# Population Density and the Rate of Mental Illness

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**Abstract:** An examination of age specific rates of psychiatric admissions within Brooklyn, New York, indicated that population density may function as an intervening variable in the production of mental illness. Measures of household and family contact were found to be significantly correlated to four rates of hospital utilization. These same measures carried unique components that were also significantly related to service use. Other measures of density such as people per acre and structures per acre were found to be unrelated to the rates of psychiatric utilization. The results of this study suggest that if density does produce mental illness its likely mechanism of action will be routed through household contact. (Am. J. Public Health 67:1165–1172, 1977)

The importance of population density in the production of human mental illness is unclear. Early studies by Pollack,[1] Pollack & Furbush,[2] Pollack & Nolan,[3] Malzberg,[4] and Tietze[5] compared the rates of mental illness for rural and urban environments. Their results suggested that urban environments were associated with relatively greater rates of hospitalization. This finding was attributed to population density although other factors related to the urban condition could have been postulated with equal validity. Faris and Dunham[6] in a classic study of Chicago addressed this issue. Examining only urban data, they demonstrated that the overall rate of state hospital admissions decreased as one moved radially from the center and more densely populated area of the city toward the suburbs. These findings were replicated by Schroeder[7] and Clausen & Kohn,[8] and again indirectly implicated population density as a possible etiologic agent in the production of mental illness.

There are few studies that have directly investigated the relationship of population density and mental illness. In 1944 Hyde & Kingsley[9, 10] studied a nonselected population of army inductees from Boston and urban communities surrounding this city. Their findings suggested that both high and low densities were associated with increased rates of inductee rejection due to major psychiatric illness. Variations of socioeconomic factors, however, were covariant with changes in population density and accounted equally well for the variations in the rates of rejection.

More recently Galle et al[11] have examined the relationship between the components of density and five measures of social pathology. Using age adjusted rates of psychiatric admissions in Chicago during 1960–1961, the authors found that the number of rooms per housing unit best predicted hospital admissions. This measure accounted for a total of 46.8 per cent of the variance (r = .68), while the addition of class and ethnicity to the predicting system only added an additional 0.02 per cent explained variance. Alternatively, the addition of this measure of density to the prior effect of class ethnicity (29.8 per cent) accounted for an additional 17.2 per cent of the variance. Thus it was clear that the number of rooms per housing unit contained unique components not shared with social class or ethnicity.

Factor, et al[12] have commented on Galle's results and the problems inherent in the use of partial correlations to determine the relative effect of one of a number of intercorrelated variables. In their study of ten socioeconomically matched homogenous communities in Chicago. Factor, et al[12] found that persons per square mile, and the percentage of housing units in structures containing more than two units strongly predicted age standardized rates of admissions to mental institutions. In addition, percentage of home ownership, and geographic mobility were also strongly correlated to admissions.

These recent data are difficult to evaluate. While both Galle, et al[11] and Factor, et al[12] have been careful to identify their predicting variables, neither study adequately identified the dependent variable, the rate of mental illness. The

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use of age standardized rates of admission is a well established and widely used practice. There are, however, serious shortcomings associated with total reliance on this measure since it is a weighted measure of admissions for all ages and therefore all forms of mental illness. Both Faris & Dunham,[6] and Hyde & Kingsley[9, 10] have demonstrated density related differences in the rates of different psychoses.

Ideally one would like to study the effect of density in relation to the functional psychoses. Unlike involutional and depressive illnesses, these disorders appear unrelated to specific loss, separation, or the social and economic effects of the middle years. It would also be very desirable to exclude disorders of the senium including particularly arteriosclerotic cerebral insufficiency as well as other degenerative disorders whose etiology can only be minimally related to current social circumstances.

Since the functional psychoses most frequently cause hospitalization during the years 16–44,[13] a selection process for this pathologic state is inherent in the use of age specific hospitalization rates. Finally, these psychoses bear a close resemblance to many of the social pathologies described by Calhoun,[14] Christian,[15] and Snyder[16] which makes them desirable for study in this context.

## *Method*

Brooklyn is especially suitable for a large scale study of psychiatric hospital use. The borough contains 2.6 million people whose psychiatric care is primarily provided at a large municipal hospital, Kings County Hospital (KCH). Accurate data on utilization is maintained in the KCH Emergency Room (ER) logbooks where all registrations for emergency care and hospital admissions are carefully recorded.

During 1971 other psychiatric hospital services in the borough were limited to two mental health centers responsible for less than 10 per cent of the total population; and two general hospitals with small acute services.

### The Sample

A sample consisting of all patient admissions for eight representative months of 1971 was taken from the KCH-ER logbooks. Patients suffering from alcoholism and/or other addictive disease were deleted from this sample and the remaining patients were grouped according to their health area of residence.*

Patients were further subdivided according to age, history of prior psychiatric hospitalization (i.e., none, or prior municipal and/or state hospitalization), and finally as an emergency room visit or hospital admission.

During 1971 all patients admitted to KCH were deemed to be psychotic and dangerous to themselves or others, and the hospital operated at capacity with continuous pressure for more admissions. Consequently, only patients with the most severe pathology were recorded as admissions in our sample data.

Because municipal hospital use alone would tend to select from the relatively disadvantaged sector of the borough, the KCH sample was enlarged to include all admissions of Brooklyn residents to any facility within New York City other than KCH.** The new sample (designated as boroughwide) contained a more complete cross section of patients from all ethnic and socioeconomic strata. This virtue, however, was offset by the fact that non-KCH admissions were diagnostically more heterogenous and thus less uniformly psychotic.

### The Dependent Variables

Since both samples had specific advantages as well as deficiencies, we used both to develop four different rates of admission. These rates are:

1. KCH—New (all new admissions aged 16–44 to KCH)
2. Boroughwide—New (all new admissions aged 16–44 of Brooklyn residents to any NYC hospital)
3. KCH—Total (all admissions aged 16–44 to KCH=new+prior treatment+undetermined)
4. Boroughwide—Total (all admissions aged 16–44 of Brooklyn residents to any NYC hospital = new+prior treatment+undetermined)

### The Independent Variables

The independent variables used to predict the rates included the following measures:

1. Socioeconomic status
2. Ethnicity
3. Migration
   (These three are collectively referred to as social structure)
4. Four different measures of population density.

Using these measures of stress we examined the contribution of each to the prediction of the rates of admissions in the borough's 113 health areas.

An area's socioeconomic level was defined by: 1) median income, 2) percentage of the population older than 25 that had completed seven years or less of school, and 3) the percentage of the population engaged in blue collar occupations. Four multiple regression equations maximizing the correlation of these measures to each rate of utilization were then summed and this new predicting equation was then used in reverse to generate an index of socioeconomic status (SI) for each health area. By so doing, the index assigned values to each health area that maximized the predictive capacity of the socioeconomic measures to the admission data. In identical fashion we also computed an index of ethnicity (EI) using the percentage of: 1) blacks, 2) whites, and 3) others in each health area, and an index of migration (MI) by

*A health area is the traditional geographic planning unit in NYC. It is composed of three or more census tracts and varies in size from 9,100 to 62,579 people.

**Data were supplied by the New York State Department of Mental Hygiene. Since area estimates of state-wide admissions were collected for fiscal years, we averaged records for fiscal years 1971 and 1972 and added this to our KCH sample.

using a weighted measure developed by Dr. Elmer Struening.*

Two of the four measures of population density were related to significant interpersonal contact within a health area, and two were straightforward measures of dispersal. They are respectively: 1) the cummulative percentage of an area's households that contained three or less people (P/H), 2 the cummulative percentage of people living in circumstances of less than or equal to 0.75 people per room (P/R), 3) the number of structures per acre (S/A), and 4) the number of people per gross acre (P/A).

The two measures of interpersonal press (P/H and P/R) were low density cummulative percentage variables arbitrarily chosen because they were approximately normally distributed and highly correlated with the four rates of admission. By selecting our dependent density variables in this way we attempted to maximize predictive capacity while not doing undue violence to the requirements of homoscedasticity.

## *Results*

Using health area indicies as predicting variables we found that each measure of stress (SI, EI, MI, P/H, P/R, S/A, and P/A) was significantly correlated to our four rates of hospitalization. Since shared or common factors could very well account for these results, we attempted to isolate the relative importance of our social structure (SI, EI, and MI) and density (P/H, P/R, S/A, and P/A) predictors. This analysis required that the multiple correlation coefficient for all the density predictors be compared to a second multiple correlation coefficient in which the effect of SI, EI, and MI were held constant. This process was then reversed, that is the multiple correlation obtained by using social structure factors was compared to the residual correlation remaining after the effect of density had been held constant (i.e., controlled). The results of this analysis are presented in Table 1.

When the contributions of socioeconomic status, ethnicity, and migration were removed from the system of density predictors, both the individual as well as the combined specific contribution of density to the prediction of hospitalization was negligible. By contrast the combined specific effect of social structure (i.e., after density's effect was removed) accounted for an average of approximately 11 per cent of the variance in the rates ($p < .01$).

These results would appear to deny the specific importance of our four different measures of population density in the prediction of mental illness and are discrepant with the findings of Galle, et al[11], and Factor.[12] Because of this discrepancy we sought to determine if a factor within our sample might be causing the effect of density to be erased in the statistical analysis.

Since blacks comprise 25 per cent of the borough's population, but made up approximately 60 per cent of all KCH admissions, race is obviously a strong predictor of hospitalization. This factor is not controlled for by our ethnicity index since this measure explains the effect of an areas racial composition on its utilization. In order to adequately control for the fact that an individual may, by virtue of his race, be strongly predisposed to the influence of certain aspects of their environments and not others, one must do one of two types of studies. Either one must compare age and race specific rates, or compare age specific rates for communities that are relatively homogeneous for racial composition. We proceeded by way of the latter alternative choosing to examine communities relatively homogeneous for race in order to see if the effect of density might thus be exposed.

Dividing the boroughs health areas on the basis of race resulted in 82 predominantly white communities (i.e., whites greater than or equal to 50 per cent), and 31 communities that were predominantly black. In point of fact however, a 50 percent or nearly 50 per cent distribution of whites and blacks occurred in only one health area. The remaining health areas had racial distributions of 70–30 per cent or greater. Indeed looking at the borough by health area one can appreciate the degree of racial separation and health area homogeneity that is present. Because of this "natural cleavage" we felt that the arbitrary separation would adequately control for the effect of race, while not reducing the number of communities available for study to numbers too small for statistical significance.

Thus we once again computed the individual correlations for "white" and "black" communities. Now the pattern of univariate correlations differed from that found in the total group (113 health areas). Significant correlations ($p < .01$) between the social structure variables and the four rates of admission persisted in the "white" group. In the "black" group only socioeconomic measures remained significantly correlated to admissions ($p < .05$), and now only in the borough-wide rates.

There were also differences between the groups with regard to our density predictors. In the "white" group people/room (P/R) was significantly correlated to all four rates, while the other predictors by and large were noncontributory. On the other hand people/room and people/household were strongly correlated to borough-wide rates in the "black" areas.

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Since it is unlikely that social structure measures would be generally uncorrelated to hospitalization, only in "black" areas we have ascribed these group differences to two factors. The sample size and the range of the social structure in the "black" group is much smaller than the "white" group.

Since the social structure related differences appear artifactual and because we obtained strong correlations to our density measures in both groups, we proceeded to analyze the data further. Table 2 presents a partial correlation analysis of the contributions made by the components of our predicting systems, with the results expressed as the percentage of explained variance in each group.

These data suggest that predictions of hospitalization

*4x (the number of persons abroad 5 years prior to the census) + 3x (the number who lived in a different state) + 2x (the number who lived in the same state but in a different home) + (the number who lived in the same county but a different home), all divided by the total population of the health area.

**TABLE 1—Partial Correlation Analysis—Mental Hospital Rates The Relative Contributions of Social Structure and Density Variables**

| | Rates of Hospitalization | | | |
|---|---|---|---|---|
| | Kings County Hospital | | Boroughwide Hospitals | |
| A. Controlling for Social Structure | New | Total | New | Total |
| 1. Multiple Correlation of P/H, P/R, P/A, and S/A | 0.65** | 0.71** | 0.70** | 0.74** |
| 2. Multiple Partial Correlation of P/H, P/R, P/A, and S/A controlling for the effect of EI, SI, and MI. | 0.11 | 0.25 | 0.19 | 0.20 |
| B. Controlling for Density Components | | | | |
| 1. Multiple Correlation of SI, EI, and MI. | 0.72** | 0.78** | 0.74** | 0.81** |
| 2. Multiple Partial Correlation of SI, EI, and MI controlling for the effect of P/H, P/R, P/A, and S/A. | 0.42** | 0.51** | 0.38** | 0.50** |

* = 0.05 level of significance
** = 0.01 level of significance

for the "white" group will be somewhat better than for the "black" group. Despite this difference, density measures accounted for roughly comparable amounts of explained variance in both groups (compare line B1, Table 2). After the contributions of social structure were removed from the set of density predictors we found that the residual variance explained by density decreased markedly in the "white" group while it remained unchanged in the "black" group (compare line B2, Table 2). In point of fact the unique (i.e., unshared) components of our density measures predicted 5.3 per cent of the variance not accounted for by social structure within the "white" group, but a far greater percentage, 24.5 per cent, in the "black" group.

Social structure would appear to be the most important predictor of hospitalization in "white" areas whereas density appears relatively more powerful in "black" areas. Looking at lines C1 of Table 2 we see that the combined effect of social structure explained an average of 45.7 per cent of the variance in "white" rates while accounting for only 17 per cent in "black" areas. Removing the total effect of density from the social structure predictors (compare lines C2) reduced the effect of social structure to an average of 28 per cent in "white" areas while causing no real change in "black" areas. More specifically, in "white" areas social structure accounted for 19.1 per cent of the variance unexplained by density while the same specific components of social structure explained 11.7 per cent of the variance not accounted for by density in "black" areas.

These differences are important and warrant further study. However, the focus here is on the role of density and these data lead to the following conclusions. The combined unique components of our density measures are significantly correlated to borough-wide rates in predominantly black health areas and to total rates in predominantly white health areas.

In order then to identify which of our density measures were responsible for these significant correlations we computed the partial correlations of each density component to the rates. Table 3 displays these data.

Where significance was obtained in the "white" group (i.e., total rates) it was provided by one variable, people per household (P/H). Similarly in "black" areas the significant correlations to density (borough-wide rates) were provided by P/H and P/R. In other words, only measures of household contact were significantly related to hospitalization and we conclude that measures of dispersal or random contact are unrelated to psychiatric hospitalization in the age group 16–44.

Comparing P/H and P/R in predominantly "black" and "white" areas, we see that the partial correlations are always positive for "whites" and negative for "blacks". Moreover, when we returned to look at the zero order correlations for our density measures in both groups, we found that they were negative for P/H and P/R. Thus a change in the directions of correlation occurred in the "White" group when the shared factors of the density measures were partialled out.

There are a number of possible explanations for this difference. One that is easy to check is that the specific components of P/H and P/R are not linearly related to the rates of admission in our original sample. We therefore examined this hypothesis by comparing the correlations obtained using a linear combination of our predictors to correlations obtained when we added a quadratic function of density measures P/H, and P/R. If significant curvlinearity did exist with respect to these components the system containing the quad-

**TABLE 2—Partial Correlation Analysis—Mental Hospital Rates The Relative Contributions of Social Structure and Density Variables**

| | % Variance Explained by Different Predicting Systems | | | | |
|---|---|---|---|---|---|
| | Kings County Hospital | | Boroughwide | | Average |
| | New | Total | New | Total | % |
| *I. "White" Group (N=82)* | | | | | |
| A. Total Variance Explained by SI, EI, MI, P/H, P/R, P/A, S/A | 38.0** | 57.7** | 45.7** | 61.6** | 51.2** |
| B. 1. Total Variance Explained by P/H, P/R, P/A, S/A | 21.8** | 38.7** | 26.9** | 40.8** | 33.6** |
| 2. Residual Variance Explained After Effect of EI, SI, MI removed | 4.5 | 14.6* | 6.0 | 13.9* | 9.3 |
| C. 1. Total Variance Explained by SI, EI, MI | 35.1** | 50.4** | 42.4** | 55.4** | 45.7** |
| 2. Residual Variance Explained After Effect of P/H, P/R, P/A, S/A Removed | 20.7** | 30.9** | 25.8** | 35.1** | 28.3** |
| *II. "Black" Group (N=31)* | | | | | |
| A. Total Variance Explained by SI, EI, MI, P/H, P/R, P/A, S/A | 36.0 | 32.3 | 50.2* | 46.8* | 41.5 |
| B. 1. Total Variance Explained by P/H, P/R, P/A, S/A | 32.4* | 18.3 | 38.1* | 29.6 | 29.3 |
| 2. Residual Variance Explained After Effect of EI, SI, MI removed | 24.2 | 19.6 | 35.7* | 38.4* | 29.3 |
| C. 1. Total Variance Explained by SI, EI, MI | 15.5 | 15.7 | 22.6 | 13.5 | 16.9 |
| 2. Residual Variance Explained After Effect of P/H, P/R, P/A, S/A removed | 5.3 | 17.1 | 19.7 | 24.4 | 15.7 |

* = 0.05 level of significance
** = 0.01 level of significance

ratic functions of P/H and P/R would explain an additional and significant increment in the variance.

This was indeed the case in the sample of all health areas (N=113) but did not occur in either the "black" or "white" groups. Thus, it is likely that the specific components of P/H and P/R operate in different directions in both groups, and because of the difference in sign would cancel out in a correlation analysis that did not properly control for race.

Since P/H and P/R appear to contain specific factors that predict a significant proportion of the variance in our rates, it is of interest to compare the relative strength of these measures. Table 4 presents this analysis.

In both groups one finds that the total subsequent contribution of P/H to the prior effect of social structure is much greater than P/R. This implies that the high total effect of P/R is primarily a function of components common to the social structure variables, and P/H appears to be a more useful and specific measure of density's contribution to psychiatric hospitalization.

## *Comment*

Disagreement persists regarding the relative importance of social factors in the production of mental illness. Major studies by Hollingshead and Redlich[17], Jaco,[18] Srole, et al,[19] and Dunham,[20] have examined the pathogenic role of social class and socioeconomic factors. The conclusions drawn from these studies are often at variance with each other and are subject to differing interpretations. For example, Hollingshead and Redlich[17] demonstrated an inverse relationship between social class and the prevalence of schizophrenia but failed to demonstrate this relationship for the incidence of new cases. Jaco[18] has demonstrated a direct relationship between social class and the incidence of schizophrenia and Bodian, et al[21] have found a number of socioeconomic measures to be directly related to rates of admission for schizophrenia.

On the other hand Srole, et al[19] concluded that social and economic differences are less important in terms of total rates than has generally been held. Similarly, Bloom[22] in a

**TABLE 3—Partial Correlations of the Measures of Density to the Rates of Hospitalization Within the Sub-Group**

| | Predominantly White (N=82) | | | | Predominantly Black (N=31) | | | |
|---|---|---|---|---|---|---|---|---|
| Rates | P/H | P/R | P/A | S/A | P/H | P/R | P/A | S/A |
| KCH–New | 0.18 | 0.13 | −0.04 | 0.03 | −0.18 | −0.17 | 0.07 | −0.08 |
| KCH–Total | 0.28* | 0.14 | −0.10 | −0.03 | −0.24 | −0.21 | −0.11 | −0.27 |
| Boroughwide–New | 0.19 | 0.12 | −0.03 | −0.05 | −0.50** | −0.50** | −0.07 | −0.33 |
| Boroughwide–Total | 0.31** | 0.17 | −0.06 | 0.02 | −0.49** | −0.46** | −0.18 | −0.43** |

* = 0.05 level of significance
** = 0.01 level of significance

study of Pueblo, Colorado found no significant relationship between socioeconomic factors and functional psychotic illness. Finally, Dunham[20] has found that mobility patterns of individuals and families are important determinants in the distribution of schizophrenia.

These divergent, often contradictory findings are drawn from carefully performed and thoughtful studies and may all be correct if we accept that a complex relationship exists between our social stressors and disease outcome. Cassel[23] has examined this complexity and based on the fact that a given psychosocial process or "stressor" is generally not etiologically specific for a given disease, he argues that social stressors should be considered to create an internal milieu propitious to the development of one or another illness. He ascribes the stressors' mode of operation to a neuro-endocrine imbalance that acts by way of a hypothalmic-pituitary-adrenocortical mechanism responsive to some dimension of the stress condition. Cassel[23] further views human social processes or events as acting through four general principles. They are: 1) social organization (i.e., family organization), 2) social dominance-submission (i.e., an individuals social or expected role), 3) social buffers (i.e., the relative

**TABLE 4—The Proportion of Variance Explained by Measures of Household Crowding and by Social Structure Variables for Each Sub-Group**

| A. *Predominantly White Sub-Group (N=82)* | KCH NEW | KCH TOTAL | BOROUGH-WIDE NEW | BOROUGH-WIDE TOTAL |
|---|---|---|---|---|
| Total Effect P/H | 1.84 | 1.67 | 3.39 | 2.18 |
| Total Effect P/R | 16.23*** | 25.25*** | 21.39*** | 27.72*** |
| Increment Added by SI, EI and MI: | | | | |
| to P/H | 35.42 | 52.50 | 41.01 | 57.36 |
| to P/R | 19.94 | 26.10 | 21.67 | 28.92 |
| Total Effect of SI, EI, and MI | 35.08*** | 50.42*** | 42.24*** | 55.37*** |
| Increment Added to SI, EI and MI: | | | | |
| by P/H | 2.18 | 3.75* | 2.16 | 4.17* |
| by P/R | 1.09 | 0.93 | 0.82 | 1.27 |
| B. *Predominantly Black Sub-Group (N=31)* | | | | |
| Total Effect P/H | 7.19 | 5.68 | 30.15** | 22.65** |
| Total Effect P/R | 12.15 | 5.66 | 34.66*** | 22.18** |
| Increment Added by SI, EI, and MI: | | | | |
| to P/H | 10.34 | 15.09 | 11.52 | 11.25 |
| to P/R | 5.93 | 13.84 | 6.98 | 9.88 |
| Total Effect of SI, EI and MI | 15.54 | 15.75 | 22.65 | 13.53 |
| Increment Added to SI, EI and MI: | | | | |
| by P/H | 2.71 | 5.02 | 19.02* | 20.38* |
| by P/R | 2.54 | 3.75 | 18.99* | 18.54* |

* = 0.05 level of significance
** = 0.01 level of significance
*** = 0.001 level of significance

presence of health promoting social structures), and 4) generalized stress (i.e., social group processes).

Thus, any social structure may simultaneously contain disease promoting components as well as an abundance or lack of ameliorative factors. The disease outcome will depend upon the relative contribution of each type of factor. As an example Nuckolls and Cassel[24] found social stress to be significantly related to pregnancy complications only when appropriate and expected social supports were absent.

We find that our data lends itself to this frame of reference. Using our measures of social class, ethnicity, and migration as a crude measure of social structure, we have found significant correlations between the rates of mental illness and this stressor. We have also found measures of household contact to contain unique components that significantly improve predictions based only on social structure. These results suggests that both social structure and meaningful interpersonal contact play independent as well as complimentary roles in relation to hospitalization. Changes in one or both will alter the outcome of morbidity and exemplifies Cassel's[23] social buffer, and generalized stress principles.

Previous studies have demonstrated poor correlations to measures of interpersonal contact or crowding when social and economic factors are controlled.[25, 26] Mitchell[25] has obtained strong correlations between mental illness and the percentage of people living above ground. Unfortunately, Mitchell[25] did not use reliable or generally agreed upon outcome measures of mental illness. Indeed he relied upon measures of stress and overt hostility, neither of which bears any demonstrable relationship to mental illness, and under appropriate circumstances can be viewed as health promoting. Factor, et al[12] on the other hand obtained significant correlations for measures of household contact but their results are subject to problems of interpretation since only age standardized rates of admission were used. The study of Galle, et al[11] suffers from the same problem; which mental illnesses are correlated to housing units/structure?

In this study we have been able to demonstrate a significant relationship between measures of household contact and total municipal and boroughwide admissions for functional psychoses. The lack of correlation to measures of dispersal suggests that random contact or crowding between unrelated or indifferent individuals plays a negligible role in predicting hospitalizations in our population. Moreover, the fact that our rates are significantly correlated to unique components of household contact defines the social setting within which our density stressor operates as the family unit.

Within the complex setting provided by a family unit we find ample opportunity to suggest that factors of stress as well as support would intervene in the production of mental illness in ways that would be a function of social custom, culture, religion, and the many other variables that define a family experience. It is this interaction perhaps that accounts for the fact that measures of household contact can be shown to be significantly and uniquely correlated to our rates only after our communities are divided on the basis of racial composition. It would seem that in controlling for race we are in a more fundamental sense isolating significant family differences.

Such speculation is supported by the fact that there is much evidence of differences between whites and blacks in terms of family disruption, social supports and roles, and ultimately life experience. We wonder then if the weak correlations obtained by Factor, et al,[12] and Galle, et al[11] to household measures of contact may be a function of their reliance on age standardized data as well as not properly controlling for family related factors mediated by way of race.

In this study our measures of household contact are defined as cummulative low density measures. Increase in P/H, and P/R imply a general decrease in the frequency of household contact. The direct correlations between our specific factors of household contact and the rates of hospitalization in "white" areas implies that decreasing family contact results in increasing hospitalization whereas the negative correlations for "black" areas implies the opposite. That is to say, decreases in the frequency of family contact result in decreases in the rate of utilization. Looking at this from the other direction we can say that increases in frequency of family contact within "black" areas promotes the utilization of hospitalization while increases in family contact in "white" areas are associated with decreased usage.

These data appear to suggest that different life experiences and different cultural affiliations may provide the background for the differential operation of social stressors, social supports, or both. If we are to study densities effect in humans with greater precision and meaning we shall have to introduce as dependent variables family related factors that mediate both stress and support within the family.

As a final observation we note that total rates are always more strongly correlated to our density measures than the new rates. Since total rates include patients with a history of prior treatment as well as new admissions, the improved correlations would necessarily be related to the former group of patients. Borough-wide rates which include patients who are generally more affluent than the municipal hospital patients are also more strongly correlated to our measures of density. Both of these facts suggest the following. A history of prior treatment may allow a family to rationalize its wish to exclude the ill member on the basis of past experience. At the same time the institution can less easily resist this family pressure for admission because the hospital has in the past agreed that hospitalization is the proper mode of treatment. If, in addition, there exists the availability of private hospitalization, family exclusion becomes easier and we would expect our borough-wide rates to be more strongly correlated to family contact. Thus we suggest that one possible mode of action of household contact is an increase in the pressure for social exclusion of the sick member.

The results of this study do not absolutely implicate population density in the production of mental illness. They do however suggest that if density is pathogenic it is likely that its effect will be routed through family contact. Further study of density should therefore pay attention to the presence or absence of family social supports as well as measures of family stress.

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## The Science of Living

*Health and, to a relative degree, longevity are not accidents. To be satisfactorily attained they demand reasonable attention and work. After all, living is a science. Too few recognize this fact, however.*

Robert B. Ludy and John C. Funk: How to Live Longer, David McKay Company, 1927, p. ix.