

Socioeconomic Characteristics in Relation to Maternal and Child Health

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CONCERN of the Welfare Council of Metropolitan Chicago with the increasing infant mortality rate for Chicago and specific areas in suburban Cook County resulted in a maternal and child health project for the county. The study design includes four interrelated phases, two of which were initiated in May 1964. Phase 1 was an analysis of socioeconomic characteristics and their relationship to major health indices for Chicago and suburban Cook County, which is discussed subsequently.

Phase 2 consists of interviews with directors, board members, and chiefs of services of 161 official and voluntary health agencies and institutions concerning present programs, problems, projections, and aspirations. This phase was started concomitantly with phase 1 and it is still in process.

The third phase of the survey includes the collection of data on incidence and prevalence of illness and disability among infants and children under age 15 and the prepartum and postpartum health status of women.

The final phase will be the superimposition of services over needs. This will delineate which problems affecting particular population groups require the services, regardless of availability, of community health agencies and institutions.

In many studies in the past 10 years health status has been compared with other population characteristics, and poor health conditions have been found to correlate with low socioeconomic status (1-5). Our project was de-

veloped to demonstrate the range of variations among suburban communities and Chicago census tract groups in order to identify areas with concentrated health problems.

Generally, mortality rates were used to indicate the health status of populations. The initial phase of the study focused on the geographic distribution of health rates (infant mortality, child mortality, maternal mortality, prematurity, and illegitimacy), relating them to specific socioeconomic characteristics of the population in an attempt to understand health differentials and their relationship to other social and economic variables (6-8).

It was believed that the findings of the initial phase would yield evidence for or against assumptions regarding the influence of certain variables, would identify high and low levels of health status, and would open the way for progressive and closer examination of causal relationships (1).

Area Studied

Chicago and suburban Cook County consist of 1,107 census tracts (1960 census). The entire area was included in the survey, except those tracts in which the population was too

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small to provide statistically valid comparisons or which were nonresidential (9, 10).

The average tract in Chicago is inhabited by 5,000 residents. The total population in Chicago, 3,550,404 in 1960, occupies 224.4 square miles (15,800 persons per square mile); suburban Cook County, 1,579,321 people in 1960, covers an area of 737.9 square miles (2,142 persons per square mile).

Methodology

An initial decision was made to study the entire county and use the smallest geographic units possible. In Chicago, demographic and health data were available by census tract. In the suburban area, identical data were available by municipality and townships.

A number of socioeconomic and health indices were reviewed and the following variables were derived for all the geographic units in the study: income, educational level, occupational status, social rank, average percentage of non-white population, illegitimacy, prematurity rate, maternal death rate, child death rate, and infant death rate.

In the initial stages the census tracts and suburban units were grouped by income levels into deciles (not necessarily geographically contiguous), and mortality and other rates were computed by area. Each decile consisted of

approximately 78 census tracts in the city and 11 geographic units in the suburbs (table 1).

In another mode of analysis, 75 communities of 20,000 or more population in Chicago and suburban Cook County were used. Data on 15 variables, including population characteristics and socioeconomic and health variables, were gathered for 4 years, 1960 through 1963, and a generalized stepwise regression analysis was run. Scores of socioeconomic status, education score, occupation score, and social rank (the Shevsky-Bell measures) were used (7).

In the regression analysis three other variables were included: percentage of migrants from the South between 1955-60, percentage of children under 18 living with one or no parents, and percentage of mothers under age 25.

Findings

The Chicago analysis verified the fact that socioeconomic status and infant mortality are inversely related. Where low-socioeconomic status prevails, poor health rates including high incidence of infant mortality, prematurity, and illegitimacy also prevail.

Infant mortality rates steadily increase as income decreases (table 1). This inverse relationship is not as clear for child and maternal mortality, although it is strikingly evident in the prematurity and illegitimacy rates. The

Table 1. Chicago deciles, by income and health indices

Decile ¹	Income range	Education score	Occupation score	Social rank	Average percent nonwhite	Death rates			Birth rates ²	
						Infant	Maternal	Child	Premature	Illegitimate
1-----	\$8, 400-19, 999	75. 5	70. 8	73. 1	3. 0	15. 5	0. 00	2. 78	70. 5	41. 5
2-----	7, 800- 8, 399	62. 3	46. 6	54. 4	2. 6	18. 5	. 52	3. 02	66. 7	18. 5
3-----	7, 400- 7, 799	57. 1	43. 6	50. 3	2. 5	18. 6	. 43	3. 89	73. 0	28. 3
4-----	7, 000- 7, 399	55. 7	44. 0	49. 8	5. 4	23. 2	. 44	5. 43	77. 6	36. 2
5-----	6, 650- 6, 999	49. 5	34. 1	41. 8	3. 3	20. 8	. 16	4. 33	72. 7	65. 2
6-----	6, 300- 6, 649	45. 1	28. 4	36. 7	7. 4	28. 5	. 28	7. 29	91. 5	81. 8
7-----	5, 900- 6, 299	43. 8	27. 1	35. 4	17. 8	24. 1	. 46	6. 40	87. 7	99. 2
8-----	5, 250- 5, 899	42. 9	26. 8	34. 8	30. 6	27. 9	. 32	6. 90	108. 9	153. 3
9-----	4, 250- 5, 249	42. 4	28. 7	35. 5	73. 3	39. 8	. 35	10. 15	148. 3	287. 7
10-----	2, 000- 4, 249	34. 0	26. 0	30. 0	88. 1	36. 9	. 58	7. 74	147. 8	337. 5

¹ Deciles, the ordering of observations or data into tenths, are based on income.

² Per 1,000 births.

SOURCES: (a) income, U.S. Census Bureau Reports, 1960; (b) health indices, Chicago Board of Health, 1963; (c) social rank and segregation scores were computed from scores provided by the Center for Metropolitan Studies, Northwestern University.

Table 2. Suburban Cook County deciles, by income and health indices

Decile	Income under \$6,000 (percent)	Completed high school ¹ (percent)	White collar workers ¹ (percent)	Nonwhite (percent)	Death rates			Birth rates ²	
					Infant	Maternal	Child	Premature	Illegitimate
1-----	9.58	70.18	71.42	1.1	14.07	0.39	3.13	64.48	7.03
2-----	12.24	61.05	65.18	3.3	18.88	.76	3.99	63.18	11.33
3-----	16.15	42.35	61.34	.3	20.51	.19	4.59	60.38	11.69
4-----	18.09	53.17	55.05	3.7	17.02	-----	3.65	62.02	13.99
5-----	21.12	48.86	50.80	.8	19.98	.30	4.33	62.93	13.72
6-----	22.61	51.20	42.96	10.9	19.18	-----	4.04	71.76	18.56
7-----	25.43	49.19	49.49	6.1	19.43	-----	4.32	73.95	26.71
8-----	28.92	35.89	37.52	.6	19.27	-----	4.65	66.00	8.47
9-----	33.11	41.78	46.09	9.8	21.58	.37	5.21	74.42	34.98
10-----	47.36	25.46	23.90	49.6	28.44	-----	6.57	93.25	91.93

¹ Midpoint of range used.

² Per 1,000 births.

SOURCES: (a) socioeconomic variables based on U.S. Bureau of Census Data, 1960; (b) health rates based on 1963 data from the Illinois Department of Public Health.

number of premature births per thousand doubles from the high-income decile to the lowest income decile. The rate of illegitimate births reported is eight times more in the lowest decile than in the highest decile.

Many studies have shown that components of socioeconomic composite rank tend to be closely interdependent (3, 5-7). Scores in table 1 demonstrate the close relationship among income level, educational level, and occupational status.

The analysis of the percentage of nonwhite population in Chicago illustrates an inverse relationship between nonwhite population and income. Most of the nonwhite population lives in the lowest income census tracts in Chicago, although small percentages live throughout the city. The highest income area (decile 1) contains two census tracts where the population is 98.6 percent nonwhite, while in other high-income tracts percentages are as low as 0.0 non-white population.

As in other studies, these data indicate that after a certain necessary minimum of income is available, additional income has little effect on health factors. The most significant change in rates on all variables occurs below the \$6,000 income level, with the greatest concentration of problems appearing where the income level is \$4,249 and less.

The lowest income groups, the largest proportion of nonwhite population, and the greatest number of infant deaths were clustered within

143 census tracts (out of 780) on the near-south, south, and near-west sides of Chicago. These data demonstrate, however, that the nonwhite population is found in all income groups and is distributed throughout a large majority of the census tracts. The health rates for the non-white population in high-income areas were comparable to those of the white population in the same areas, and the low-income white areas had rates comparable to those in low-income nonwhite areas. This supports the hypothesis that disparity in health rates among nonwhites reflects economic differences rather than racial differences.

In suburban Cook County, 114 geographic units were arranged into economic deciles based on the percentage of families with an annual income under \$6,000, and other rates were computed. A wide range of scores was observed (table 2). The percentage of families with income under \$6,000 ranged from 9 to 47 percent. The suburban data were difficult to interpret, because of the great variation within a decile. Most high rates of mortality and illegitimacy were observed within one decile and four geographic units.

The infant mortality rates fluctuated widely in the suburban areas and a definitive inverse relationship between income and infant mortality was observed only in the four worst units in decile 10. The median family income measure in the suburban areas showed the same four

units below the \$6,000 median family income per year. In suburban Cook County, only decile 10 demonstrates dramatically the association between socioeconomic variables and health status.

In addition to the methods described for the separate analysis of Chicago and suburban Cook County, a third procedure was used in which 75 communities with populations of more than 20,000 (53 Chicago community areas and 22 suburban municipalities) were used in the study of 15 variables related to our 5 dependent variables: infant mortality, child mortality, maternal mortality, prematurity, and illegitimacy. The statistical technique, generalized stepwise multiple regression analysis, was used to try to measure the extent to which each dependent variable was associated with each independent variable by gradually (stepwise) eliminating each factor in turn. In this analysis, 4 years (1960 through 1963) of health data were used for Chicago communities and suburban Cook County.

Very high correlation was found between the expected variables. It was difficult to develop a few predictor variables, because most of the dependent and independent variables were in-

terrelated (table 3). However, this analysis provides a statistically significant association between socioeconomic status and selected indices of health. The key variables in their relationship to four dependent variables (infant and child mortality, prematurity, and illegitimacy) may be considered in making recommendations for further study, evaluation, and planning. The key variables in relationship to infant mortality were found to be percentage of nonwhite (0.73), median family income (-0.65), illegitimacy (0.72), prematurity (0.79), and percentage of children under 18 years of age living with one or no parent (0.76).

Child mortality is also highly correlated with percentage of nonwhite (0.70), median family income (-0.69), illegitimacy (0.73), percentage of children living with one or no parent (0.75), and prematurity (0.74).

As stated above, the premature and illegitimate birth rates are highly correlated with infant and child mortality and each other. The premature birth rate is also highly correlated with the percentage of nonwhite population (0.89) and percentage of recent migrants from the South (0.69). The illegitimate birth rate is also highly correlated with the percentage

Table 3. Chicago and suburban Cook County, units of 20,000 and more population ¹

Variable No.	Correlation matrix		Percent mothers under 25	Median family income	Median school years	Percent professional and technical	Recent migrants	Substandard housing	Illegitimate	Percent children with one or no parent	Birth rate	Premature rate	Infant mortality	Child mortality	Maternal mortality
	Total population	Nonwhite													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.000	0.217	0.422	-0.424	-0.339	-0.249	0.270	0.416	0.280	0.347	0.102	0.317	0.273	0.330	0.067
2		1.000	.344	<i>-.666</i>	<i>-.306</i>	<i>-.302</i>	<i>.677</i>	<i>.666</i>	<i>.900</i>	<i>.941</i>	<i>.452</i>	<i>.887</i>	<i>.732</i>	<i>.697</i>	<i>.291</i>
3			1.000	<i>-.732</i>	<i>-.661</i>	<i>-.611</i>	<i>.310</i>	<i>.444</i>	<i>.443</i>	<i>.496</i>	<i>.306</i>	<i>.497</i>	<i>.448</i>	<i>.544</i>	<i>.085</i>
4				1.000	<i>.742</i>	<i>.687</i>	<i>-.525</i>	<i>-.766</i>	<i>-.717</i>	<i>-.787</i>	<i>-.461</i>	<i>-.696</i>	<i>-.654</i>	<i>-.686</i>	<i>-.258</i>
5					1.000	<i>.876</i>	<i>-.199</i>	<i>-.539</i>	<i>-.377</i>	<i>-.436</i>	<i>-.270</i>	<i>-.367</i>	<i>-.435</i>	<i>-.431</i>	<i>-.120</i>
6						1.000	<i>-.114</i>	<i>.424</i>	<i>-.356</i>	<i>-.371</i>	<i>-.215</i>	<i>-.373</i>	<i>-.392</i>	<i>-.372</i>	<i>-.070</i>
7							1.000	<i>.618</i>	<i>.701</i>	<i>.686</i>	<i>.692</i>	<i>.686</i>	<i>.620</i>	<i>.670</i>	<i>.277</i>
8								1.000	<i>.757</i>	<i>.809</i>	<i>.451</i>	<i>.709</i>	<i>.644</i>	<i>.684</i>	<i>.254</i>
9									1.000	<i>.936</i>	<i>.503</i>	<i>.862</i>	<i>.718</i>	<i>.728</i>	<i>.276</i>
10										1.000	<i>.445</i>	<i>.893</i>	<i>.755</i>	<i>.748</i>	<i>.317</i>
11											1.000	<i>.469</i>	<i>.478</i>	<i>.693</i>	<i>.134</i>
12												1.000	<i>.788</i>	<i>.741</i>	<i>.296</i>
13													1.000	<i>.834</i>	<i>.215</i>
14														1.000	<i>.179</i>
15															1.000

¹ Data include 4 years, 1960 through 1963.

NOTE: Italic correlation coefficients indicate high positive or negative associations.

of nonwhite population (0.90) and percentage of substandard housing (0.76), median income (-0.72), and percentage of recent migrants from the South (0.70).

Although three variables (nonwhite population, income, and age of mother) are related to maternal mortality and were found significant at a 95 percent level, the small number of observations may cause the true correlation to be overstated.

Conclusions

The delineation of areas of great socioeconomic needs in Chicago is not new; however, our study revealed a relationship between health needs and socioeconomic needs by area through statistical distribution of mortality and other indices. It must be remembered that ecological findings regarding the relationships between attributes of population aggregates and particular behavior are not applied. For example, the relationship between lower socioeconomic status of an area population aggregates and particular behavior do not necessarily mean that persons with lower socioeconomic status produce the bulk of the mortality cases. Actually, the deaths may be occurring among persons in the upper socioeconomic levels in the lower socioeconomic areas. However, mortality rates can provide insight into the causes of mortality as well as explain its status in terms of social structure. Further research focusing on individuals should be pursued to verify this hypothesis.

Socioeconomic and health factors have been identified and related to each other. Use of

this information for implementation of recommendations arising from the total study will follow.

REFERENCES

- (1) Anderson, O. W.: Infant mortality and social cultural factors: Historical trends and current patterns. *In* Patients, physicians and illness, edited by E. Gartly Jaco. Free Press, Glencoe, Ill., 1958.
- (2) Chase, H. C.: The relationship of certain biological and socioeconomic factors to fetal infant and childhood mortality. Children's Bureau, 1964.
- (3) Donabedian, A., Rosenfeld, L. S., and Southern, E. M.: Infant mortality and socioeconomic status in a metropolitan community. *Public Health Rep* 80:1083-1094, December 1965.
- (4) Hartman, E. E., and Sayles, E. B.: Some reflections on birth and infant death among the low socioeconomic groups: Current facts and figures in the Minneapolis community. Minneapolis Health Department, 1964.
- (5) Quinney, R.: Mortality differentials in a metropolitan area. *Social Forces* 43:222-230, December 1965.
- (6) Molina, G., and Noam, I. F.: Indicators of health, economy, and culture in Puerto Rico and Latin America. *Amer J Public Health* 54:1191-1206, August 1964.
- (7) Shevky, E., and Bell, W.: Social area analysis. Stanford University Press, Stanford, Calif., 1955.
- (8) de Vise, P.: Human geography of the city and metropolitan area. Department of Geography, DePaul University, Chicago, April 1964.
- (9) Kitagawa, E. M., and Taeuber, K. E., editors: Local community fact book, Chicago Metropolitan Area, 1960. Chicago Community Inventory, University of Chicago, 1963.
- (10) U.S. Census Bureau: Population characteristics by census tract and communities. U.S. Government Printing Office, Washington, D.C., 1960.

PUBLICATION ANNOUNCEMENTS

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Family Structure, Dynamics and Therapy. By Irvin M. Cohen, M.D. January 1966; 234 pages. Psychiatric Research Reports, American Psychiatric Association, 1700 Eighteenth St. NW., Washington, D.C. 20009.

Prescription Drug Industry Fact Book. 1966; 71 pages. Pharmaceutical Manufacturers Association, 1155 Fifteenth St. NW., Washington, D.C. 20005.

Science Policy in Latin America. Substance, structures, and processes. Report of a study group prepared for the PAHO Advisory Committee on Medical Research. Scientific Publication No. 119. March 1966; 70 pages. PAHO Pan American Sanitary Bureau, 525 Twenty-third St. NW., Washington, D.C. 20037.

The First National Directory of Senior Centers. AoA Publication No. 252. 1966; \$1.25. Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

Nursing Care Plans. Study program in nursing management. 1966; 77 pages; \$3.50. Hospital Continuing Education Project of the Hospital Research and Educational Trust, 840 North Lake Shore Drive, Chicago, Ill. 60611.

Vital Statistics, Illinois, 1964. March 1966; 62 pages. Illinois Department of Public Health, Springfield 62706.

Measuring the Utilization of a Federal Short Term General Hospital. By Francis Montague. 1966; 52 pages. The University of Iowa, Iowa City.

Chronic Diseases and Public Health. By Abraham Lilienfeld and Alice Gifford. June 1966; 846 pages; \$15. The Johns Hopkins Press, Baltimore, Md. 21218.

Man in Equilibrium With His Environment. Summary of a discus-sional. Prepared by Robert M. Brown. 1965; 15 pages. National Sanitation Foundation, School of Public Health, University of Michigan. P.O. Box 1468, Ann Arbor, Mich. 48106.

Proceedings of the 1965 Annual Conference of the Surgeon General, Public Health Service and Chief, Children's Bureau With State and Territorial Health Officers, and 1965 Annual Meeting of the Association of State and Territorial Health Officers. 1966; 34 pages. Association of State and Territorial Health Officers, 3500 N. Logan St., Lansing, Mich. 48914.

World Health Organization

WHO publications may be obtained from the Columbia University Press, International Documents Service, 2960 Broadway, New York, N.Y. 10027.

Immunology and Parasitic Diseases. Report of a WHO Expert Committee. WHO Technical Report Series No. 315. 1965; 64 pages; \$1; Geneva.

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Requirements for Biological Substances. Report of a WHO Expert Group. WHO Technical Report Series No. 323. 1966; 72 pages; \$1.25; Geneva.

The Use of Human Immunoglobulin. Report of a WHO Expert Committee. WHO Technical Report Series No. 327. 1966; 29 pages; 60 cents; Geneva.

WHO Expert Committee on Biological Standardization. Eighteenth report. WHO Technical Report Series No. 329. 1966; 132 pages; \$2; Geneva.

University Health Services. Fourteenth Report of the WHO Expert Committee on Professional and Technical Education of Medical and Auxiliary Personnel. WHO Technical Report Series No. 320. 1966; 23 pages; 60 cents; Geneva.

Immunological Aspects of Human Reproduction. Report of a WHO Scientific Group. WHO Technical Report Series No. 334. 1966; 21 pages; 60 cents; Geneva.

Index. The work of WHO, 1965 annual report of the Director-General to the World Health Assembly and to the United Nations. Official Records of the World Health Organization No. 147. May 1966; 10 pages; Geneva.

WHO Expert Committee on Leprosy. WHO Technical Report Series No. 319. 3d report. 1966; 31 pages; 60 cents; Geneva.

WHO Expert Committee on Rabies. WHO Technical Report Series No. 321. 1966; 38 pages; \$1; Geneva.

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Bibliography of Hookworm Disease (Ancylostomiasis) 1920-1962. 1966; 251 pages; \$4; Geneva.

WHO Activities in Nutrition, 1948-1964. 1965; 38 pages; 60 cents; Geneva.

Financial Report, 1 January-31 December 1965. Supplement to the Annual Report of the Director-General for 1965 and Report of the External Auditor to the World Health Assembly. Official Records of the World Health Organization No. 146. April 1966; 106 pages; \$1.25; Geneva.