in its course.

CONSTITUTIONAL FACTORS IN HUMAN CANCER

Although certain of the precancerous lesions (leukoplakia, farmer's skin) are attributable to environmental agents, others such as familial intestinal polyposis and multiple neurofibromatosis are apparently the result of hereditary or at least familial influences. Further, even in the effects of identified exogenous carcinogenic agents, the degree of inherent susceptibility or resistance probably plays a rôle, as is indicated by the many workers who, although exposed for long periods to carcinogenic chemicals, do not develop cancer. As in most other diseases, both the constitutional factor and the environmental must be considered in the etiology of malignant tumors.

The information available concerning presumably constitutional factors affecting cancer incidence in man comprises data on (1) hereditary forms of cancer or of benign tumors; (2) the occurrence of cancer families; (3) the familial incidence of cancer; and (4) the incidence of secondary primary cancers in patients following successful treatment of first cancer.

In a few rare tumors a hereditary mechanism is generally accepted, although the effect of unknown environmental factors cannot be excluded entirely. Retinoblastoma of the eye occurs with sufficient frequency in siblings and in descendants of cured patients to justify advice against marriage or having more children. Examples of hereditary benign tumors are familial intestinal polyposis which occurs in one-third the children of affected families and which becomes malignant in at least 25 per cent of cases; multiple neurofibromatosis which occurs in half the children if one parent is affected, and of which 13 per cent are reported to develop sarcoma; and certain benign bone tumors.

In addition, there have been described "cancer families," in which cancer, often of the same organ, such as the breast, uterus, or stomach, occurred in several brothers or sisters. What proportion of cancer patients come from such families is not known.

With regard to the common forms of cancer, studies have been made to determine whether the parents and siblings of cancer patients have any greater cancer mortality than the general population. The majority of such studies do show increased mortality in both parents and siblings, ranging from 20 to 60 per cent higher than expected. When cancer occurs in the same family, there is also a definite tendency for it to appear in the same organ.[15-20] It should be noted that such findings do not necessarily indicate a *general* familial concentration of cancer, but could be accounted for by assuming that a relatively small percentage of cancer patients come from cancer families. For example, in Crabtree's data,[15] among 1,029 families there occurred an excess of 93 cancer deaths (37 per cent) over that expected in parents and siblings together. An increase above normal of one case in 9 per cent of the families would thus account for all of the observed excess of cancer deaths, with a normal incidence in the remaining 91 per cent of families. It is probably superfluous to point out that an increased familial incidence of cancer does not necessarily indicate that hereditary or genetic factors are responsible, since similar environmental factors may also run in families.

The evidence regarding familial cancer, although far from conclusive, is

sufficiently impressive so that in some clinics a family history of cancer, particularly of the breast and uterus, is regarded as indicating need for increased watchfulness for the possible development of a similar tumor in other members of the family. Certainly no objection will be raised to such an interpretation, which can lead only to increased chance of early diagnosis with correspondingly increased probability of successful treatment.

Obviously, the time has not yet come to look upon the occurrence of cancer in one member of a family as the signal for examination and continued follow-up of the patient's brothers and sisters. In identified cancer families this procedure is justified. Without further information, its employment in families where only one case has occurred would be experimental. The principle is being applied by some physicians and clinics, but it has not reached the stage of public health practice.

Related to the problem of the nature of inherent susceptibility to cancer is the question whether the development of cancer in one organ denotes an increased susceptibility to cancer in other parts of the body. This question has been approached by studying the subsequent incidence of other primary cancer in persons successfully treated for one malignant tumor. The subject has been investigated extensively by Peller,[21] and more recently by Lombard and Warren.[22] Their findings are similar and indicate that the incidence of second cancer is not significantly different from that of the general population. It should be emphasized that the opposite conclusion of Peller rests not on different findings but on the theoretical assumption that in cancer patients the subsequent expected incidence *should* be 5 times that of the general population. This is based on the further assumption that only 20 per cent of the population are susceptible to cancer and, consequently, that among cancer patients, who are susceptible, of course, the annual age-specific mortality rates should be 5 times that of the general population. There is no known method of determining susceptibility to cancer and no reason to assume that only those who develop cancer are susceptible. The available experimental evidence indicates that environmental factors can alter incidence markedly.

From the practical standpoint the significant fact is that the incidence of second cancer in cancer patients is not greatly different from that of the general population. This suggests that increased susceptibility to cancer, whatever its nature, is not general but more probably is organ specific, as is the case in certain high tumor strains of mice and rats.

The rôle of hereditary factors in the causation of human cancer and the extent to which such factors are modifiable by environmental agents, remains obscure. There seems little doubt that such factors do exist for some tumors and in some families, but the available evidence indicates that they are of only minor importance in the majority of cases.

DIFFERENTIAL MORTALITY FROM CANCER

The known facts regarding the etiology of cancer, fragmentary as they are, can be correlated with only a few of the differential characteristics of cancer mortality. These characteristics, however, have intrinsic interest from the standpoint of a control program.

Although great stress has been laid on the errors of diagnosis inherent in mortality statistics of cancer, many of the differences in cancer mortality observed in different population groups are not readily explainable by diagnostic error. The extent to which

diagnostic errors are responsible for differences in mortality in different population groups must be considered separately for each group and each site of cancer where such differences are found.

TREND OF CANCER MORTALITY

The continued upward trend of cancer mortality has made cancer one of the major health problems of our time. One-third of the increase in mortality is due to increased "aging" of the population. The remaining increase is sometimes written off as reflecting increased recognition of cancer rather than increased incidence.

In upstate New York, comparison of age-standardized mortality from 1931 to 1941 shows an increase during this period of 10 per cent in male mortality; and a decrease of 6 per cent in female mortality. Mortality from cancer of the buccal cavity, skin, and lip, has decreased slightly in both sexes. Death rates from cancer of the stomach and the liver have decreased significantly in both sexes. Cancer of the breast increased only slightly; mortality from uterine cancer decreased by approximately 16 per cent. The increase in mortality from certain types of cancer in males is sufficient to raise the total mortality above that in the earlier period. The most marked increase occurred in cancer of the lungs and other respiratory organs, mortality from which increased threefold in males but only slightly in females. In females the decline in certain sites, notably the stomach, the liver, and the uterus, more than offsets the increased rate for other types of cancer. Since there is no reason to believe that diagnostic accuracy lessened during the past decade, it is probable that this decrease foreshadows a continued downward trend in cancer mortality among women.

From data regarding hospitalization of cancer cases and proportion of diagnoses verified by pathological examination, there is no reason to believe that, for the same site of cancer, diagnostic accuracy is different in the two sexes. For this reason, as Gover has pointed out, the more rapid increase in mortality for certain internal types of cancer in males than in females is probably real and not due entirely to improved diagnosis.

CANCER MORTALITY BY COLOR AND GEOGRAPHIC REGIONS IN THE UNITED STATES

The possible association of cancer of the buccal cavity and of the liver with certain dietary deficiencies and the association of tongue cancer and probably cervix cancer with preëxisting syphilis suggest that mortality statistics in this country might reflect corresponding differences for cancer of these sites between geographic sections and between white and colored. For example, we might expect a relatively high mortality from buccal and liver cancer in those southern states with widespread gross dietary deficiency as indicated by high mortality from pellagra; also, colored males would be expected to have a higher mortality from tongue cancer; and colored females from cancer of the cervix.

Govers data [24] for the years 1930 to 1932 show that age-standardized mortality from total cancer in both sexes in this country is highest in the Northeast and on the Pacific coast, lowest in the South and Southwest. The only exceptions are cancer of the skin, which is highest in the South, and cancer of the mouth and pharynx, which is highest in southern females and second highest in southern males. All other forms of cancer, including cancer of the liver and biliary passages, show lower rates in the South. These relative differences in site distribution of cancer between North and South appear in hospital deaths as well as in all

recorded deaths. The differences, however, are not so marked in morbidity data. The expected difference in cancer mortality in the South is thus present for buccal cavity cancer but not for cancer of the liver.

Comparison between white and colored cancer mortality in the United States shows that for most forms of cancer, colored mortality is lower than among whites. The differences are less marked in the North than in the South, presumably due to the fact that Negroes in the North obtain better medical care. A peculiar feature of cancer mortality in Negroes is that it is lower only in the age groups above 54 years; in younger age groups it is as high or slightly higher than among whites. Mortality from tongue cancer is lower in colored females, and only slightly higher in colored males than in whites.

The forms of cancer showing markedly higher mortality in the colored race are cancer of the external genitalia in males, and of the uterus and other female genital organs in females. The excess mortality from cancer of the uterus among colored women is 75 per cent in the South and 91 per cent in the North, and is sufficient to bring total cancer mortality among colored females slightly above that among whites in both sections of the country. In the experience of the Metropolitan Life Insurance Company's industrial department [25] from 1917 to 1935, the age-standardized mortality from uterine cancer among colored females was 55 per cent higher than among whites. We do not as yet have mortality data for cancer of the cervix uteri separated from that of the uterine fundus, but it is known that approximately 85 per cent of uterine cancers arise in the cervix.

The expected differences in cancer mortality between white and colored races because of the apparent association of tongue and cervix cancer with syphilis are not found for tongue cancer, but are for uterine cancer. Obviously, such a finding is merely corroboratory and does not establish the fact of an association between syphilis and uterine cancer.

Regardless of its cause, the markedly high mortality from uterine cancer among colored females deserves greater attention than it has received, both from the standpoint of investigation and from that of administration of cancer control programs.

Cancer of the uterus and of the breast and ovary occur also with different frequency among women of different marital status. Uterine cancer mortality is highest among married women, while breast and ovarian cancer mortality is higher among single women. The mortality from breast cancer among childless married women is as high as in single women. The higher mortality from breast cancer among single women and childless married women is usually attributed to the absence of normal lactation, while the higher mortality from uterine cancer in married women has been interpreted as evidence that injuries resulting from childbirth are causes of uterine cancer. These interpretations have not been fully established. Recent data from Australia, described by Dorn,[26] indicate that uterine cancer mortality is highest among married women who have never borne children.

A more complete review of the differential mortality of cancer is not within the scope of this paper. It may be said, however, that most of the major forms of cancer exhibit sufficiently different epidemiological characteristics to indicate that each must be approached as a separate problem in cancer control.

SUMMARY AND DISCUSSION

In summary, there is evidence that the occurrence of human cancer is in

some cases attributable to the influence of specific chemical and physical agents; in others to an association with precancerous lesions and with other diseases; and, in a relatively small number of cases, familial factors, which may be hereditary, are operative. In a large proportion of cases, none of these etiologic factors can be identified. Considerable differences appear in mortality from various forms of cancer in persons of different race, economic status, and marital status. Most of these differences are not readily explainable by any single hypothesis regarding the causation of cancer.

Many of the etiological and differential factors discussed point to possible public health applications in the form of special attention in education, in case finding and in follow-up directed to the groups which have an apparently high mortality and incidence of certain forms of cancer. Examples of such groups are: industrial and unskilled workers (cancer of the skin, lip, mouth, larynx, and stomach); unmarried women (cancer of the breast); syphilis patients (cancer of the vulva, cervix, tongue); Negro women (cancer of the uterus). The experience of the Strang Cancer Prevention Clinic in New York City, in case finding among apparently healthy women, indicates that the proportion of early cancer cases found is comparable to that of early cases of tuberculosis discovered by mass x-ray examinations.[27] Active case finding applied to groups with higher than normal incidence of cancer may be correspondingly more effective.

It seems reasonable to forecast that, in the future, cancer control programs will be guided to a greater extent than in the past by existing knowledge and by further investigation of the epidemiological characteristics of the disease. These point to a logical development of control activities directed toward population groups which apparently stand in greatest need of such measures and among which they should prove most fruitful.

REFERENCES

1. Pott, Percival. *Chirurgical Observations.* Hower, Clarke & Pollins, London, 1775.
2. Rhoads, C. P. Recent Studies in the Production of Cancer by Chemical Compounds, the Conditioned Deficiency as a Mechanism. *Bull. New York Acad. Med.*, 18:53–64 (Jan.), 1942.
3. Dublin, L. I., and Vane, R. J. Occupation Hazards and Diagnostic Signs. *Bull. No. 582,* U. S. Bureau of Labor Statistics. Washington, 1933.
4. Hueper, W. C. Cancer in Its Relation to Occupation and Environment. *Bull. Am. Soc. Control Cancer,* 25:63 (June), 1943.
5. (a) *The Registrar-General's Decennial Supplement, England & Wales, 1921.* Part II. Occupational Mortality, Fertility and Infant Mortality. London, 1927.
(b) *The Registrar-General's Decennial Supplement, England & Wales, 1931.* Part IIa. Occupational Mortality. London, 1938.
6. Knight, Augustus S., and Dublin, Louis I. *The Relation of Cancer to Economic Condition.* Metropolitan Life Ins. Co., New York, 1917.
7. Whitney, Jessamine S. (ed.). *Death Rates by Occupation.* Nat. Tuberc. Assoc., New York, June, 1934.
8. Lombard, H. L., and Doering, Carl R. Cancer Studies in Massachusetts. III. Cancer Mortality in Nativity Groups. *J. Prev. Med.*, 3:343, 1929.
9. Chapin, Charles V. Deaths among Tax-payers and Non-taxpayers, Income Tax. Providence, 1865. *A.J.P.H.*, 14:647 (Aug.), 1924.
10. Mackee, George M., and Cipollaro, Anthony C. Cutaneous Cancer and Precancer. New York. *Am. J. Cancer,* 1937.
11. Warren, Shields. The Relation of "Chronic Mastitis" to Carcinoma of the Breast. *Surg., Gynec. & Obst.*, 7:257–273 (Sept.), 1940.
12. Levin, Morton L., Kress, Louis C., and Goldstein, Hyman. Syphilis and Cancer. *New York State J. Med.*, 42:1737 (Sept. 15), 1942.
13. Rhoads, C. P. Precancerous Lesions. *Bull. Am. Soc. Control Cancer,* 25:5–7 (Jan.), 1943.
14. Kensler, C. J., Sugiura, K., Young, N. F., Halter, C. R., and Rhoads, C. P. Partial Protection of Rats by Riboflavin with Casein against Liver Cancer Caused by Dimethylaminoazobenzene. *Science,* 93:308, 1941.
15. Crabtree, James A. Observations on the Familial Incidence of Cancer. *A.J.P.H.*, 31:49 (Jan.), 1941.
16. Deelman, H. J. Heredity and Cancer. *Ann. Surg.*, Jan., 1931, pp. 30–34.
17. Wassink, W. F. Cancer et Hérédité. *Genetica,* 17:103–144, 1935.
18. Waaler, H. M. *Ueber die Erblichkeit des Krebses.* Oslo, 1931.
19. Wainwright, J. M. Breast Cancer in Great Britain and America. *Am. J. Cancer,* 15, 4:2610, 1931.
20. Lombard, H. L. Studies on Familial Aspects of Cancer. *New Eng. J. Med.*, 218:711–713 (Apr. 28), 1938.
21. Peller, Sigismund. Metachronous Multiple Malignancies in 5876 Cancer Patients. *Am. J. Hyg.*, 34, 1, Sec. A—1–11 (July), 1941.
22. Lombard, H. L., and Warren, Shields. Association of Other Malignant Tumors with Cancer of the Skin. *A.J.P.H.*, 33:533–536 (May), 1943.
23. Pohlen, Kurt, and Emerson, Haven. Errors in Clinical Statements of Causes of Death. *A.J.P.H.*, 32: 251–260 (Mar.), 1942.

24. Gover, Mary. Cancer Mortality in the United States.

I. Trend of Recorded Cancer Mortality in the Death Registration States of 1900 from 1900 to 1935. *Pub. Health Bull. No. 248,* U. S. Public Health Service, Washington, 1939.

II. Recorded Cancer Mortality in Geographic Sections of the Death Registration States of 1920, from 1920 to 1935. *Pub. Health Bull. No. 252,* U. S. Public Health Service, Washington, 1940.

III. Geographic Variation in Recorded Cancer Mortality for Detailed Sites for an Average of the Years 1930–32. *Pub. Health Bull. No. 257,* U. S. Public Health Service, Washington, 1940.

25. Dublin, L. I., and Lotka, A. J. *Twenty-five Years of Health Progress.* Metropolitan Life Insurance Co., New York, 1937.

26. Dorn, Harold E. Cancer and Marital Status. *Human Biol.,* 15, No. 1 (Feb.), 1943.

27. *Memorial Hospital, New York City. Annual Report, 1942.*

U. S. Cadet Nurse Corps Induction Pledge

At this moment of my induction into the United States Cadet Nurse Corps of the United States Public Health Service:

I am solemnly aware of the obligations I assume toward my country and toward my chosen profession.

I will follow faithfully the teachings of my instructors and the guidance of the physicians with whom I work;

I will hold in trust the finest traditions of nursing and the spirit of the corps;

I will keep my body strong, my mind alert, and my heart steadfast;

I will be kind, tolerant and understanding;

Above all, I will dedicate myself now and forever to the triumph of life over death.

As a Cadet Nurse, I pledge to my country my service in essential nursing for the duration of the war.