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THE SPATIAL DISTRIBUTION OF
DEATHS IN THE CITY OF
HOUSTON, TEXAS

FENNOY

1944

THE SPATIAL DISTRIBUTION OF DEATHS IN THE CITY
OF
HOUSTON, TEXAS

By

MRS. THELMA RAND FENNOY

A THESIS IN SOCIOLOGY SUBMITTED
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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AUTOBIOGRAPHY

The writer was born in Lodi, Cass County, Texas, September 13, 1921. She received her elementary school training in the Ebenezer Elementary School at Lodi, Texas. The greater part of her high school work was done at Jarvis College High School, a private institution. In May 1938 she graduated from Hawkins Public High School at Hawkins, Texas. She graduated from Prairie View State College in May 1942.

During the school year 1942-43 the writer worked as social science teacher in the junior high department of the Booker T. Washington High School, Conroe, Texas.

In September, 1943 she entered the Graduate Division at Prairie View State Normal and Industrial College.

TABLE OF CONTENTS

CHAPTER	PAGE
I. INTRODUCTION.....	1
A. Theoretical Statements and Researches of Other Scholars	
1. Theoretical Statements of Other Scholars	
2. Researches of Other Scholars	
B. General Setting of the Problem	
1. Statement of the Problem	
2. Scope of the Problem	
3. Significance of the Problem	
4. Method of Study	
II. ANALYSIS AND INTERPRETATION OF THE PROBLEM.....	13
A. Extent and Nature of Mortality in the Metropolitan City	
1. Population characteristics of the city	
2. Extent of Mortality within this Population Aggregate	
3. Nature of Mortality within the Population Aggregate	
B. Spatial Pattern of Death Rates in a Metropolitan City	
1. Spatial Variations of the Crude Rate	
2. Spatial Variation of Standardized Rates	
3. Delineation of High and Low Death Areas Within the City	
C. Delineation of Specific Disease Areas	
III. SUMMARY AND CONCLUSION.....	35
A. Summary of Research	
B. Conclusion of Research	

IV. APPENDICES

Appendix	A.....	43
Appendix	B.....	44
Appendix	C.....	46
BIBLIOGRAPHY.....		48

LIST OF TABLES

TABLES	PAGE
I. Mortality Rates For Houston, Texas For Specific Age Groups 1939, 1940, 1941 (Rates per 10,000 Population).....	16
II. The Number and Per Cent of Cases By Specific Diseases.....	18
III. Per Cent of Infant Mortality Cases By Specific Diseases.....	19

LIST OF MAPS

TITLE	PAGE
I. Crude Mortality Rates For Houston, Texas By Census Tracts 1939, 1940, 1941 (Rates per 1,000 Population).....	23
II. Standardized Mortality Rates For Houston, Texas By Census Tracts 1939, 1940, 1941 (Rates per 1,000 Population).....	25
III. Infant Mortality Rates For Houston, Texas According to Census Tracts 1939, 1940, 1941 (Rates per 1,000 population under 1 year of age).....	26
IV. Heart Disease Areas And The Mortality Rates Resulting Therefrom In Houston, Texas According to Census Tracts 1939, 1940, 1941 (Rates per 10,000 population).....	29
V. Cancer Areas and the Mortality Rates Resulting Therefrom In Houston, Texas By Census Tracts 1939, 1940, 1941 (Rates per 10,000 population).....	30
VI. Tuberculosis Areas And Mortality Rates Occurring Therefrom In Houston, Texas By Census Tracts 1939, 1940, 1941 (Rates per 10,000 population).....	31
VII. Pneumonia Areas and Mortality Rates Occurring Therefrom In Houston, Texas By Census Tracts 1939, 1940, 1941 (Rates per 10,000 population).....	32
VIII. Areas of the Diseases of the Nervous System and the Mortality Rates Resulting Therefrom in Houston, Texas By Census Tracts 1939, 1940, 1941 (Rates per 10,000 population).....	33

THE SPATIAL DISTRIBUTION OF DEATHS IN THE CITY
OF
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INTRODUCTION

This study is primarily concerned with the spatial pattern of deaths in the city of Houston, Texas. It will mention briefly, however, some of the researches that have previously emphasized the importance and the relation of "place" to social phenomena.

THEORETICAL STATEMENTS AND RESEARCHES
OF OTHER SCHOLARS

Robert E. Park has been the pioneer figure in America in the application of the ecological approach to the study of human relations. The term ecology was borrowed from the study of plants and their environment, and came into Social Science as a logical conclusion to human or anthropogeography.¹

Theoretical Statements: Human ecologists have assumed the spatial distribution of social phenomena. The principle here is that social phenomena vary directly or inversely with the distance from the city of dominance, the central business district zone.² Human ecologists have assumed

1. Floyd N. House, The Range of Social Theory, Henry Holt and Co. Inc., New York; 1929, Chapter IV Quoted by Elliot and Merrill, Social Disorganization, Harper and Brothers, p. 184
2. M. A. Alihan, Social Ecology, (Columbia University Press, New York) p. 222

an order among all living organisms.³ This order is the result of the "competition of life" as Park describes it, which is analogous to Darwin's "struggle for existence".⁴ Competition arises among human beings because there is a homogeneity of human wants and demands in excess of nature's supply. This competition of organisms creates a constructive process known to ecologists and sociologists as symbiosis which is the tendency of one to render services to another. Symbiosis among human beings as well as plants and animals creates a pattern Darwin called the "web of life". This is a figure of speech which indicates the tendency of various elements of organic life to be interlinked in the life process. It is in this life getting process that competition plays the important role as an organizing force. As a result of this "competition of life" or "struggle for existence" a definite spatial pattern arises in which peoples and institutions are distributed over territory in a definite manner, so plain that it can be mapped. This definite spatial pattern which is the result of the struggle for existence and in which people and institutions are distributed in such a definite manner that they can be mapped, is a natural area. It is not the result of plan or design but comes into existence as a part of a dynamic emerging

3. Robert E. Park, An Outline of the Principle of Sociology, (Barnes and Noble Inc., New York) p. 90.

4. M. A. Alihan, Social Ecology, (New York, Columbia University Press), p. 30.

pattern of city growth.⁵ Every large community is composed of a mosaic of many diverse areas, each with its own type of people, institutional activities, physical characteristics, standards of life, sentiments, and traditions. Sometimes these natural areas are in pronounced contrast with one another while at other times the differences are relatively slight, with the characteristics of one area shading off imperceptibly into those of another.⁶

Researches of Other Scholars: The foundation for this study has been made by other demographic and ecological studies. James H. S. Bossard and Thelma Dillon in their study of divorced women in Philadelphia brought out two facts of significance regarding the spatial distribution of divorced women in Philadelphia. The first fact was that of high concentration of divorced women in two long strips about thirty blocks long and varying from five to seven blocks wide. These two strips run parallel with and include the main artery of electric and motor car transportation going west and north out of the center of the city. In this right angle are found twenty-nine census tracts or seven per cent of the total number of census tracts in the city, and in it reside twenty-five per cent of all divorced women of the city.

5. Pauline V. Young, Scientific Social Surveys and Research, (New York, Prentice-Hall Inc.), 1939.

6. Ibid., p. 378

The second outstanding fact about the spatial distribution of divorced women in Philadelphia is their relative absence in some sections of the city. There were ninety-two census tracts which had no divorced women. Another thirty-four tracts had one divorced woman each. In view of their findings, the study indicates that the highest concentration of divorced women in Philadelphia is in apartment and rooming-house areas, characterized by mobility, dense population, and a relative degree of anonymity; while the sections showing scarcity of divorced women are sparsely populated predominately foreign born groups of Roman Catholic persuasion, and located on the outskirts of the city of Philadelphia.⁷

Research in Juvenile Delinquency has made special application of the ecological approach. Clifford R. Shaw has made a noteworthy study of the distribution of juvenile delinquents in Chicago. Shaw shows that the cultural and ecological base is an important factor in determining the delinquency of a group. When the observer knows the position of each juvenile delinquent in the social morphology, he has completed the first step toward understanding the role in his group relationships.⁸ Shaw studied all the cases brought before the

7. James H. S. Bossard and Thelma Dillion, "The Spatial Distribution of Divorced Women", American Journal of Sociology, XL, Jan., 1935.

8. Clifford R. Shaw, Delinquency Areas, (Chicago, University of Chicago Press, 1927), p. 8

juvenile court during the years 1900-1917. These cases were located according to residence. The delinquency rates were then computed for the area per square mile per hundred population for the same age and sex groups. By spotting on a large base map of Chicago the residence of youth offenders he discovered they were grouped in certain characteristic areas; and that there were very striking variations in delinquency rates between areas. Some areas had very high and others had very low per capita rate.⁹

The ecological approach has also been used in the study of birth rates. H. A. Bullock in his study "The Spatial Aspect of The Differential Birth Rate" brought out three significant facts concerning the spatial distribution of the birth rates of Houston, Texas. First, he pointed out the highest rates are characteristic of those tracts that are not immediately adjacent to the central business district of the city. Second, not only does the spatial pattern which is made when the distribution of birth rates are cast on a map by census tract tend to persist, but approximately the same pattern is recognizable when the birth rates were computed for areas representing zones marked according to the number of miles from the central business district. Third, each of these types of rates shows an irregular tendency for the birth rate to increase as distance

9.

Clifford R. Shaw, Delinquency Areas, (Chicago, University of Chicago Press, 1927) p. 188

from the city's center increases. Such a pattern of gradiency suggests that the phenomena of births are not only biological in nature, but also cultural and very definitely associated with the ecological distribution of the city's population, institutions and functions.¹⁰

The researches which have been quoted above have been concerned with the spatial pattern of social phenomena which do not pertain to health. But the ecological approach has also been applied in studies of health. Among them, of particular interest, is a study of infant mortality¹¹ which has proved the gradiency pattern of the phenomena of infant mortality. This study of the spatial distribution of deaths in a metropolitan city is the first made of general mortality rates. It is the purpose of this study to show the spatial pattern of general mortality rates rather than infant mortality rates in particular. Therefore, the pattern of gradiency shown by this study is more reliable than the study made of infant mortality rates because it deals with a general mortality rate rather than a specific one.

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10. Henry Allen Bullock, "The Spatial Aspect of the Differential Birth Rate", American Journal of Sociology, XLIX (Sept.) 1943.
11. Calvin F. Schmid, Mortality Trends in the States of Minnesota, Minneapolis(University of Minnesota Press) 1937

GENERAL SETTING OF THE PROBLEM

From the above mentioned researches it seems valid to say that social phenomena appear to fall into classes. They include the social phenomena that are normal, and those that are abnormal or pathological. The classifications are made on the basis of the regular or irregular occurrence of the phenomena. Social phenomena therefore vary inversely or directly within a metropolitan city. The spatial pattern made by the pathological or abnormal aspect of social phenomena¹² such as a divorces, delinquency mental disorders, and family disorganization differs from the patterns made by normal phenomena as births and marriages.¹³

Statement of the Problem: Many research studies have been made which showed the spatial pattern of social phenomena. Many of such studies, however have not tested the spatial pattern by seeing what the pattern might be when all possible factors which might influence the rate are controlled. I believe the death rate within a metropolitan city varies from place to place, according to the causes of death. I believe the pattern made by the standardized or adjusted death rates will differ from a pattern in which the death rates were not adjusted. I further believe that there are natural areas within a city or

12.

For studies pertaining to the pathological aspects of social phenomena see: Bossard and Dillion, "Spatial Distribution of Divorced Women", American Journal of Sociology, XL, January, 1935. N. S. Hayner, "Delinquency Areas in the Puget Sound Region", American Journal of Sociology, Vol. XX:X., pp. 314-28. Footnote (12 and 13) continued on next page.

areas where diseases naturally seem to thrive and deaths very regularly occur. In the light of this belief my hypothesis is posed:

"What is the spatial pattern of deaths in the city of Houston, Texas?"

In order that this question may be fully answered it is necessary that the following subsidiary but pertinent questions be answered:

1. What is the standardized death rate per 1000 for each census tract in Houston, Texas?
2. What variation is there in the death rate by specific age groups according to cause of death per census tract?
3. What spatial pattern do the death rates make when cast upon a map?

The answers to the above questions will form the basis for the analysis of this study.

There are some terms that must be defined for clarity. By spatial pattern is meant that people and institutions are not

12. (cont'd)

Clifford R. Shaw, Delinquency Areas, (Chicago, University of Chicago Press), 1927

R.E.F.Faris, "Cultural Isolation and the Schizophrenic Personality", American Journal of Sociology, 40: 155-169 September, 1934

R.E.L.Farris, "Demography of Urban Psychotics with Special Reference to Schizophrenic"; American Sociological Review, 3: 203-209 (Apr. '38).

Faris and Dunham, Mental Disorder in Urban Areas, (Chicago, University of Chicago Press) 1939. Footnote (13) continued on next page

haphazardly distributed in space. As a result of the process¹⁴ of competition they are distributed in a definite manner so plain and so definite that it can be mapped. It is shown above in the "Researches of Other Scholars" that social phenomena are also distributed in a definite pattern or manner which can be mapped. It is the writer's assumption which she hopes to prove that deaths too are not haphazardly scattered in space, but are, according to an orderly fashion or pattern, in accord with the spatial pattern of habitation.

A natural area is a spatially contiguous territory whose people possess particular cultural characteristics which distinguish them from the people of another area. The essential feature of a natural area is a sufficient cultural similarity between the constituent elements so that one area can be distinguished from another area. These areas are natural in the same sense that any social phenomena may be natural--that is, the unplanned results of certain uncontrolled and relatively unpredictable factors.¹⁵

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13. For studies pertaining to Spatial Patterns of Normal Aspect of Social Phenomena.
See - James H. S. Bossard, "Ecological Areas and Marriage Rates", American Journal of Sociology, XLIV (July, 1938) pp. 71-85
Henry Allen Bullock, "The Spatial Aspect of the Differential Birth Rate", American Journal of Sociology, XLIX, September, 1943.
14. Robert E. Park, Outlines of the Principles of Sociology, (New York, Barnes and Noble Inc.) Chapter II.
15. Elliot and Merril, Social Disorganization, (New York) Harper Brothers, Publishers, pp. 815-817

Standardized death rates are comparable rates regardless of differences in the population composition. Standardized rates are quite reliable because the all important age factor in the population has been held constant by standardization.¹⁶

Cause of death refers to how the individual met with death, whether by natural causes, which include specific diseases, or other causes as suicide, homicide, or accident.

Scope of the Problem: This study is horizontal in scope, and is limited to deaths of residents only of Houston, Texas. Deaths occurring in the city, but not to residents of the city, were discarded. The deaths for a period of three years, 1939-41, are used. The deaths for a three year period instead of a one year period is used for the purpose of stabilization.

Methodology and Critical Evaluation: The method used in this problem includes the definition of the problem, the field work, and the presentation.

As a result from readings assigned me by my professor and advisor, I became interested in the "Spatial Pattern of Social Phenomena". Then from the experience of reading "The Spatial Aspect of The Differential Birth Rate"-----A Houston Study made by my own professor and adviser Dr. H. A. Bullock, and from

16.

Pauline V. Young, Scientific Social Surveys and Research, (New York, Prentice-Hall, Inc.), 1939, p. 399

some conversations with him, I became intensely interested in spatial pattern deaths might make in the city of Houston, Texas. My hypothesis indicated to me just what data ^I needed and should collect.¹⁷ This included all the deaths of residents of Houston for the time period 1939-41 inclusive, by address race, age, sex, and cause of deaths. I collected the greater part of the data with the help of three young ladies I hired to help me for a very limited time. Duplications of records of all the deaths occurring in the city during 1939-41 inclusively were made from the death records of the vital statistics bureau of the city Health Department of Houston, Texas. Deaths occurring in the city but whose address was unknown were discarded along with deaths occurring in the city but not to residents of the city. By the use of the address the death is assigned to the census tracts.

Death rates were first computed on the basis of the number of deaths per 1000 population per census tract. The phenomenon of death is greatly influenced by the factor of age. Therefore, the variation of rates of deaths according to census tracts may be dependent upon the factor of the variation of the age composition of each tract. In order to avoid this possible influence of the factor of age in the spatial

17.

See Appendix A - Form to collecting data

variation of the phenomenon of death, the standardized death rate was computed. This standardization was actually the computation of a death rate that would occur in each tract if the age composition of each tract were the same. A map of the city of Houston in which the census tracts are shown is cross-hatched on the basis of standardized rates of each tract in order to demonstrate the spatial pattern of deaths in the city.

Significance of the Study: This study attempts to extend the number of researches that have shown the variation of rates of social phenomena according to place of habitation in a metropolitan center. The primary objective of this study is to find what different rates of deaths exist in the city of Houston, Texas, and to demonstrate the spatial pattern these rates make when spotted on a map of the city.

This study of the spatial distribution of mortality rates in a metropolitan city is the first study made dealing with general mortality rates in which specific death rate areas are delineated.

CHAPTER II

ANALYSIS AND INTERPRETATION OF THE PROBLEM

In determining the spatial distribution of deaths in a metropolitan city, it is necessary to present some type of picture of the nature and extent of mortality in the city as a whole. This chapter is designed to make this presentation.

THE NATURE AND EXTENT OF MORTALITY IN A METROPOLITAN CITY

Mortality within a metropolitan city is a reflection of the ecological organization and population characteristics of the city. This section of the study is designed to show the effects of these factors as they relate to or are reflected in the nature and extent of the mortality within the city of Houston, Texas.

Population Characteristics of the City: The metropolitan city of Houston, Texas has a total population of 384,514. This aggregate is composed mainly of whites, Negroes, and other racial groups.¹⁸ The white population of the city represents 77.5 per cent of the total population and the non-white, which is principally

18. Bureau of Census, Population and Housing, Houston, Texas, 1940
Washington, U.S. Government Printing Office, 1940

19. Ibid., p. 2

Negro, constitutes 22.5 per cent of the population. Persons of Mexican birth or ancestry who were definitely Indians were returned as white in the 1940 census.

Of the total population of Houston there were, according to the 1940 census, 7,878 more females in the city than males. True to the general form of metropolitan cities, Houston has selected a population which is predominantly youthful. More than half or 57.2 per cent of the total population of Houston are under 40 years of age.

The city of Houston is bisected by Buffalo Bayou. On the South side of the river will be found an area entirely different from the area on the North side of the river. The South side represents the aristocratic residential and exclusive area. The North side or half of the city constitutes the city's main industrial area.

Houston is divided into census tracts ranging in number from one to fifty. From among these census tracts it is possible for one to point out certain tracts as natural racial areas. For example, census tracts 16, 17, and 19, are inhabited predominantly by Mexicans and therefore referred to as Mexican areas. Tracts 1, 9, 18, 8, 34, 37, and 27 are designated as Negro areas because it is in these areas that the bulk of the Negro population resides.

Tract 9, 8, 18, constitute 5th Ward which is a Negro ward; tracts 34, and 37 make up another Negro area designated as 3rd ward, and tract 27 constitutes 4th ward, another Negro area.

Just as the composition of the population of the census tract varies according to race, it also varies according to the age and sex patterns. Some census tracts are heavily populated by younger or older elements of the population while others may be predominantly male or female. Tract 25 has 1,033 more males than females. Over half of the population of tract 25 are males, whereas females dominated most of the other 49 tracts. Only 25.5 per cent of the population of census tract 8 are 40 years of age or above.

The population characteristics are very definitely associated with mortality. In the first place, wherever there exists a large element of aged people the mortality rate for that area will be higher, and certain specific diseases will tend to predominate. For example, heart trouble is highly concentrated among older persons. Consequently, one would expect a higher death rate in an area in which older persons are concentrated. It is also true that one would expect an area of heart disease in that territory in which older members of the population are concentrated.

In an area predominantly female one would expect to find this area to be an area of Cancer or an area of Nervous diseases in as much as these two diseases are more often associated with or found among females than males. As for race, Negroes and

Mexicans tend to die more rapidly than do whites. Therefore, in the Negro and Mexican areas will be found higher mortality rates and specific diseases peculiar to these races.

THE EXTENT OF MORTALITY WITHIN
THE POPULATION AGGREGATE

During the three year period 1939-41, there occurred in the city of Houston, Texas 9,943 deaths. These deaths occurred at a rate of 82.2 per cent per 10,000 population for the population as a whole. In observing the rate of deaths by age groups a great variation in rate is seen. At 5-9, the rate of death is 10.0 per 10,000, whereas from 70 and over the rate is 820.6 per 10,000 population.

TABLE I

MORTALITY RATE FOR HOUSTON, TEXAS
FOR SPECIFIC AGE GROUPS, 1939, 1940, 1941
(Rate per 10,000 population)

Age	Population	No. of Deaths	Rates
0-4	80,502	1,014	125.8
5-9	77,289	85	10.9
10-14	84,573	95	11.2
15-19	95,964	198	20.6
20-24	111,725	309	26.7
25-29	130,704	365	27.9
30-34	124,320	450	36.1
35-39	111,987	527	47.1
40-44	90,222	578	64.0
45-49	72,375	744	102.7

TABLE I (cont'd)

MORTALITY RATE FOR HOUSTON, TEXAS
FOR SPECIFIC AGE GROUPS, 1939, 1940, 1941
(Rate per 10,000 population)

Age	Population	No. of Deaths	Rates
50-54	55,152	853	154.6
55-59	39,267	891	226.9
60-64	29,085	782	268.8
65-69	22,653	859	379.2
70-over	26,724	2,193	820.6
Total	1,153,544	9,943	82.2

Table I shows the pronounced tendency of the death rate to increase from one age group to another. The contrast is most pronounced and outstanding between the younger age groups and the older age groups. This signifies that older persons die much more rapidly than younger persons.

For the three year period 1939-1941, there occurred in the metropolitan city of Houston 923 infant deaths. This was a rate of 56 infant deaths per 1000 population under 1 year of age.

THE NATURE OF MORTALITY WITHIN THE POPULATION AGGREGATE

The primary causes of the 9,943 mortality cases that occurred in Houston, Texas, 1939-41, fell into 49 categories when classified. Among these 49 categories, however, were some which occurred much more frequently as primary causes of death than the others.

The five leading causes of death were as follows:

- | | |
|------------------------------------|------------------|
| (1) Heart diseases | (3) pneumonia |
| (2) Cancer | (4) tuberculosis |
| (5) Diseases of the nervous system | |

Below is a Table showing the number of cases that resulted from each specific disease. It also shows the per cent of total deaths caused by each specific disease.

TABLE II
THE NUMBER AND PER CENT OF CASES
BY SPECIFIC DISEASES

Specific Diseases	No. of Cases	Per cent
Heart Disease	2,957	29.7
Cancer	678	6.8
Pneumonia	660	6.6
Tuberculosis	558	5.6
Diseases of the Nervous System	508	5.1
All others	4,582	46.2
Total	9,943	100.0

From Table II it is plain that heart disease is by far the leading cause of death among all causes. This disease accounts for 29.7 per cent of all deaths. The factor of age is tied up with the leading causes of deaths.

Just as the primary causes of death were distributed into many classification of categories for the general mortality of the city, the primary causes of infant deaths also fell into many

different groups. The major part of the cases of infant mortality, however, were found to fall into several specific diseases as follows:

- | | |
|--|---------------------------------|
| (1) Prematurity | (3) Pneumonia |
| (2) Heart diseases and congenital heart diseases | (4) Diarrhea and enteritis, and |
| (5) Birth injuries | |

Below is a Table of the per cent distribution of the infant mortality cases according to specific diseases.

TABLE III
 INFANT PER CENT OF MORTALITY CASES
 BY SPECIFIC DISEASES

Diseases	No. of Cases	Per cent
Prematurity	340	36.8
Pneumonia	147	15.9
Heart Diseases	77	8.3
Diarrhea and Enteritis	72	7.8
Birth Injuries	22	2.4
Others	265	28.8
Total	923	100.0

The great killers are diseases which seem to attack their victims in their later years. As for infant deaths the greater number of deaths occur among the first or newly born. Prematurity is the leading cause of infant mortality. This is shown by the fact that 36.8 per cent of all infant deaths were due to this cause.

THE SPATIAL PATTERN OF DEATH RATES
IN A METROPOLITAN CITY

The rate of deaths occurring within a metropolitan city is not the same throughout the city. The deaths are definitely related to the ecological organization and the population characteristics of an area. In areas where Negroes and Mexicans are concentrated, higher death rates are expected to occur. Age plays a significant role. Areas primarily made up of younger persons will have a low death rate. The place in the city where one lives seems to show relationship to the death rate. It is the purpose of this section of the study to describe the spatial variations made by the crude death rates; to compare the spatial pattern of deaths made by the crude rates with that pattern made by deaths when the factor of age is controlled; and to describe the areas of specific diseases within the city.

Spatial Variation of the Crude Rate: The crude death rates range from a very low rate of 4 per 1000 population in some tracts to a high rate of 15 per 1000 population in other tracts. Tracts 36, 47, 46, and 29 are the tracts with the lowest death rates. The rates in these tracts range from 4 to 5 per 1000 population. Map 1 shows that these tracts of low death rate areas are located South of Buffalo Bayou. Tracts 27, 24, and 17 have the highest death rate, ranging from 14-15 per 1000 population. They

are followed by tracts 1, 9, 8, 18, 25, and 26 that have rates ranging from 12 to 13 per 1,000 population. Tract 27 with a high death rate of 14 per 1,000 population is located in 4th ward of the city. Tract 25, with the highest rate, 15 per 1,000 population, is located near the downtown section of the city. Tract 17 with its high rate of 14 per 1,000 population is an area of Mexican habitation. Tracts 25 and 26 are also located in the downtown section of the city. This might account for their high rates of 12 to 13 death per 1,000 population.

There have been many studies designed to show the spatial pattern of demographic and social phenomena.²⁰ Such studies have shown that rates of social phenomena when cast upon a map of a city make a definite pattern of gradiency. They show that social phenomena vary inversely or directly with the distance from the city's center. Rates of abnormal aspects of social phenomena tend to cluster near the center of the city when cast upon a map of the city. In this study the phenomena of deaths is considered an abnormal aspect of social phenomena. A definite pattern of gradiency does exist when the crude rates

20.

See: J. H. Bossard and Thelma Dillion, "The Spatial Distribution of Divorced Women", The American Journal of Sociology, XL, January 1935, 503-7

Clifford R. Shaw, Delinquency Areas, Chicago: University of Chicago Press, 1929

R. E. L., Faris and H. W. Dunham, Mental Disorders in Urban Areas, Chicago: University of Chicago Press, 1930

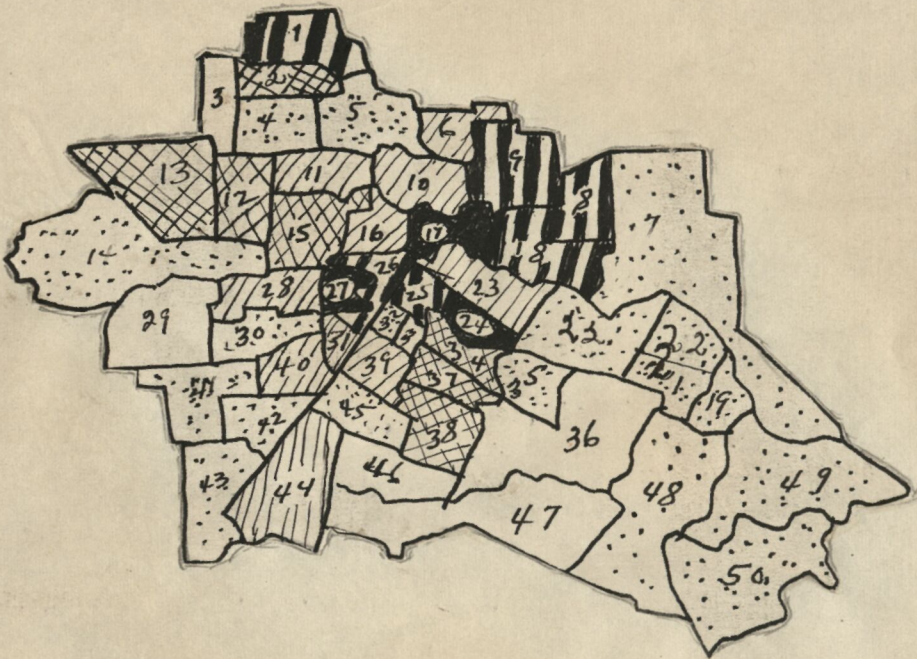
of this phenomenon are hatched on a map of the city by census tracts. Map 1 is done to present this pattern. The pattern of gradiency, however, is distorted by heavy death rates which exist in tracts 1, 8, 9, and 18. These are Negro tracts and thereby show unusually high rates.

Map 1 shows that the high death rate areas are found in and near the center of the city. Tracts 26, 25, and part of tract 17, make up the down town area. The highest death rates occur in tracts 27, 24, and 17. These tracts are adjacent to the downtown district areas. One may also observe that like areas tend to be contiguous. Tracts of low death rates are contiguously located as are tracts of high rates. Almost the entire East section of Houston is an area of relatively low death rates. Tracts 7, 22, 20, 19, 49, 48, 21, 35, and 50 are included in this section.







MAP 1

CRUDE MORTALITY RATES FOR HOUSTON, TEXAS
BY CENSUS TRACTS
1939, 1940, 1941

(Rates per 1,000 population)



LEGEND

.004-.005		.010-.011	
.006-.007		.012-.013	
.008-.009		.014-.015	

SPATIAL VARIATION OF THE STANDARDIZED RATES

The standardized rates are rates which have been computed for each census tract for the purpose of equalizing the population of each tract from the point of view of the age distribution. These standardized rates range from a low rate of 4 per 1000 expected population to the high rate of 18 per 1000 expected population. Tract 16 with a rate of 18.7 has the highest standardized rate of any tract. Tracts 17, 27, 38, and 9 have the next highest rates. The death rates for these tracts range from 14 to 16 per 1000 population. The tracts with the lowest standardized death rates are 35, 36, 47, 46, 45, 40, 42, 43, 30, 29, 4, and 3. The rates for these low death areas range from 4 to 6 deaths per 1000 population. All of the tracts having the lowest standardized death rates are located in the Southern section of the city.

The distribution of the standardized death rates are shown by census tracts in Map 2.

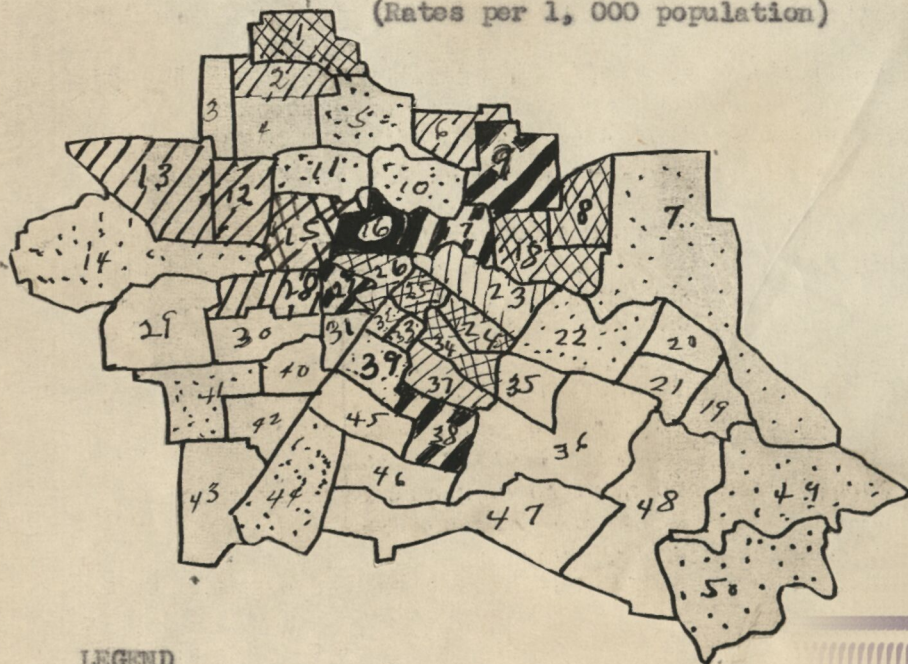
A definite pattern of gradiency is shown in this map. There is a specific tendency for the rate to decrease with an increase in distance from the center of the city. The facts show that the highest rates are clustered around the center of the city. The highest rate with the population of each tract standardized, occurs in tract 16. Tracts 17, 27, 9, and 38 possess the next highest rates. It should be noted that all of these tracts are near the

center of the city. The fact that this type of spatial variation of rates occurs under these conditions is proof of the fact that the ecological organization of the city is a factor in the health status of the city's population. This conclusion is drawn because, except for the interference of the high rates of tracts inhabited by Negroes and Mexicans, the pattern of gradiency made by these rates in the metropolitan city of Houston is very similar to that of other cities in which spatial aspects of social phenomena are shown by this research technique.

MAP 2

STANDARDIZED MORTALITY RATES FOR
HOUSTON, TEXAS BY CENSUS TRACTS
1939, 1940, 1941

(Rates per 1,000 population)



LEGEND

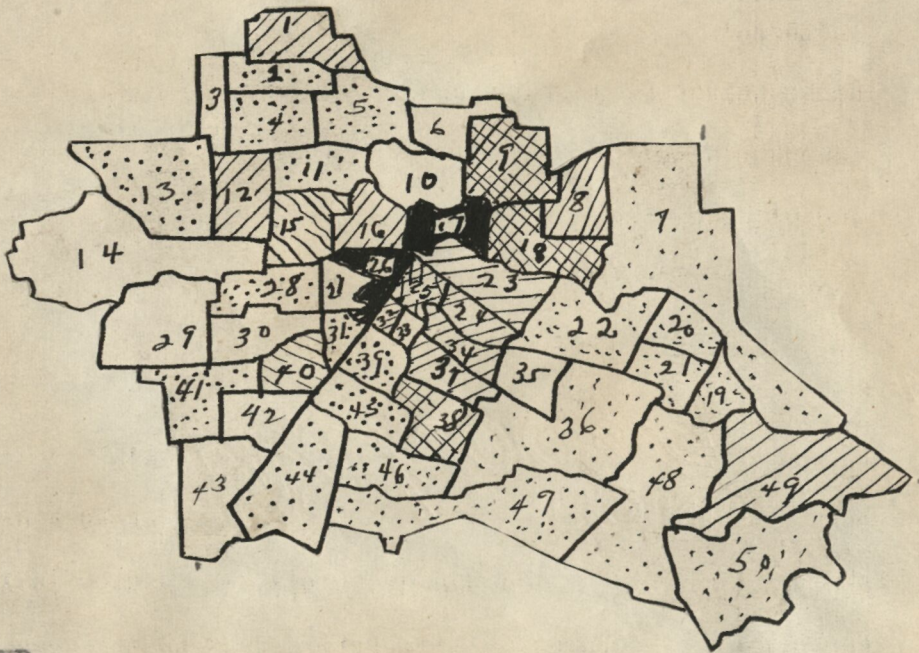
4.0-6.4		11.5-13.9	
6.5-8.9		14.0-16.4	
9.0-11.4		16.5-18.9	

The infant mortality rates, when cast on a map of the city by census tracts, present a pattern of gradiancy that is very definite. Map 3 is presented to show the spatial pattern made by the infant mortality rates.

MAP 3

INFANT MORTALITY RATES FOR HOUSTON, TEXAS
ACCORDING TO CENSUS TRACTS
1939, 1940, 1941

(Rates per 1,000 population under one year of age)



LEGEND

4.0-6.4	□	11.5-13.9	▨
6.5-8.9	▤	14.0-16.4	▧
9.0-11.4	▥	16.5-18.9	■

The area as indicated by Map 3 can be safely referred to as a natural area of infant mortality. This area is made up of tracts 17, 26, and 27. Tracts 17 and 26 have a rate of 150 deaths and

above per 1,000 population under 1 year of age. The infant death rate for tract 27 is 132 per 1,000 population under 1 year of age.

Tracts of like rates are spatially contiguous. Tracts 17, 26, and 27 have very high infant death rates and are adjacent to each other. Tracts 9 and 8 are contiguous and have relatively high infant mortality rates. On the whole, the infant mortality rates are relatively low outside of the zone of the city which is adjacent to the zone surrounding the loop. Generally, the rates increase as the center of the city is reached.

DELINEATION OF HIGH AND LOW DEATH RATE AREAS WITHIN THE CITY

From observing Map 1 and Map 2 one can readily see the low death areas of the metropolitan city of Houston. Almost the entire Southeast section of the city is an area of low death rates. This section includes tracts 7, 22, 20, 19, 21, 49, 48, 35, 36, and 50. On the West side of the city the low rate areas will be found in tracts 14, 29, 42, 41, and 43. In the Northern section of the city the low rate area is found especially in tract 3, and, to a considerable degree, in tract 4.

Invariably the high death rate areas of Houston are found in and near the center of the city, and in areas densely populated by Negroes and Mexicans. Tracts 26, 25, 17, and 24, are in or located immediately adjacent to the downtown district. The death rates are very high in this area as indicated by the

fore-going maps. The death rates for tracts 18, 9, 27, 1, 34, and 37 are also high, and on the contrary, these tracts are not in and around the center of the city. The fact that these tracts are very densely populated by Negroes is responsible for this irregularity. The high rates which occur in tracts 16, 17, and 19 are caused by the racial composition of their population. Mexicans are densely located in these tracts. Negroes and Mexicans tend to die much more rapidly than do whites. Areas inhabited by Negroes and Mexicans have high rates irrespective of their location. Tract 1, a Negro area, indicates this point of view. It is located in the extreme Northern part of the city but the rates, nevertheless, are invariably high.

Delineation of Specific Disease Areas: Just as there are natural mortality areas, within a metropolitan city there are also natural disease areas. One of these areas may be found to overlap another, in whole or in part. On the other hand, one disease area may be peculiar to and concentrated in a section of the city in which other leading causes of death are not found.

Since heart diseases, cancer, tuberculosis, pneumonia, and disease of the nervous system have been found to be the leading causes of death for the three year period 1939-41 in Houston, Texas, it has become necessary to construct maps showing the concentration of each of these diseases in the city. This was

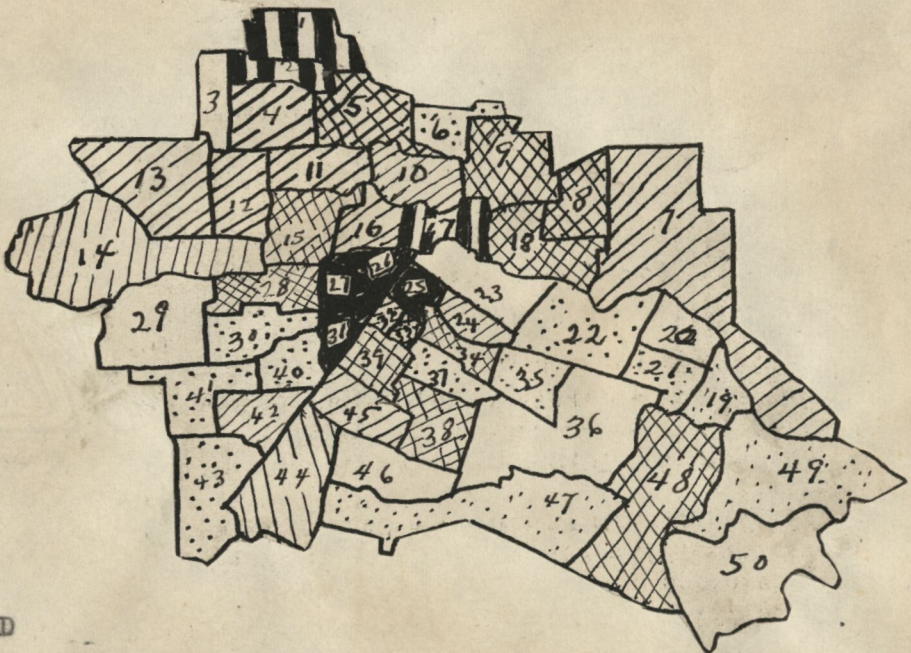
done by hatching in each tract the rate of deaths occurring from a specific disease. The disease rate by tracts were computed by finding the ratio of the total number of cases in each tract dying from each specific disease to the total population of that tract.

Map 4 shows that heart diseases also make a definite pattern

MAP 4

HEART DISEASE AREAS AND THE MORTALITY RATE RESULTING THERE- FROM IN HOUSTON, TEXAS ACCORDING TO CENSUS TRACTS 1939, 1940, 1941

(Rates per 10,000 population)



LEGEND

13-17	□	28-32	▨
18-22	▧	33-37	▩
23-27	▪	38-42	■

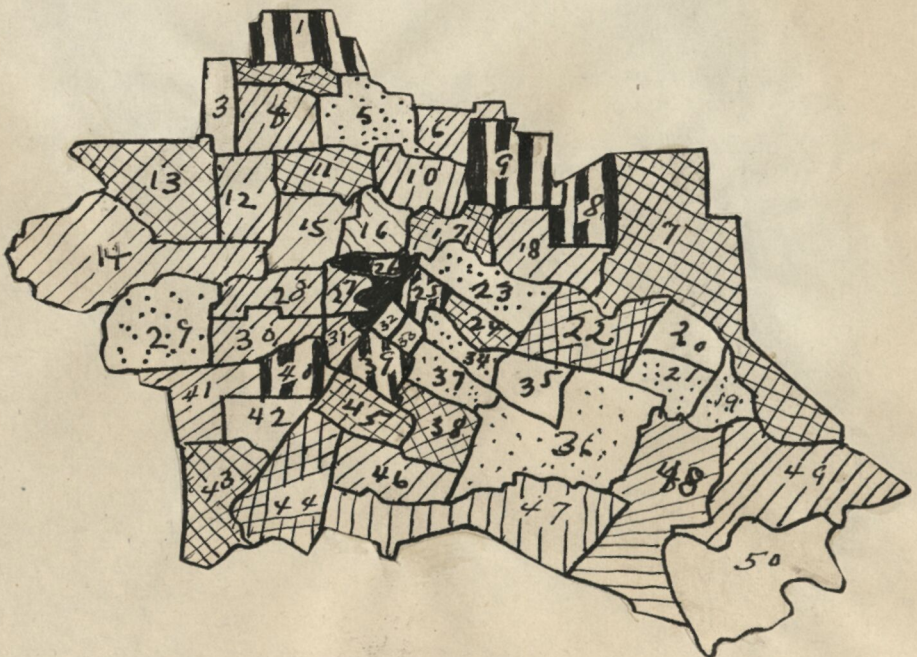
of gradiancy when the rates are cast on a map by census tracts. The heart disease area is located in the central section of the city, mainly in tracts 25, 26, 27, and 31. The rates for these

tracts range from 32-42 per 10,000 population. Tract 17, which is immediately adjacent to tracts 26 and 25 has a relatively high rate of deaths caused by heart trouble. Two other tracts, 1 and 2, have high rates, ranging from 33-37 per 10,000 population. As in the case of general mortality rates, tracts of like areas tend to cling together.

The natural areas of cancer are not exactly the same as the areas of heart diseases. This can be seen by observing Map 5.

MAP 5

CANCER AREAS AND THE MORTALITY RATES RESULTING THEREFROM
IN HOUSTON, TEXAS ACCORDING TO CENSUS TRACTS
1939, 1940, 1941
(Rates per 10,000 population)



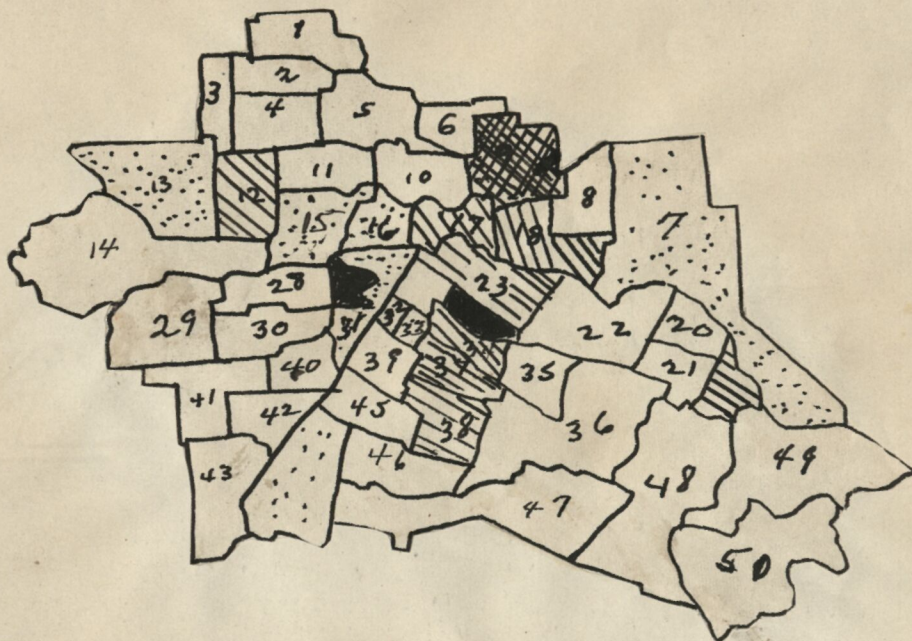
LEGEND

- | | | | |
|-----|--|-------|--|
| 1-2 | | 7-8 | |
| 3-4 | | 9-10 | |
| 5-6 | | 11-12 | |

Cancer is also concentrated in tracts 26 and 25. One can also observe that cancer extends beyond these tracts. Relatively high rates are found in tracts 39, 50, 8, and 9. The pattern of gradiency is not as pronounced as the pattern made by heart disease.

MAP 6

TUBERCULOSIS AREAS AND MORTALITY RATES OCCURRING THEREFROM
IN HOUSTON, TEXAS BY CENSUS TRACTS
1939, 1940, 1941
(Rates per 10,000 population)



LEGEND

- | | | | |
|-----|---|-----------|---|
| 1-3 | □ | 10-12 | ▨ |
| 4-6 | ▤ | 13-15 | ▧ |
| 7-9 | ▩ | 16 & over | ■ |

This irregularity in pattern may be due to the high concentration of females in tracts 39 and 40. Cancer is a disease to which females are more susceptible than are males.

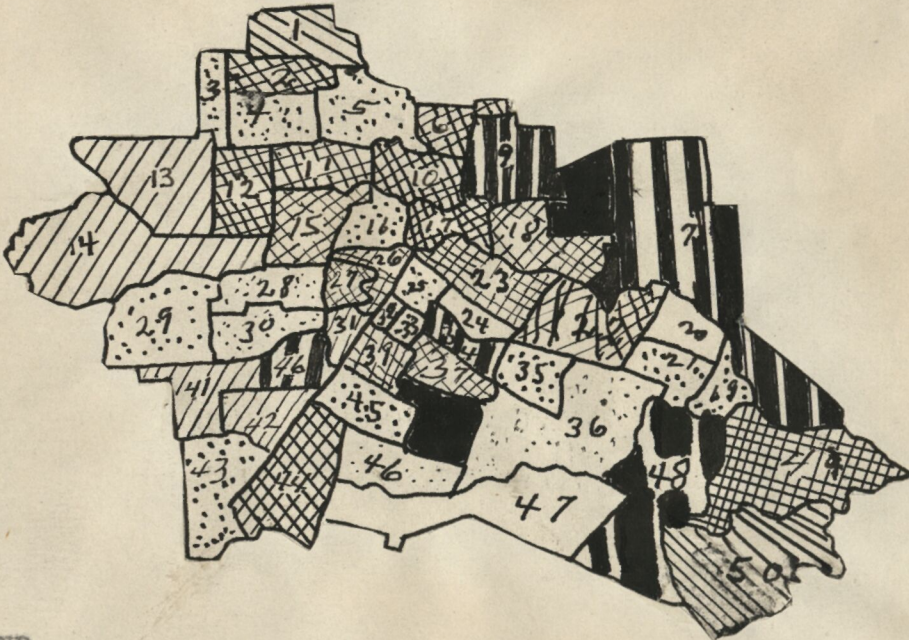
Tuberculosis is highly concentrated in only two census tracts, 27 and 24. Tract 27 is a Negro area constituting 4th Ward of the city of Houston.

The spatial pattern made by tuberculosis as indicated in Map 6 is definite enough to show that tuberculosis is concentrated in the downtown section of town, and in the Negro and Mexican areas of the city.

Pneumonia tends to occur in a more random fashion throughout

MAP 7

PNEUMONIA AREAS AND THE MORTALITY RATE OCCURRING THEREFROM FOR HOUSTON, TEXAS 1939, 1940 1941 (Rates per 10,000 population)



LEGEND

- | | | | |
|-----|--|-------|--|
| 1-2 | | 7-8 | |
| 3-4 | | 9-10 | |
| 5-6 | | 11-12 | |

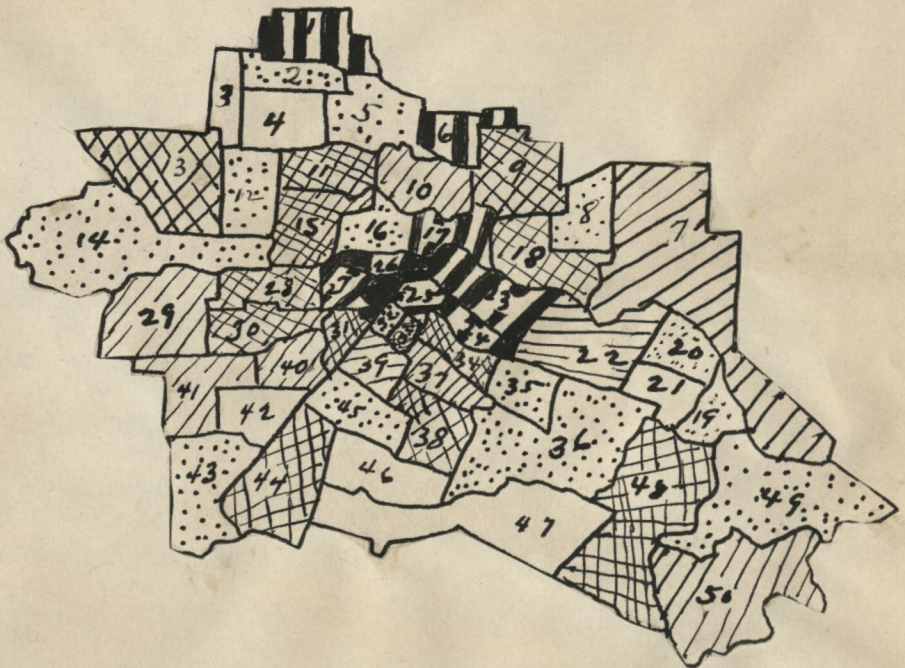
the city. This is indicated by Map 7.

The areas where mortality rates are usually high are not the pneumonia areas. Pneumonia areas are random. The pattern made







by this disease is almost directly reverse to patterns made by heart disease, tuberculosis, and other forms of pathological social phenomena. The tracts having the highest rate of deaths caused by pneumonia are tracts 8 and 38.

MAP 8

AREAS OF DISEASES OF THE NERVOUS SYSTEM AND THE MORTALITY RATES RESULTING FROM THEM IN HOUSTON, TEXAS BY CENSUS TRACTS 1939, 1940, 1941 (Rates per 10,000 population)



LEGEND

0-1.5		4.8-6.3	
1.6-3.1		6.4-7.9	
3.2-4.7		8.0-9.5	

These tracts are not spatially contiguous. The rates range from 11-12 per 10,000 population. Tracts with the second highest rates are tracts 9,7,48, and 40. The pneumonia mortality rates

for the downtown area are relatively low. Tract 25 has a rate of 3 deaths from pneumonia per 10,000 population. Tracts 26, 23, and 17, have rates slightly higher. These rates range from 5-8 deaths from pneumonia per 10,000 population.

The diseases of the nervous system are concentrated in the central section of the city and on the northern borders of the city limits. This is indicated by Map 8.

This map makes a definite pattern of gradiency. The high rates for diseases of the nervous system are concentrated in the central section of the city. This section includes tracts 26, 17, 23, 25 and 24. Tract 26 has the highest rate. Tracts 17, 23, 25, and 24 possess the next highest rates.

There is a probability that this concentration of cases of diseases of the nervous system in the central section of the city is due to the type of population groups that settle there. It is known that the residential pattern of this area includes more apartment houses than do the other areas. This being true, there is a great probability that the people who live there are transient roomers and apartment dwellers. Dunham and Faris' research showed that transient people tend to experience nervous disorders more than those whose pattern of life is more stable. However, this research does not include evidence sufficient to determine the extent to which the findings of Dunham and Faris are duplicated. It is left for further research on deaths in the Metropolitan city of Houston, Texas to determine the actual degree of duplication.

CHAPTER III

SUMMARY AND CONCLUSIONS

SUMMARY: The basis for this research study has been made by previous demographic and ecological researches. The demographers whose interest have been in phenomena of births and deaths have concerned themselves with analysis of rates of births, fertility ratios and the like. The human ecologist has been concerned with the spatial distribution of social phenomena. The idea here is to tie up the relationship or interplay between "place" and various aspects of social phenomena. The human ecologists are concerned with the analysis of rates when cast on a map to show the spatial distribution of social phenomena.

This research study is designed to analyze the crude, standardized, and infant mortality rates, and show the spatial pattern these rates make when cast on a map of the city of Houston, Texas.

The data for this study were secured from the registration files of the Bureau of Vital Statistics, City Health Department, Houston, Texas. The address, age, race, sex, and primary cause of death was recorded from each death certificate filed for the years 1939, 1940, 1941. The address on each registration blank was assigned to a specific census tract. The cases were then allocated to their given tracts. Each cause of death was assigned a given disease code number. All cases which occurred in Houston,

but not to residents of Houston were discarded. The cases used for this study are only cases of deaths occurring to residents of Houston, within the city limits.

A crude death rate per 1,000 population for each tract was computed. This was done by getting the ratio of deaths for each tract for the three year period (1939-41) to the population for each tract. The crude death rate for the entire city was 8.6. The crude rates by tracts were cast on a map of the city and the spatial pattern was observed.

The standardized rate was next computed for each tract on the basis of population per 1,000. This rate was computed in order to see what the death rate for each tract would be if the factor of age were controlled. Unless the rates are standardized it is possible that one can be measuring the age distribution of the population rather than the death rate in a specific "place" or "area". The standardized rates were computed by equalizing the population of each tract.

The cases of infant mortality were separated from the general mortality cases. Rates for the infant mortality cases were computed for each tract per 1,000 population under one year of age. These cases were grouped according to the causes of death of infants. Five causes stood out as leading causes of death. They were pre-maturity, heart and congenital heart diseases, diarrhea and enteritis, and birth injury. The infant mortality rates by census tracts were cast on a map and the pattern made by them

was observed.

The general mortality cases were separated according to disease code numbers. This step revealed that the bulk of the deaths which occurred in Houston in 1939, 1940, and 1941 were caused by five specific diseases. These five leading diseases were heart diseases, cancer, tuberculosis, pneumonia, and diseases of the nervous systems. The rates for each of these diseases were computed by census tracts. This was done by computing the ratio of the total number of cases from each cause in each tract for three years to the population for each tract. The rate was computed on 10,000 population base. The rates for each specific disease by census tracts were cast on a map of the city, thus making specific disease areas observable.

This study is of significance in the field of social research. In the first place, it attempts to extend the list of researches which have emphasized the importance of place of habitation in human life. It attempts to extend the demographic information already in existence. The delineation of the natural death rate areas of the city of Houston in this study will aid the Health Agencies at work in that city to plan and direct their activities to points of greater need. In the third place, there has been no study made which sought to determine the spatial pattern of deaths in a metropolitan city. This study, consequently, becomes the first research study to attempt such a task.

The crude mortality rate for the city as a whole is 8.6 per 1,000 population. The standardized rate for the city is 9.2. This crude rate might at first seem small but one must bear in mind that the crude rate does not take under consideration the age distribution of the population.

The infant mortality rate for the city was 56.0 per 1,000 population under one year of age. The rate of infant mortality deaths for each tract varied greatly. Tract 29 had a rate as low as 10, whereas tracts 26 and 27 had rates 182 and 132 respectively.

There is a variation in the specific disease rates. The heart disease has by far the highest rate which is 29.7 per 10,000 population. Heart disease is followed by cancer at a rate of 6.8. Pneumonia, with a rate of 6.6 ranks third, followed by tuberculosis at a rate of 5.6. Diseases of the nervous system have a rate of 5.1 per 10,000 population.

When the crude death rates by census tracts were cast on the map of the city a pattern of gradiency was discerable. The rates were slightly higher in the central section of the city, and tended to decrease as distance from the center increased. The Negro areas tended to distort the pattern to some extent. The pattern made by the infant mortality rates is more gradient than the pattern made by the general crude rates. The points of high concentration are in tracts 17, 26, and 27. The rates decrease at a gradual rate with the increase of distance from the downtown area.

The gradiency pattern made when the standardized death rates by census tracts are hatched on the map of the city is more distinct than the pattern made by the crude rate. There is a specific tendency for the rate to decrease with an increase in distance from the center of the city. The highest rates are clustered around the center of the city. The highest rate occurs in Tract 16. Tracts 17, 27, 9, and 38 possess the next highest rates. It is important to note that these tracts are located near the center of the city.

In plotting the specific disease rates by tracts, outstanding observations are made with reference to the pattern these diseases make. In the first place, like areas tend to be territorily-contiguous. Tracts with like disease rates tend to cling together. This is an indication that the socio-economic characteristics and ecological organization of an area have a definite relationship to the types of diseases that predominate in a given territory. In the second place, most of the specific disease areas are also the natural death rate areas. The high specific disease rates are, on a whole, concentrated in the downtown section of the city and in the Negro areas. This does not hold true, however, for the disease of pneumonia. The pneumonia disease area is concentrated in the Eastern section of the city. The Eastern section of the city is the low death rate area. In the Northwestern section the tracts with high pneumonia rates are

the low general death rate areas. Pneumonia tends to have made a pattern just the opposite to the pattern made by the other specific diseases. This pattern varies from the pattern usually made by pathological phenomena.

CONCLUSION: The spatial pattern made by the phenomenon of deaths within a metropolitan city is definitely gradient. The high death rates are concentrated in and near the center of the city. These rates decrease gradually as distance from the center of the city increases.

Most of the death rate areas are found in the downtown section of the city, and in the tracts next adjacent to this section. There are other death rate areas along the northern city limits. Tract 1 represents this area. This a Negro tract and the high rate found there can be accounted for on the same grounds as those in tracts 9 and 18. Tracts 9 and 18 are densely populated with Negroes. Negroes tend to die more rapidly than do whites. Because Negroes die rapidly, the rate of deaths in a Negro area is higher than in an area not inhabited by Negroes.

These death rate areas are distinctly shown in the distribution of the crude and standardized rates when they are cast on a map. The pattern made by the standardized rates is somewhat more gradient than that made by the crude rates. Nevertheless, the pattern made by the crude rates is gradient. The infant mortality rates are very definitely concentrated in the general

death rate area. The pattern made by the infant mortality rates is distinctly gradient and definite. The death rate areas according to the crude rates are tracts 24, 25, 26, and 27. The tracts with the next highest rates are tracts 16, 27, 26, 17, 9, and 38. It is important to note that some of these areas overlap. The map of infant mortality rates shows the infant death areas to be tracts 26, 17, 25, and 24. These are all in the central section of the city. Tracts 9, 8, 1, and 18 have the next highest rate of infant mortality. These areas, too overlap with death rate areas shown by the crude and standardized rates. With the exception of pneumonia, the specific disease areas are found in the death areas of the city. The heart disease area is located in the central section of the city. It includes tracts 25, 26, 27, and 31. The cancer disease area is concentrated in tracts 25 and 26. Tracts possessing the next highest cancer rates are tracts 39, 40, 8, and 9. Hence, the pattern is less gradient for cancer. Tuberculosis is highly concentrated in only two tracts, 27 and 24. These tracts have also been shown to be high death rate areas from other causes. The area of diseases of the nervous system is definitely in the central section of the city. The tracts included in this area are tracts 26, 17, 23, 25, and 24. Tract 26 has the highest rate.

The spatial pattern of mortality areas of the city of

Houston, Texas do vary spatially in the city in a manner similar to ecological phenomena on the one hand and pathological social phenomena on the other. It is left for further research to extend the frontier of this study to include the following research hypotheses:

- A. Why do the spatial patterns made by these rates occur in the manner shown?
- B. With what socio-economic variables of the respective areas are these associated?
- C. Is there any specific socio-economic variable which alone explains the phenomena of deaths in a metropolitan city?

When these questions are answered, the body of knowledge pertaining to the spatial distribution of demographic phenomena will be greatly extended.

CHAPTER IV

APPENDIX A

TYPE OF REGISTRATION FORM

Deaths of Residents of Houston

Address _____ Year, 19____
 Number Street

Primary Cause of Death _____

This registration form was used to record cases taken from the registration files, Bureau of vital statistics, City Health Department, Houston, Texas.

APPENDIX B

CRUDE, INFANT, AND STANDARDIZED MORTALITY RATES FOR HOUSTON, TEXAS

Tract	Crude Rates	Infant Mortality Rates	Standardized Rates	1939, 1940 1941
1	12	67	12.5	
2	10	45	10.0	
3	4	14	14.1	
4	6	45	5.5	
5	7	51	7.0	
6	9	27	10.7	
7	7	37	8.5	
8	13	73	12.8	
9	13	114	14.6	
10	8	23	7.8	
11	8	32	7.8	
12	10	72	10.1	
13	10	52	10.6	
14	7	29	7.1	
15	10	83	11.7	
16	9	75	18.7	
17	14	175	14.6	
18	12	101	13.7	
19	7	47	7.5	
20	6	43	7.2	
21	6	36	5.0	
22	7	50	7.2	
23	9	64	10.7	
24	15	76	12.3	
25	13	111	11.5	
26	13	182	12.0	
27	14	132	15.2	
28	8	38	9.5	
29	4	10	5.9	
30	6	21	4.9	
31	12	55	8.4	
32	7	68	7.3	
33	8	24	6.4	
34	11	63	12.8	
35	6	19	5.5	
36	5	30	5.9	
37	10	85	11.0	
38	11	108	14.2	
39	9	42	6.6	
40	8	61	5.3	
41	6	41	7.0	
42	6	16	5.8	
43	6	24	6.4	

APPENDIX B
(Continued)

CRUDE, INFANT, AND STANDARDIZED MORTALITY RATES FOR HOUSTON, TEXAS

Tract	Crude Rates	Infant Mortality Rates	Standardized Rates	1939, 1940 1941
44	8	38	7.1	
45	6	51	5.7	
46	5	32	4.3	
47	5	56	4.5	
48	7	31	8.7	
49	7	68	8.2	
50	7	31	6.8	

APPENDIX C

SPECIFIC MORTALITY RATES FOR HOUSTON
1939, 1940 1941

Rates per 10, 000 Population

Tract	Heart Disease	Cancer	Tuberculosis	Pneumonia	Disease of Nervous System
1	34	10	3	6	8
2	37	8	3	8	3
3	17	2	2	4	1
4	26	5	3	3	1
5	30	3	2	3	2
6	22	6	1	7	7
7	23	7	6	9	6
8	32	10	3	11	3
9	30	7	10	10	6
10	27	6	3	7	4
11	26	7	2	7	6
12	23	6	7	8	3
13	24	8	5	6	5
14	26	5	2	6	3
15	29	5	6	8	5
16	25	5	5	4	3
17	35	8	9	7	8
18	28	5	9	7	5
19	21	3	7	4	2
20	17	2	2	2	2
21	19	4	2	3	1
22	21	7	3	3	4
23	17	4	12	8	7
24	24	7	20	2	8
25	41	9	9	3	8
26	42	12	4	8	9
27	39	6	17	8	8
28	31	5	3	4	6
29	16	3	1	4	4
30	20	6	1	4	5
31	39	5	3	6	6
32	23	2	5	4	3
33	29	4	5	4	9
34	29	5	10	10	6
35	10	2	1	3	3
36	15	4	1	3	2
37	22	4	9	8	4
38	29	7	7	12	5
39	29	10	3	8	4

APPENDIX C
(Continued)

SPECIFIC MORTALITY RATES FOR HOUSTON
1939, 1940, 1941

Rates per 10, 000 Population					
Tract	Heart Disease	Cancer	Tuberculosis	Pneumonia	Disease of Nervous System
40	22	10	2	9	4
41	21	6	0	5	3
42	26	1	2	5	1
43	18	7	2	4	3
44	24	6	4	7	6
45	23	6	2	4	2
46	17	5	2	2	1
47	19	7	3	1	1
48	32	5	1	9	6
49	18	1	3	8	3
50	13	1	1	6	4

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