Intracommunity Variation in Cancer Incidence for Pittsburgh

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A FRUITFUL APPROACH to cancer control may lie in determining the way in which cancer manifests itself in different population groups. Unfortunately, adequate information on the total incidence of the disease in large population groups in the United States is not readily available. Connecticut (*1,2*) and New York (*3*) have provided information on incidence based on continuing case registers. The most recent, and most comprehensive, data on total cancer incidence in large urban areas of the United States, however, are the 10-city morbidity studies for 1947 of Dorn and Cutler (*4*).

Our report presents the results of a cooperative study of the incidence of cancer in Pittsburgh in the years 1957–58. Results for the white population only are presented. This study was conducted by the department of biostatistics, Graduate School of Public Health, University of Pittsburgh, and the National Cancer Institute, Public Health Service. Pittsburgh is the only one of the 10 cities studied by Dorn and Cutler which has been resurveyed after an interval of 10 years. It thus provides information not available in the other cities as to the type of change in cancer incidence in the decade from 1947 to 1957. By comparing the results of the more recent study with the 1947 data for the Pittsburgh portion of the Dorn and Cutler 10-city morbidity studies (*4,5*), it is possible to observe some unique temporal and spatial contrasts in cancer incidence in a large industrial community. Patno's earlier work (*6*) provided a description of the geographic variation in the prevalence of cancer in Pittsburgh for 1947.

The intracommunity variation in cancer incidence which was observed and the lack of consistency in this variation from 1947 to 1957–58 were the primary considerations of our analysis. We sought answers to the following questions: Are there differences in incidence according to residence within an urban population? Does this relationship remain constant over a period of time?

Materials and Methods

Using the morbidity survey techniques developed by the National Cancer Institute, we obtained information on virtually all cases of cancer first diagnosed among residents of Allegheny County, Pa., in 1957 and 1958. These methods, which have been fully described else-

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where (*4*), seek to account for all cancer cases diagnosed within a given area.

The Allegheny County (Cancer) Registry, which receives reports of cancer patients from all hospital record rooms and tumor clinics in the county, was the basic source of our cancer records. Data were also collected, however, from records of the Pennsylvania State Office of Vital Statistics, as well as through a special survey. This survey, conducted by the National Cancer Institute in cooperation with the registry, the Allegheny County Medical Society, and the University of Pittsburgh Graduate School of Public Health, was undertaken to insure as complete an enumeration of cancer patients as possible.

All sources of medical records in the county not routinely reporting to the county registry were canvassed. These sources included all the physicians, as well as departments within hospitals which maintain their own record systems. Abstracts of records of cancer patients whose cases were first diagnosed in 1957 or 1958 were obtained from pathology, radiology, gynecology, outpatient, and isotope departments of hospitals, as well as from cobalt clinics maintained at two of the larger hospitals. Vital statistics records were searched for information concerning deaths from cancer as a partial check on completeness. The composite information obtained from both the registry and the survey serves to increase the reliability and completeness of our data (*7*).

The information on each patient which we requested—and generally obtained—included name, street address, age, sex, race, primary site of tumor and its histological type, date of diagnosis, stage of disease at diagnosis, method of diagnosis (biopsy, clinical examination only, and so forth), and—if patient was deceased—date and cause of death.

Data for 1947 presented in this paper refer only to white residents of Pittsburgh (plus the Mount Oliver and Baldwin Boroughs) and differ somewhat from those data reported by Dorn and Cutler (*4*) and Cutler (*5*), which included information on all persons in Allegheny County.

There were 4,414 white residents of Pittsburgh (including boroughs of Mount Oliver and Baldwin as well as the city proper) in whom cancer was first diagnosed in 1957 or 1958. Table 1 shows the distribution of cases by the source of the medical record. Information on 17 percent of the cases diagnosed in the 2-year period was obtained from sources other than hospitals. In 10 percent of the cases for the 2 years, medical certification that cancer was the cause of death was the only source of information re-

Table 1. Cases of cancer first diagnosed among white residents of Pittsburgh, Pa., in 1957–1958, by primary site and source of case record

Primary site	ISC number [1]	All sources	Hospital	Physician	Death certificate	Other
All sites		4, 414	3, 667	224	438	85
All sites except skin		4, 008	3, 355	145	434	74
Buccal cavity and pharynx	140–148	152	132	4	15	1
Digestive system	150–159	1, 161	936	44	158	23
Respiratory system	160–165	429	390	12	16	11
Breast	170	544	483	21	35	5
Female genital organs	171–176	433	382	12	32	7
Male genital organs	177–179	267	221	12	29	5
Urinary organs	180–181	258	235	7	14	2
Skin	190–191	406	312	79	4	11
Eye	192	10	9	0	1	0
Brain and nervous system	193	65	56	4	5	0
Endocrine glands	194–195	41	37	2	2	0
Bone	196	18	14	3	1	0
Soft tissue	197	32	29	1	1	1
Leukemias	204	107	87	6	13	1
Lymphomas	200–203, 205	143	125	8	9	1
Other and unspecified	199	348	219	9	103	17

[1] Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death. 6th revision. World Health Organization, Geneva, 1948.

Table 2. Cases of cancer first diagnosed among white residents of Pittsburgh, Pa., in 1957–1958, with number and percent of cases microscopically confirmed

Primary site	ISC number [1]	Total cases [2]	Confirmed cases only	
			Number	Percent
All sites		3, 882	3, 330	85. 8
All sites except skin		3, 480	2, 947	84. 7
Buccal cavity and pharynx	140–148	137	128	93. 4
Digestive system	150–159	1, 003	807	80. 5
Stomach	151	182	128	70. 3
Large intestine	153	356	292	82. 0
Rectum	154	206	179	86. 9
Respiratory system	160–165	413	309	74. 8
Breast	170	509	478	93. 9
Female genital organs	171–176	401	376	93. 8
Male genital organs	177–179	238	184	77. 3
Urinary organs	180–181	244	223	91. 4
Skin	190–191	402	383	95. 3
Eye	192	9	6	66. 7
Brain and nervous system	193	60	54	90. 0
Endocrine glands	194–195	39	36	92. 3
Bone	196	17	13	76. 5
Soft tissue	197	31	29	93. 5
Lymphomas	200–203, 205	134	126	94. 0
Other and unspecified	199	245	178	72. 7

[1] See footnote, table 1.
[2] Excludes leukemia and cases obtained from death certificates only.

garding the first diagnosis of cancer. This 10 percent, referred to as death-certificate-only cases, is included in our consideration of cancer incidence.

Cancer diagnoses included. We followed the standard practice of combining data on patients having clinical diagnoses only with data on patients with a microscopically confirmed diagnosis for several reasons. It is considered desirable to examine the total experience of all persons in the community with a medical diagnosis of cancer. Zimmerer and Chiazze (*8*) and Axtell and associates (*9*) found that survival rates for patients with only a clinical diagnosis were considerably lower than for those with microscopically confirmed cases. This observation suggests that the group of patients with clinical diagnoses only "includes patients for whom biopsy was considered medically inadvisable or unnecessary" (*9*). Eighty-six percent of the cases diagnosed among Pittsburgh residents in 1957 or 1958 were microscopically confirmed (table 2). If the clinically diagnosed cases were excluded, incidence would be underestimated to a greater degree than it would be overestimated by including them. Exclusion of cases only clinically diagnosed might distort both the intracommunity variation in cancer incidence and the trends over time. Consequently, inclusion of all cases classified by physicians as cancer appears appropriate for the determination of cancer incidence.

The proportion of cases microscopically confirmed in 1957 and 1958 was considerably higher than the 68 percent reported for the comparable Pittsburgh portion of the 1947 10-city surveys. As might be expected, there was some variation by cancer site in the percentage of cases with microscopic confirmation. For example, records of 75 percent of the patients diagnosed as having respiratory cancer in 1957–58 indicated a microscopic confirmation, compared with records of 94 percent of the female patients with cancer of the genital organs. There has been substantial improvement over 1947 in the percent of microscopically confirmed diagnoses for each of the site groups shown in table 2.

Residence areas. The basic unit for our initial classification of patients by residence was the census tract. The Bureau of the Census publishes demographic information on these relatively small areas (*10*). Use of census data permitted us to estimate the population of subareas of the city and to obtain some idea of their demographic characteristics.

Pittsburgh was subdivided into 189 census tracts in 1960. Patients enumerated in our study who lived within the city limits were assigned one of these 189 residence classifications. We then established 15 residence areas by using combinations of the 189 Pittsburgh census tracts and two municipalities (fig. 1). One of these municipalities, Mount Oliver Borough, is contained wholly within the limits of the city. The other, Baldwin Borough, was partly annexed by the city between 1950 and 1960. Both boroughs are treated as part of the city in the residence analysis.

The 1957 and 1958 populations were esti-

mated by straight-line interpolation between the 1950 and 1960 census counts. Extensive investigation of local conditions indicated that such a procedure would provide reasonable intercensal estimates of the population. Available local demographic data on births, deaths, and so forth also provided supportive evidence that straight-line interpolation would be adequate. Because of the variety of changes in tract boundaries between the two census years, however, we made interpolations between groups of census tracts; each group was designed to enclose the same geographic area in 1960 as in 1950. Population estimates were obtained by race, sex, and age for the groupings of the 189 census tracts and for the two municipalities mentioned. We then regrouped these estimates to establish the populations of the 15 areas.

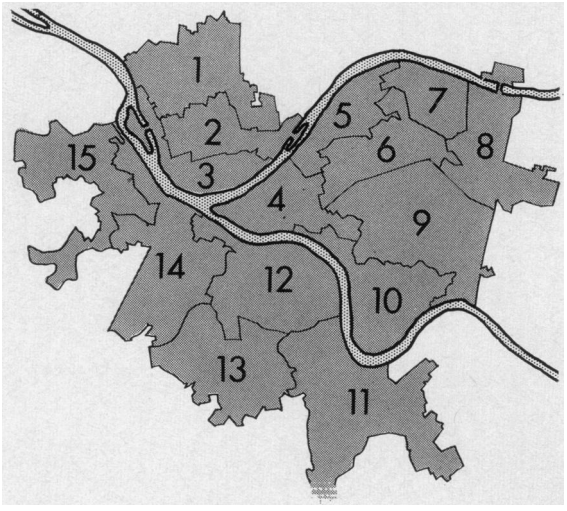
A variety of socioeconomic indicators and population characteristics are available from the Bureau of the Census for 1960. Although the censal year did not coincide with any study year, we assumed that the area indicators available for 1960 reflected those for the study years to a meaningful degree. Agreement between median income levels and other socioeconomic indexes is relatively close, as the following summary of demographic characteristics of the 15 residence areas (fig. 1) shows.

Characteristic	*Areas of low rank*	*Areas of high rank*
Median income	4, 3, 8, 2	12, 7, 11, 9
Median school years completed.	3, 5, 4, 2	13, 11, 7, 9
Percent of housing sound.	3, 4, 2, 5 and 8	7, 1, 9, and 13, 11
Percent of population white.	4, 8, 6, 2	11, 7, 1, 13
Percent of population of foreign stock.	11, 15, 14, 2	4, 5, 10, 7
Percent of employed white males classified as laborers.	9, 7, 13, 11	3, 12, 5, 4

Areas of high, middle, and low income were established by first computing the median family income for each area and then ranking these incomes from high to low. For our study, the areas with the four highest median incomes and those with the four lowest median incomes are considered the areas of high and low socioeconomic status.

A comparison of 1957–58 with 1947 in respect to area characteristics, such as median income and the percent of population of foreign stock, indicates little change in the relative position of the 15 areas in the 10-year period.

Figure 1. Geographic boundaries of the 15 residence areas, Pittsburgh



Trends in Incidence, 1947 to 1957–58

To account for changes in the age distribution in the community, we used the direct method to adjust both the 1947 and the 1957–58 rates to the 1960 age distribution of men and women in the Allegheny County population. Age-adjusted incidence rates for cancer of selected sites among white males and white females in the entire city of Pittsburgh are shown in table 3. Little change in rates was noted for all forms of cancer combined among white males or among white females. The age-adjusted incidence rate in males increased by about 5 percent, from 371 per 100,000 population in 1947 to 388 in 1957–58; the rate for females declined somewhat in the 10-year period.

Although there has been relatively little change in the total incidence of cancer from 1947 to 1957–58, there have been substantial changes in incidence for specific cancer sites. Cancer of the digestive system continued to account for a major proportion of all cancer in 1957–58, even though incidence rates decreased by 22 percent in white males and by 26 percent in white females. This decline is generally consistent with the decline in mortality from cancer of the digestive organs which has been ob-

Table 3. Age-adjusted cancer incidence rates per 100,000 population and percentage changes over time for white population of Pittsburgh and for New York State, by primary site of lesion and sex of patient

Primary site	Pittsburgh						New York State, percent change 1949–51 to 1958–60	
	White males			White females				
	1947	1957–58	Percent change	1947	1957–58	Percent change	Males	Females
All sites	371. 1	388. 4	+4. 7	373. 0	355. 4	−4. 7	+12. 2	+2. 6
Buccal cavity and pharynx	20. 0	21. 7	+8. 5	6. 8	4. 8	−29. 4	−9. 2	−8. 3
Digestive system	140. 8	109. 8	−22. 0	112. 5	83. 4	−25. 9	+. 4	−4. 2
Stomach	37. 9	24. 5	−35. 4	24. 7	13. 8	−44. 1	−24. 6	−23. 6
Large intestine	40. 0	32. 2	−19. 5	40. 6	34. 8	−14. 3	+15. 2	+. 8
Rectum	31. 3	22. 6	−27. 8	18. 7	15. 0	−19. 8	−1. 9	−6. 3
Respiratory system	48. 4	67. 4	+39. 2	9. 3	6. 0	−35. 5	+49. 8	+37. 5
Lung and bronchus	36. 1	55. 0	+52. 4	6. 7	5. 2	−22. 4	+58. 4	+45. 4
Breast	. 8	1. 8	+125. 0	74. 0	87. 6	+18. 4	0	+1. 6
Female genital organs				76. 0	71. 1	−6. 4		−. 9
Cervix				30. 5	24. 9	−18. 4		+2. 4
Corpus and other uterus				30. 4	26. 0	−14. 5		−9. 7
Male genital organs	42. 7	46. 3	+8. 4				−1. 4	
Prostate	37. 8	42. 4	+12. 2				0	
Urinary organs	24. 6	30. 0	+22. 0	17. 6	13. 8	−21. 6	+27. 2	+10. 1
Kidney	5. 7	5. 6	−1. 8	3. 5	3. 0	−14. 3	+31. 7	+24. 0
Bladder	18. 6	24. 3	+30. 6	13. 8	10. 6	−23. 2	+24. 0	+2. 3
Skin	39. 4	40. 6	+3. 0	30. 6	28. 5	−6. 9	+25. 5	+24. 8
Brain and nervous system	6. 3	6. 0	−4. 8	3. 7	5. 6	+51. 4	+30. 6	+40. 0
Endocrine glands	2. 0	2. 2	+10. 0	3. 7	4. 5	+21. 6	+33. 3	+45. 4
Bone	4. 9	1. 8	−63. 3	1. 7	1. 4	−17. 6	−7. 7	−30. 0
Soft tissue	1. 4	2. 2	+57. 1	1. 2	3. 2	+166. 7	+25. 0	+7. 1
Leukemias	8. 2	11. 4	+39. 0	6. 3	7. 2	+14. 3	+19. 5	+9. 1
Lymphomas	13. 0	14. 6	+12. 3	7. 1	9. 8	+38. 0	+29. 5	+26. 2
Other and unspecified sites	17. 4	30. 8	+77. 0	20. 2	26. 8	+32. 7	−44. 6	−46. 2

served among white persons in the United States (*10*). The greatest relative decrease was noted for stomach cancer. Again, this observation is consistent with the decline in mortality from this cause in the United States as well as for the decline observed in incidence in New York State for a comparable period (*3*). In interpreting the decline in risk for any specific organ within the digestive system, we must consider whether the decline may be the result of changes in diagnostic accuracy. The magnitude of the change for an individual site may be affected by misclassification, but it is unlikely that the rate for the total digestive system would be affected. Therefore, the overall decrease in the rate for cancer of the digestive system is undoubtedly real.

Substantial increases in the risk of cancer for other organ systems, however, offset the decline in cancer of the digestive system. Among males, the age-adjusted incidence rate for respiratory cancer increased by 39 percent in the 10-year period while breast cancer rates among females increased by some 18 percent. Cancer of both of these sites affects substantial numbers and poses increasingly important community public health problems.

A substantial increase in the mortality from respiratory cancer in the United States has been noted for some time (*11*). The evidence suggests that such an increase in risk is a true one although some part of the rise may not be real because of misclassification of tumors. Fifty-five percent of all respiratory tumors among white residents of Pittsburgh enumerated in the 1947 survey were microscopically confirmed compared to 75 percent in 1957-58. Although the proportion confirmed is higher in the later period, there still is room for error in assignments of cancer to the respiratory system. Nevertheless, the evidence seems to indicate that a real and substantial rise in the rate

for respiratory cancer has taken place in Pittsburgh.

Uterine cancer incidence rates for white women in Pittsburgh show an encouraging drop from 1947 to 1957–58. The incidence rate for cancer of the cervix dropped some 18 percent, while that for the corpus and other uterus dropped 14 percent. Although the New York data show an increase in the incidence of cervical cancer, an unspecified number of carcinomas in situ are included, while carcinomas in situ have been omitted from the Pittsburgh material. More recent data from New York State indicate that incidence rates for invasive carcinoma of the cervix in New York have also declined (*12*). Mortality rates in the United States for cancer of the uterine cervix and corpus have been declining in recent years, a decline consistent with the direction of the change in the Pittsburgh rates.

The incidence rate for cancer of the prostate among white men in Pittsburgh rose 12 percent in the 10-year period—from 38 to 42 per 100,000 population. It remains to be determined whether this rise reflects a true increase in incidence rather than changes in diagnostic practices.

The increase in the rate for female breast cancer appears to be greater than might be expected on the basis of trends in U.S. mortality and is greater than that for New York State (*3*). On the other hand, the relative increase in Pittsburgh is consistent with that reported recently for Connecticut, where incidence rates for breast cancer increased about 19 percent from 1947–51 to 1961 (*13*). The data on breast cancer incidence in Pittsburgh may be considered very reliable in both time periods, since 85 percent of all breast cancer cases enumerated in the 1947 survey were microscopically confirmed. In our study, 94 percent were microscopically confirmed. If we exclude the possibility of misclassification, the reasons for an increase in incidence are unclear. Observations on significant changes in factors such as size of families, breast feeding, and the like, which may have a bearing on incidence, are not available but may provide the basis for further study (*14*).

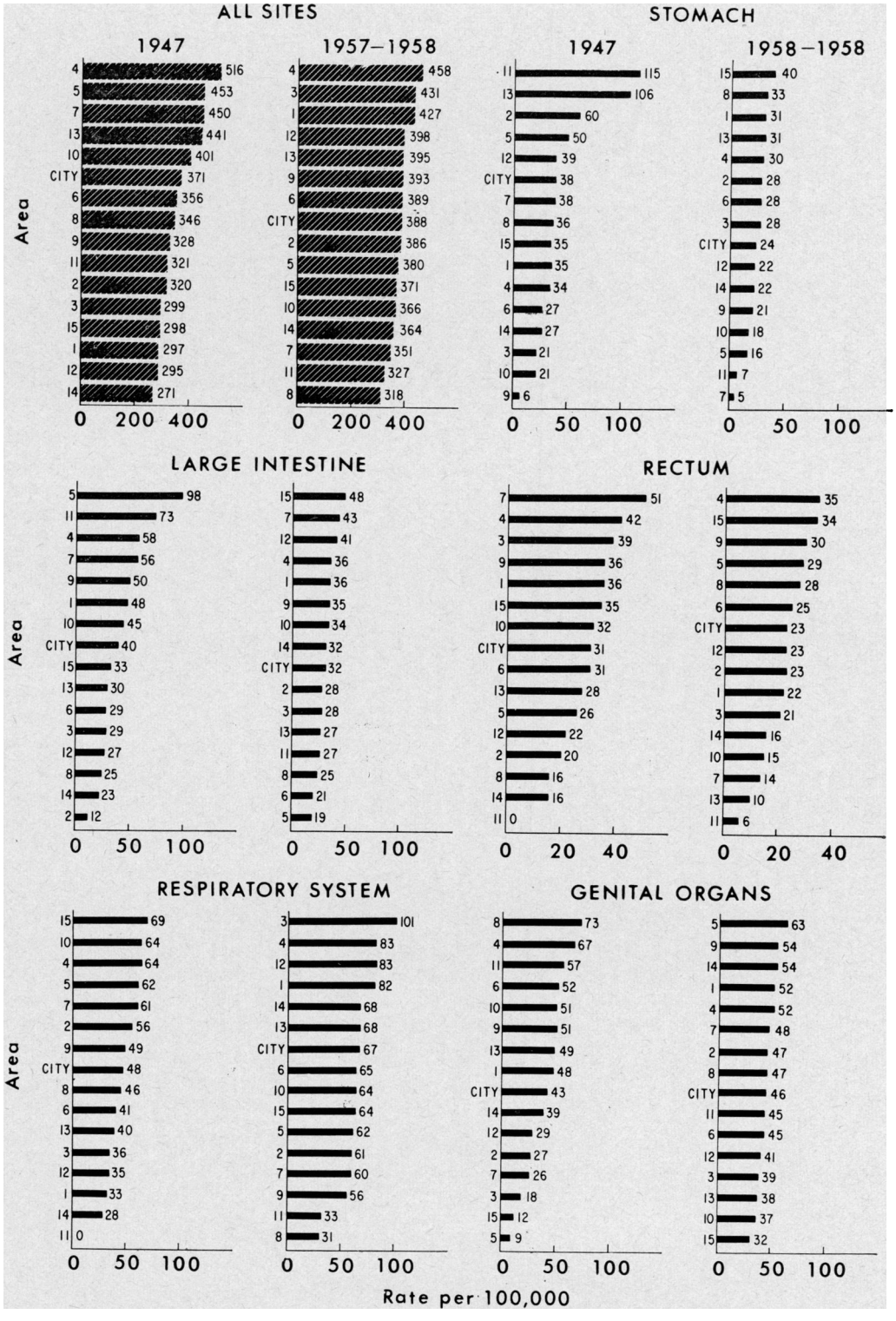
The changes in incidence which have taken place between 1947 and 1957–58 for the entire city do not necessarily indicate the changes observed in each of the 15 geographic areas, either for all forms of cancer combined or for the individual sites. Interpretation of changes by area will be tempered by the fact that approximately 6 percent of the cases diagnosed within the city in 1947 could not be assigned to the patient's census tract of residence. For 1957–58, we were able to determine the tract of residence for virtually all patients. Consequently, observed relative decreases may be somewhat less than the true situation, while observed relative increases may be somewhat overstated. We shall, therefore, place primary emphasis on the overall configuration—on the pattern, rather than any single result.

White males. We ranked the 15 areas according to the incidence by sex of all forms of cancer and the incidence by selected sites (fig. 2). Incidence rates for all forms of cancer in males increased in 9 of the 15 geographic areas during the decade. The greatest relative advance occurred on the city's north side (areas 1, 2, and 3) and in those areas grouped south of the juncture of the Monongahela and Ohio Rivers (areas 12, 14, and 15). A substantial portion of the increase in cancer incidence for four of these areas (1, 3, 12, and 14) may be attributed to increments in the rate for respiratory cancer. In each of these four areas, respiratory cancer rates more than doubled between 1947 and 1957–58. Rates for genital cancer, on the other hand, also increased somewhat in all six of the areas (1, 2, 3, 12, 14, and 15). No consistent pattern emerges for changes in the rates for other sites within these locales.

In the areas with substantially decreasing incidence for all forms of cancer (areas 4, 5, 7, 10, and 13), males experienced a decline in incidence rates for most cancer sites. Exceptions are increasing respiratory cancer rates in areas 4 and 13; the rate for area 4 reached a level similar to that of the other areas grouped around the Golden Triangle, where the Allegheny and Monongahela Rivers merge and become the Ohio (fig. 1).

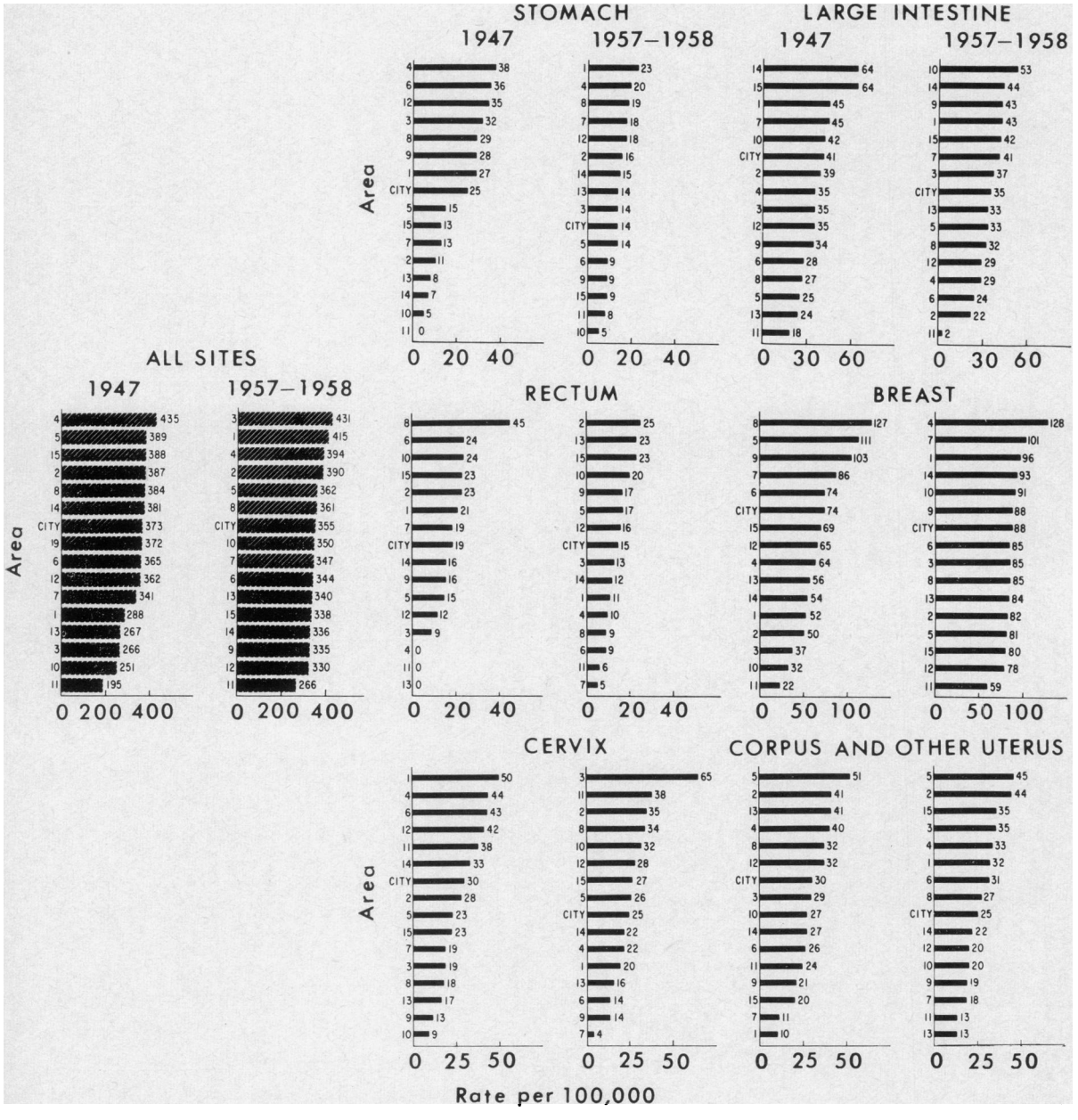
White females. Incidence rates for cancer in white females advanced between 1947 and 1957–58 in seven of the 15 areas under consideration (fig. 3). The experience of women in the areas north of the Allegheny and Ohio Rivers was similar to that of the males, with

Figure 2. Age-adjusted cancer incidence rates among white males, by primary site and in order of magnitude by residence area, Pittsburgh, 1947 and 1957–58



the greatest relative increases occurring in areas 3 and 1. Substantial increases in the incidence rates of breast and cervical cancer account for much of the change in area 3. The average rate for breast cancer in area 3 in 1957–58 was more than double the rate for 1947, while that for cervical cancer was more than three times as great as that 10 years earlier and 71 percent more than the rate in the next highest area in 1957–58. It is somewhat difficult to point to any one site which weighs most heavily in the overall change for white females in areas 1 and 2. Rates for cancer of the breast and of the corpus and other uterus have increased while rates for cancer of the digestive system generally declined.

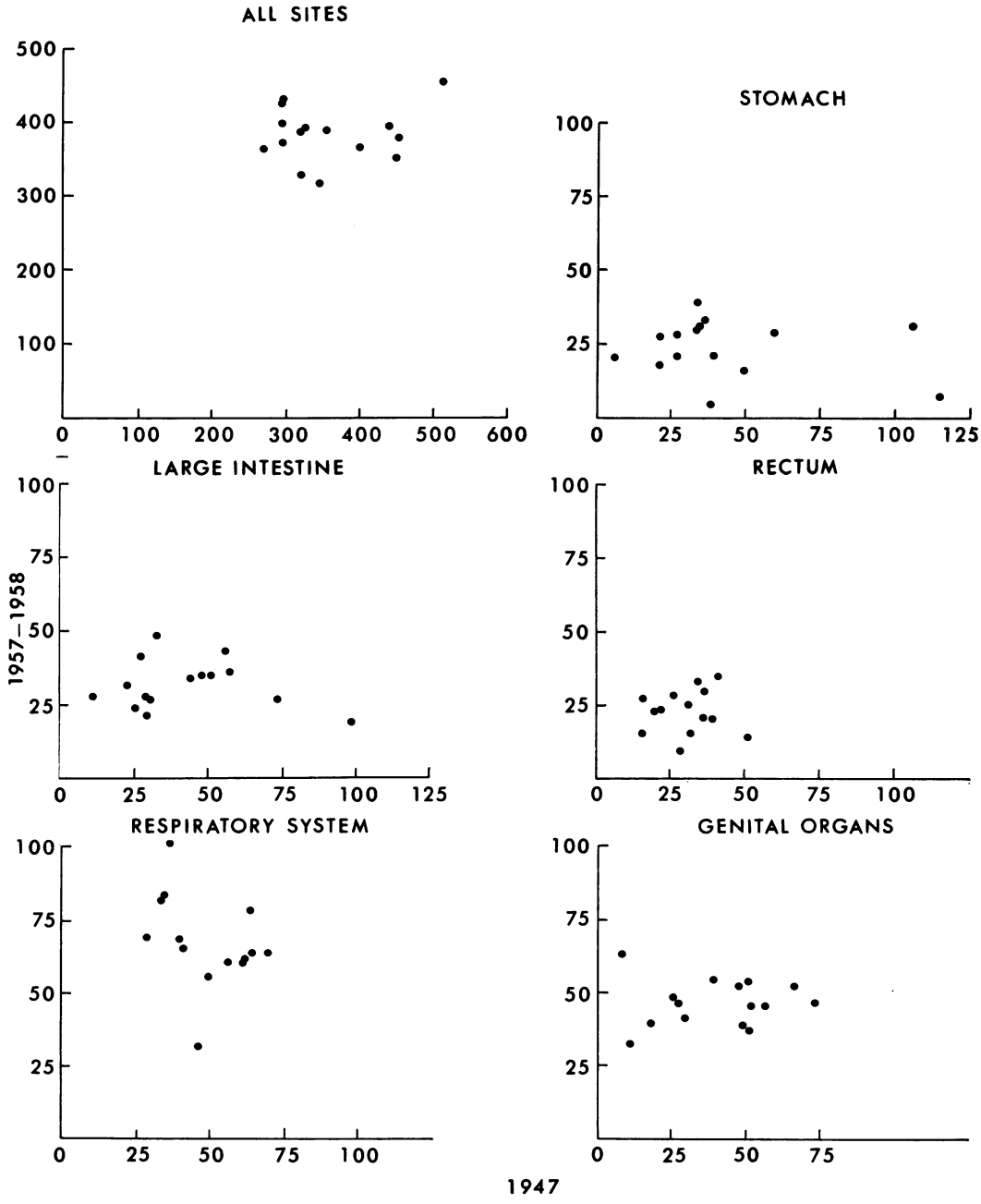
Figure 3. Age-adjusted cancer incidence rates among white females, by primary site and in order of magnitude by residence area, Pittsburgh, 1947 and 1957–58



Other areas with large relative increases in incidence (10, 11, and 13) mainly reflect changes in breast cancer incidence between 1947 and 1957–58. Breast cancer rates, in fact, more than doubled in areas 10 and 11. Cervical cancer rates rose sharply in area 10, a rise commensurate with the change noted in area 3.

Contrary to the experience for males in areas 12, 14, and 15, among females in these areas, incidence rates for all forms of cancer declined between 1947 and 1957–58. Breast cancer rates, however, advanced in all three areas; uterine cancer rates were dropping in areas 12 and 14 and increasing somewhat in area 15. Changes

Figure 4. Age-adjusted incidence rates for cancer of selected sites among white males in the 15 residence areas of Pittsburgh, 1947 and 1957–58

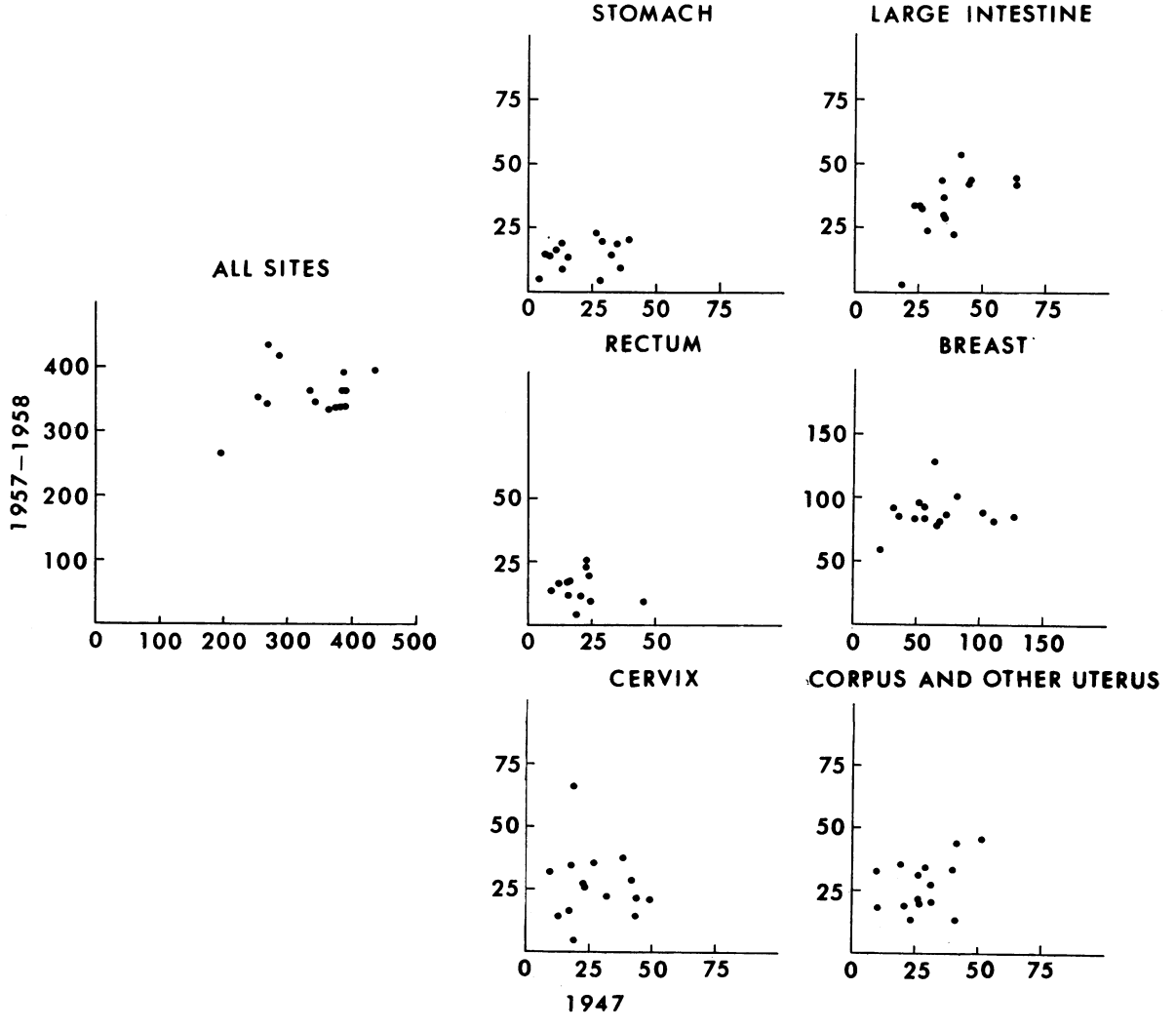


in rates for females at other sites present an inconsistent pattern with the exception of rates for cancer of the intestine, which went down in all three areas. Declines in the incidence of cancer of the digestive organs have been partially offset by advances in rates for other sites, primarily in the rates for breast cancer in area 4.

Discussion

Perhaps one of the more provocative aspects of the comparison of the intracommunity distribution of cancer in Pittsburgh in 1957–58 with that 10 years earlier is the overall dissimilarity of the rankings of the 15 study areas according to incidence rates in the two periods. There is a strong correlation between the rankings according to income in 1950 and in 1960. In addition, there is close correspondence between the two periods in the rankings according to the proportion of foreign stock in the population. One might have expected, therefore, a stronger relationship between the 1947 and 1957–58 rankings according to cancer incidence (*4*, *15*). In fact, there was little or no correlation between the overall area distributions of incidence in 1947 and 1957–58 (figs. 4 and 5). Rank correlation coefficients for the sites shown in figures 4 and 5 range from −0.18 to +0.58;

Figure 5. Age-adjusted incidence rates for cancer of selected sites among white females in the 15 residence areas of Pittsburgh, 1947 and 1957–58



only one of these coefficients is significantly different from zero at the 5 percent probability level. The only statistically significant rank-correlation coefficient is for cancer of the intestine among white females. (For the number of contrasts considered, one statistically significant result would not be unusual.) The overall result indicates that there have been changes not only in the rates of cancer incidence for each study area but also in the relationships of the area rates with one another.

Errors in data need to be considered in any large-scale study. Bias in our study data is possible—for example, errors in reporting. It is unlikely, however, that such errors were of sufficient magnitude to substantially affect the results, at least for the years 1957–58. Each step in the process of data production—coding, punching, tabulating—required essentially complete verification. Of course, no control of incorrect statements on the basic medical record is possible.

Differences in recognition of cancer over time, however, may alter the intracommunity picture of incidence. The proportion of cases obtained only from death certificates decreased from 1947 to 1957–58. This decrease could indicate that more cases were missed in the earlier period than in the later. Temporal comparisons of the observed intracommunity variation could be affected by these missed cases if underreporting is assumed to be related to income level or other charactertistics of the areas.

Further observation is necessary before accepting or discarding the hypothesis that the observed changes in intracommunity incidence are the result of accidental fluctuations. The relative position of the areas in terms of income and percentage of foreign stock has not been altered substantially in the 10-year period; yet the distribution of disease rates has shifted. The variation in incidence between 1947 and 1957–58 indicates that the elements of income level and other demographic characteristics must be more carefully specified if we are to understand the meaning of relationships between income and disease incidence. When taken individually, the rates for 1947 and 1957–58 do demonstrate certain previously observed relationships for certain cancer sites. For example, the data for both 1947 and 1957–58 indicate that the poorer areas of the city had the higher incidence rates for respiratory cancer.

Within an individual city, factors related to the broad physical environment, such as temperature, cannot be studied since they are common for the whole city. On the other hand, changes in certain aspects of the physical and social environment related to income probably have taken place over time. Factors such as housing and availability of medical care probably have improved. The effect of such changes on incidence could not be determined in our study. If, however, environmental factors associated with residence affect incidence rates, these factors would not be expected to operate in a sex-specific fashion. Yet, between 1947 and 1957–58, the incidence of all forms of cancer in areas 12, 14, and 15 increased among males but declined among females. This result would not be expected if a common environmental background associated with residence was operating. This difference in the disease experience of the two sexes could, however, suggest some environmental exposure experienced by the men but not by the women, such as the working environment. Information on specific occupational exposure may prove enlightening in view of the observed increases in incidence of cancer, especially of respiratory cancer, in those study areas grouped around the point of the Golden Triangle. It may not be unreasonable to assume that residents of these adjoining areas experienced some common occupational exposures possibly related to the risk of respiratory cancer.

Other assumptions might be made about the changes in incidence. Changes may have taken place in the composition of the population of an area with reference to characteristics that we did not examine. The lack of correlation in rates of incidence between 1947 and 1957–58 possibly arose because of peculiarities of movers and stayers. For example, the reduction of risk of cancer in area 4 and the subsequent increase in area 3 may reflect movement between these areas because of such factors as the urban redevelopment taking place in area 4. Some assumption of this kind is required if the results of the comparison of incidence rates between 1947 and 1957–58 are to be reconciled. Such an assumption implies that a number of unknown factors can play a role in the determination of

the level of risk and that these factors have yet to be identified or explored. Results of our analysis of the 1957–58 data clearly indicate that such unknown factors must play an important role in the intracommunity variation in incidence.

It is apparent that further study is needed to determine the reasons for any observed shifts in the intracommunity pattern of cancer incidence. The distribution of incidence in the two periods studied was not consistent. Perhaps in searching for explanations for this inconsistency, we can arrive at more positive leads about the unknown factors which play a role in intracommunity variation in the incidence of cancer.

Summary

Results of a survey of the incidence of cancer in Pittsburgh, Pa., for the years 1957–58 were compared with results of a similar survey in 1947. The city was divided into 15 residence classifications with definable demographic characteristics, and the total incidence of cancer among whites in each area was determined for both 1957–58 and 1947. Substantial temporal and spatial variation in incidence was observed. The rankings of the areas according to incidence rates were, on the whole, dissimilar in the two periods. Rankings of the areas according to selected demographic characteristics, on the other hand, remained about the same.

REFERENCES

(*1*) Griswold, M. H., Wilder, C. S., Cutler, S. J., and Pollack, E.: Cancer in Connecticut, 1935–1951. Connecticut State Department of Health, Hartford, 1956.

(*2*) Connecticut State Department of Health: Cancer in Connecticut, 1960. Hartford, undated.

(*3*) Ferber, B., Handy, V. H., Gerhardt, P. R., and Solomon, M.: Cancer in New York State, exclusive of New York City, 1941–1960. A review of incidence, mortality, probability, and survivorship. New York State Department of Health, Bureau of Cancer Control, Albany, 1962.

(*4*) Dorn, H. F., and Cutler, S. J.: Morbidity from cancer in the United States. PHS Publication No. 590, Public Health Monograph No. 56. U.S. Government Printing Office, Washington, D.C., 1958.

(*5*) Cutler, S. J.: Cancer illness among residents of Pittsburgh, Pennsylvania, 1947. PHS Publication No. 126, Cancer Morbidity Series No. 5. U.S. Government Printing Office, Washington, D.C., 1951.

(*6*) Patno, M. E.: Geographic study of cancer prevalence within an urban population. Public Health Rep 69: 705–715, August 1954.

(*7*) Chiazze, L., Jr.: Morbidity survey and case register estimates of cancer incidence. *In* National Cancer Institute Monograph No. 19. U.S. Government Printing Office, Washington, D.C., 1966, pp. 373–384.

(*8*) Zimmerer, E. G., and Chiazze, L., Jr.: Survival experience of cancer patients in Iowa. J Iowa Med Soc 53: 397–407 (1963).

(*9*) Axtell, L. M., Breslow, L., and Eisenberg, H.: Trends in survival rates of cancer patients: Connecticut and California. *In* National Cancer Institute Monograph No. 6. U.S. Government Printing Office, Washington, D.C., 1961, pp. 47–67.

(*10*) U.S. Bureau of the Census: U.S. census of population and housing: 1960. Census tracts. Final Report PHC (1)–118. U.S. Government Printing Office, Washington, D.C., 1961.

(*11*) Gordon, T., Crittenden, M., and Haenszel, W.: Cancer mortality trends in the United States, 1930–1955. *In* National Cancer Institute Monograph No. 6. U.S. Government Printing Office, Washington, D.C., 1961, pp. 133–350.

(*12*) Handy, V. H., and Wieben, E.: Detection of cancer of the cervix; A public health approach. Obstet Gynec 25: 348–355 (1965).

(*13*) World Health Organization: Epidemiological and Vital Statistics Report 17. Geneva, 1964, pp. 643–736.

(*14*) Levin, M. L., Sheehe, P. R., Graham, S., and Glidewell, O.: Lactation and menstrual function as related to cancer of the breast. Amer J Public Health 54: 580–587 (1964).

(*15*) Haenszel, W.: Cancer mortality among the foreign-born in the United States. J Nat Cancer Inst 26: 37–132 (1961).