Jarvis' Law and the Planning of Mental Health Services

Influence of Accessibility, Poverty, and Urbanization on First Admissions to Connecticut State Hospitals

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A STUDY of service in general hospitals revealed that differences in the supply of beds account for a large proportion of the variance in utilization (*1*). It has long been recognized that accessibility has a strong bearing on the use of public mental hospitals and that admission rates tend to vary inversely with distance from the patient's residence to the institution. This phenomenon is known as Jarvis' law, because it was reported by Dr. E. Jarvis of the Worcester State Hospital in Massachusetts before the Civil War (*2*). The same observation was made by Selmer in Denmark in 1879 (*3*), by others in Scandinavia (*3*, *4*), and in North America (*5–11*). In Norway the pattern tends to disappear in times of overcrowding and to reappear during periods of greater availability of beds (*4a*).

Where Jarvis' law is in effect, it should be considered in the planning of mental health services in order to avoid serious underestimation. However, it has been suggested that Jarvis' law is an artifact resulting from the chance operation of confounding factors. It may be due to the distribution of high-risk groups (the elderly, the disadvantaged, or the nonwhite), the urban-rural continuum (*11*), or the location of alternative services (*6a*, *7a*, *10a*). It is highly desirable to resolve these questions, to assess the contributory role of other factors, and to ascertain whether or not Jarvis' law is relevant to planning.

Two multivariate analyses have provided tentative answers to these questions. In California, Blumberg found distance from the institution, measured by constructive mileage, to be the best single variable in a multiple correlation of admissions to State mental hospitals (*10b*). In Connecticut, similar findings (unpublished)

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Table 1. First admission rates per 10,000 to Connecticut State hospitals, July 1, 1959–from patient's residence to the hospital,

Miles	15–24 years		25–34 years		35–44 years		45–54 years		55–64 years	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
	White males									
0–9	95	22. 8	121	26. 4	155	31. 4	129	30. 1	82	26. 3
10–19	284	17. 4	346	19. 6	432	21. 2	373	23. 1	244	21. 9
20–29	312	15. 3	346	17. 8	426	17. 9	382	19. 0	271	19. 3
30–39	248	19. 3	248	17. 3	265	15. 8	233	15. 9	178	16. 5
40–49	40	11. 3	38	9. 9	57	11. 1	33	7. 5	36	11. 1
50 or more	12	10. 3	16	7. 8	24	12. 4	13	10. 7	5	6. 6
Total	991	17. 0	1, 115	18. 0	1, 359	18. 6	1, 163	19. 1	816	18. 9
	White females									
0–9	80	18. 9	122	26. 7	118	22. 9	96	22. 3	54	16. 0
10–19	216	13. 1	350	19. 6	306	14. 7	239	14. 8	192	15. 8
20–29	245	12. 1	333	16. 1	375	14. 8	288	13. 9	234	15. 1
30–39	147	10. 2	226	15. 1	218	12. 3	188	12. 3	147	12. 5
40–49	24	6. 4	34	8. 1	43	8. 0	20	4. 4	10	2. 9
50 or more	10	7. 5	23	11. 1	20	11. 0	14	12. 4	8	9. 2
Total	722	12. 0	1, 088	16. 9	1, 080	14. 1	845	13. 6	645	13. 7

were reported in 1964 by J. D. Thompson and Dr. Max Pepper, director of mental health planning. Crude admission rates were correlated with characteristics of towns of origin—distance from the State hospital, population size, median years of education, median family income, and percentage of population aged 65 or over. For the total caseload, and for most diagnostic groups, distance proved to be the variable with the highest coefficient of correlation; in some cases it was exceeded by the factor of old age. Distance and age together accounted for 30 percent of the variance; for all other independent variables, the association was not statistically significant.

Other investigators have controlled for some of the relevant variables, but not for all. Weiss and associates used three levels of urbanization in analyzing the effect of distance on first admissions to State hospitals in Wisconsin (*11a*). Person showed that crude first admission rates to Warren State Hospital in Pennsylvania declined markedly with distance, both in urban and in rural areas. However, when Person broke down his figures by age and sex, the pattern proved to be most pronounced for persons aged 75 years old and older (*8a*). Similarly, Buck and associates reported from western Ontario that Jarvis' law was restricted to elderly persons from the larger towns (*5a*). None of these analyses were controlled for race or for poverty; the bearing of alternative service is uncertain, although it was discussed by both Weiss and associates (*11*) and Blumberg (*10*).

This study was undertaken to determine whether Jarvis' law in Connecticut is an artifact resulting from confounding variables and whether it has relevance for planning service. We expected that specific and standardized rates would provide a more definitive answer than a multivariate analysis of crude rates.

Connecticut and California, 1961

The entire area of Connecticut is subdivided into 169 small townships. Distance was measured (on the official State highway map) from the population center of each township to the State hospital district in which the town is located. Less than 1 percent of admissions were "residence unknown," and these were excluded from the analysis, as were admissions from outside the State. About 3 percent of admissions were

June 30, 1963, by age groups and distance white males and white females

65 or over		Total	
Number	Rate	Number	Rate
White males—Continued			
210	61. 9	792	32. 4
484	41. 0	2, 163	23. 2
549	39. 3	2, 286	20. 4
381	37. 1	1, 553	19. 5
63	22. 0	267	11. 6
24	28. 6	94	11. 8
1, 711	39. 6	7, 155	21. 0
White females—Continued			
269	61. 8	739	28. 4
509	34. 9	1, 812	18. 5
574	32. 5	2, 049	17. 1
324	24. 5	1, 250	14. 3
67	17. 9	198	7. 9
7	6. 5	82	9. 9
1, 750	32. 0	6, 130	16. 8

from Connecticut towns outside the hospital district (5 percent of those admitted to Connecticut Valley Hospital) (*12*). If these admissions were reclassified according to distance between patient's residence and hospital actually entered, the net effect would be to intensify Jarvis' law.

Measurements were made by odometer along the most commonly traveled routes. Thus they partially reflect differences in travel time, although with less precision than the constructive miles used by Blumberg (*10*) to estimate relative distances in California. On the other hand, Connecticut townships are much smaller than California counties.

In 1961, the crude admission rate for Connecticut was 25 per 10,000, considerably higher than California's rate (8.7) the same year (*10c*). For the innermost 10-mile zone of Connecticut towns, the rate was 60; for towns more than 40 miles distant from a State hospital, it was 15. In California, rates ranged from about five in remote areas to about 20 per 10,000 in the neighborhood of the mental hospital (*10d*). Interestingly, the ratio of proximal to distal rates is similar in the two States, despite the large differences in average rate and in territory. Few Connecticut towns are more than 50 miles from a State hospital—the most distant is 56 miles. In California some county population centers are more than 300 constructive miles from the nearest mental hospital, or 200 miles as the crow flies (*10e*).

Readmissions

In Connecticut the ratio of readmissions to first admissions tends to diminish slightly with distance; the slope of the readmission rate is somewhat steeper than the corresponding slope for first admissions. Discharged patients may be readmitted more frequently and for shorter stays when they live near the hospital—the revolving door may spin more rapidly in the inner zones. It is also possible that some patients first admitted from remote areas may move near the hospital after discharge. These are questions relevant to planning and will be discussed elsewhere. This paper is concerned with unduplicated first admissions to the Connecticut State hospital system from July 1, 1959 through June 30, 1963.

First Admissions, 1959–63

Method. Since this was a period of rising admissions—from 20.6 in 1959 to 28.1 in 1963 (*13*)—first admissions for each town were averaged over the 4 years. Population bases were estimated populations as of July 1, 1961. Institutional populations were added to official State estimates to make them comparable with the 1960 U.S. census. In estimating bases specific for age, race, and sex, we applied ratios derived from the 1960 census to adjusted 1961 estimates for each town.

In measuring associations and testing them for statistical significance, we used the Spearman rank correlation coefficient (r_s) throughout (*14*). We considered it more appropriate for some of the data than the Pearson product-moment correlation coefficient. The Spearman technique does not require an equal-interval scale, and it makes no critical assumptions regarding the distribution of the underlying population.

Results. In Connecticut the inverse association between first admission rate and distance was by no means restricted to upper-age groups—it was apparent at all ages (table 1).

Table 2. First admission rates per 10,000 to Connecticut State hospitals, July 1, 1959–June 30, patient's residence to the hospital,

Miles	15–24 years		25–34 years		35–44 years		45–54 years		55–64 years	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate	Number	Rate
	Nonwhites									
0–9	15	47. 2	18	54. 8	13	50. 7	8	47. 1	0	0. 0
10–19	68	44. 5	67	35. 8	76	48. 9	33	35. 0	16	28. 7
20–29	87	35. 8	132	48. 0	96	44. 1	52	36. 4	18	19. 9
30–39	73	34. 4	131	52. 8	81	38. 6	35	26. 0	25	30. 2
40–49 [2]	3	-------	3	-------	3	-------	3	-------	0	-------
50 or more [2]	2	-------	0	-------	2	-------	1	-------	1	-------
Total	248	37. 4	351	45. 2	271	42. 7	132	32. 6	60	23. 9
	Whites, functional psychoses [3]									
0–9	53	6. 3	80	8. 7	82	8. 1	54	6. 3	31	4. 8
10–19	195	5. 9	306	8. 6	258	6. 3	193	6. 0	118	5. 1
20–29	233	5. 7	308	7. 7	315	6. 4	236	5. 8	180	6. 1
30–39	166	6. 1	209	7. 1	186	5. 4	163	5. 4	99	4. 4
40–49	23	3. 2	38	4. 7	37	3. 5	21	2. 4	14	2. 1
50 or more	8	3. 2	18	4. 4	11	2. 9	15	6. 4	1	. 6
Total	678	5. 7	959	7. 6	889	6. 0	682	5. 6	443	4. 9

[1] Ages 15–64, age adjusted.
[2] Rates not computed.
[3] Codes 20–24, "Diagnostic and Statistical Manual" of the American Psychiatric Association, 1952: all psychotic disorders—involutional, affective, schizophrenic, paranoid, and other psychotic reactions (without clearly defined structural change).

For all the pre-geriatric groups, the innermost rate was double or triple the outermost. For men aged 65 or over, the difference was in the same order of magnitude. For geriatric women, the slope was much steeper; the innermost rate was almost 10 times the outermost. Hence, it is not surprising that, in the preliminary multivariate analysis, distance and proportion of aged persons accounted for a large share of the variance in crude admission rate. Not only were the geriatric rates higher, as usual, but they contributed heavily to the inverse association of crude rate with distance.

In Connecticut, as in California, and in all age groups, the decrease in admission rate with distance was linear. As Blumberg expressed it, there is no critical distance for State hospital admissions (*10f*). It is hardly surprising that utilization is higher in the immediate neighborhood of any institution; the phenomenon would be less remarkable if it took the form of a very high rate within a clearly defined service area and a very low rate outside. Weiss and coworkers reported that the first admission rate in Wisconsin tended to level off at 100 miles. However, their outermost zone was large—from 100 to nearly 300 miles—and differences may have been concealed (*11*).

There were few nonwhites in the outlying regions of Connecticut during the period studied. In all zones their rates were less stable than those of the whites (table 2). However, for nonwhites also, a slight inverse association with distance was apparent, especially in age-adjusted rates for those under 65 years old ($r_s = -1.0$; $P = .05$); the high P value for the high r_s value is due to the small size of the sample (*14a*). The relatively small angle of inclination for nonwhites was probably (like their high average admission rate) a function of socioeconomic status.

In Pennsylvania, Person found no association between distance and the functional psychoses (*7b* cf. Locke and associates *6a*). In Connecticut the trend was visible even in this group of major mental disorders (table 2: $r_s = -0.943$;

1963, by age groups and distance from nonwhites and whites

65 and over		Total		Age-adjusted rate [1]	Standard error
Number	Rate	Number	Rate		
Nonwhites—Continued					
4	37. 2	58	44. 6	42. 6	6. 0
22	54. 0	282	41. 1	39. 5	2. 6
50	73. 6	435	41. 9	38. 1	2. 0
29	49. 1	374	39. 5	36. 9	2. 1
1	------	13	----------	----------	----------
2	------	8	----------	----------	----------
108	58. 0	1, 170	40. 1	37. 3	
Whites, functional psychoses [3]—Continued					
17	2. 2	317	6. 3	7. 0	0. 4
70	2. 7	1, 140	6. 0	6. 5	. 2
69	2. 2	1, 341	5. 8	6. 4	. 2
37	1. 6	860	5. 1	5. 8	. 2
7	1. 1	140	2. 9	3. 3	. 3
2	1. 0	55	3. 4	3. 0	. 5
202	2. 1	3, 853	5. 5	6. 0	

P=.01). For white persons aged 15–64 years, the age-adjusted rate in the innermost zone was more than double that in the outermost zone (for other diagnoses the corresponding ratio was roughly 3 to 1). These differences may reflect optional utilization (*11*) even by persons diagnosed as psychotic. The State hospitals may be serving as mental health centers in their neighborhoods, treating ambulatory or pseudoneurotic schizophrenics who receive no treatment in more distant localities.

In assessing the role of other factors, we restricted attention to whites because there were not enough nonwhites for fine breakdowns. That is, rates are specific for race but not for sex. We found that differences obscured by this method are smaller than those concealed in rates (more commonly employed in mental health reporting) specific for sex but not for race. We also restricted attention to persons under age 65, because they are more relevant to the planning of psychiatric service in mental health centers. We standardized rates for age by the direct method, using the white population of Connecticut in 1960 as the standard.

The three State hospitals of Connecticut are located in scenic towns ranging in size from 10,000 to 40,000. Their district boundaries trisect the State from north to south. The central district, served by Connecticut Valley Hospital, has no towns in the two most distant zones. Jarvis' law, evident in all three districts (table 3), is most pronounced in the easternmost and the largest in area—the district served by Norwich Hospital. This district includes the Norwich-New London standard metropolitan statistical area (SMSA) near the hospital; its outer zones cover the more populous cities of the Hartford SMSA and the depressed small towns of the rural northeast.

Population Size and Poverty

Metropolitan and nonmetropolitan towns also show the characteristic regression of age-adjusted first admission rates with distance (table 4). However, for metropolitan towns, rates also correlate with the poverty index (percentage of families who had incomes less than $3,000 in 1959). The correlation is statistically significant (r_s=.943; P=.01). In the nonmetropolitan towns, the correlation is not with poverty but with size of town (r_s=.886; P<.05) and with population per square mile.

To control further for these variables we grouped towns by size and by poverty status. Small towns are those with less than 10,000 estimated population in 1961; large towns are 10,000 and over. This cutoff point was selected because it falls between the median size of town (6,400) and the average (15,400). Ten percent of white families with incomes less than $3,000 in 1959 was the criterion for high poverty. This is closer to the State average for both whites and nonwhites (9.9) than for whites only (9.2). Adjustments were made for all towns with large nonwhite populations and for all towns close to the cutoff point—thus the index applies to white families only. This index was found to be more pertinent to State hospital utilization than median income.

There is a marked and statistically significant difference (in average age-adjusted first admission rate) between the high-poverty towns (20.6) and the low-poverty towns (13.7:

$P<.001$). Connecticut rates are affected more by the proportion of families under the poverty line than by size of town or population density. The rate for all towns of less than 10,000 (15.5) does not differ significantly from that for towns of 10,000 or more (16.3). However, within the high-poverty group, there is a small but significant difference ($P<.001$) between the small towns (18.3) and the large ones (21.2).

Despite these differences, Jarvis' law showed no tendency to disappear when Connecticut towns were grouped by size and poverty status (table 5). The slope tended to be steeper among the large towns, owing chiefly to differences in proximal rate. This is similar to findings in Norway where Jarvis' law is more pronounced when the inner zone contains a large town (*4*) and is of considerable significance for planning service at a time when cities are growing rapidly in size and density.

Discussion

Blumberg has estimated that the effect of Jarvis' law in California will be to double the demand for psychiatric service in more numerous and more accessible facilities (*10a*). In Connecticut its impact may be even greater. The presence of more numerous small facilities will not only tend to eliminate the distal low-rate zones; the location of services in metropolitan centers also will have the effect of applying high proximal rates to much larger populations. For example, if the rate in the innermost zone of the Norwich Hospital district were applied to the white population aged 15–64 living within 10 miles of the center of Hartford, the number of first admissions from that zone would have been 2,860 instead of 355 (table 3) in the 4-year period, an eightfold difference. Thus it is not surprising that, in some instances, waiting lists have built up before a mental health center has opened its doors.

The pronounced and pervasive effect of Jarvis' law on first admissions may be associated, both in California and in Connecticut, with the decline in resident population since the advent of psychotropic drugs and the open hospital. This would be parallel with historical changes reported from Norway (*4a*) where Jarvis' law tended to reappear with the opening of new facilities. This might also explain why studies in New York State (*15*), western Ontario, and Pennsylvania reported Jarvis' law to be much more limited in impact—all three studies were conducted before the changes in treatment had had full effect in reducing resident caseload and freeing beds.

However, this does not alter the importance of Jarvis' law for planning. Even if the decline in resident rate is retarded, the construction of new capacity will maintain the conditions which were found in Norway to be associated with high utilization in the neighborhood of the institution. The community investment in new capacity is both the result and the cause of a more hopeful attitude toward psychiatric care, and this attitude in turn may be reflected more rapidly in the institution's immediate sphere of influence than in outlying areas. So long as

Table 3. Age-adjusted first admission rates (whites, aged 15–64 years) per 10,000 to the three State hospitals in Connecticut, July 1, 1959–June 30, 1963, by distance from patient's residence to the hospital

Miles	Fairfield Hills Hospital (western)		Connecticut Valley Hospital (central)		Norwich Hospital (eastern)	
	Number	Rate	Number	Rate	Number	Rate
0–9	405	25.9	292	21.0	355	27.0
10–19	1,501	19.6	819	13.9	662	22.3
20–29	1,067	15.7	1,811	16.2	334	16.7
30–39	668	15.2	227	11.6	1,203	15.1
40–49	55	13.2	----	----	280	7.7
50 or more	25	12.8	----	----	120	9.7
Total	3,721	17.7	3,149	15.4	2,954	15.3

the hopeful attitude persists, the demand for psychiatric care will be high.

In Connecticut the high demand for care resulting from Jarvis' law may be, partially and in the long run, offset by the role of poverty in State hospital admissions. If prosperity persists, and if the proportion of disadvantaged families continues to decline, there may be a tendency for average first admission rates to fall gradually. At best, this trend will be slow to make itself felt; it may in turn be offset by greater middle-class use of community mental

Table 4. Age-adjusted first admission rates (whites, aged 15–64 years) per 10,000 to Connecticut State hospitals, July 1, 1959–June 30, 1963, by distance from patient's residence to the hospital, poverty status in 1959, and population density and mean town size in 1961: metropolitan and nonmetropolitan towns

Miles	Number	Age-adjusted rate	Poverty [1]	Density	Mean size
			Metropolitan towns		
0–9	371	26. 6	12. 5	503. 4	15, 000
10–19	2, 306	18. 2	10. 5	1, 413. 6	36, 100
20–29	2, 680	16. 3	9. 6	1, 140. 6	27, 300
30–39	1, 701	14. 5	9. 8	1, 520. 9	42, 300
40–49	267	7. 8	5. 5	898. 1	20, 700
50 or more	117	9. 8	6. 8	605. 1	17, 500
Total	7, 442	15. 9	9. 6	1, 181. 8	30, 100
			Nonmetropolitan towns		
0–9	681	23. 7	9. 5	346. 8	11, 000
10–19	676	17. 7	9. 9	195. 5	6, 100
20–29	532	15. 1	10. 8	198. 5	5, 800
30–39	397	15. 2	12. 4	130. 9	4, 600
40–49	68	10. 0	11. 9	88. 9	3, 300
50 or more	28	10. 9	11. 2	63. 6	2, 300
Total	2, 382	17. 2	10. 7	177. 8	3, 300

[1] Percentage of families with incomes less than $3,000 in 1959.

Table 5. Age-adjusted first admission rates (whites, aged 15–64 years) per 10,000 to Connecticut State hospitals, July 1, 1959–June 30, 1963, by distance from patient's residence to the hospital and poverty status and size of town [1]

Miles	Low poverty [2]						High poverty [3]						Total	
	10,000 or less			10,000 or more			10,000 or less			10,000 or more				
	Number	Age-adjusted rate	Standard error	Number	Age-adjusted rate	Standard error	Number	Age-adjusted rate	Standard error	Number	Age-adjusted rate	Standard error	Number	Age-adjusted rate
0–9	207	17. 8	1. 2	511	25. 1	1. 1	34	19. 5	3. 4	300	33. 4	1. 9	1, 052	24. 6
10–19	198	15. 0	1. 1	1, 270	14. 1	. 4	223	24. 5	1. 6	1, 291	24. 6	. 7	2, 982	18. 1
20–29	184	12. 1	. 9	1, 479	13. 8	. 4	293	18. 0	1. 1	1, 256	20. 5	. 6	3, 212	16. 1
30–39	105	10. 9	1. 1	1, 055	13. 7	. 4	198	18. 0	1. 3	740	16. 3	. 6	2, 098	14. 6
40–49	35	7. 3	1. 2	226	7. 4	. 5	38	12. 2	2. 0	36	14. 1	2. 4	335	8. 2
50 or more	7	[4]	[4]	104	10. 1	1. 0	34	10. 1	1. 7	----	----	----	145	10. 1
Total	736	13. 3	. 5	4, 645	13. 8	. 6	820	18. 3	. 6	3, 623	21. 2	. 4	9, 824	16. 2

[1] Estimated population in 1961.
[2] Less than 10 percent of white families had incomes less than $3,000 in 1959.
[3] 10 percent or more of white families had incomes less than $3,000 in 1959.
[4] Not computed.

health facilities. It will not diminish the force of Jarvis' law which has a strong influence on first admissions from low-poverty towns (table 5).

Summary

Jarvis' law has a marked effect on first admissions to Connecticut State hospitals. It applies to all age groups, to nonwhites (in lesser degree) as well to whites, and to the functional psychoses as well to the less-severe disorders. It is not an artifact due to the confounding effect of poverty or urbanization. It tends to be more pronounced among large towns than among small ones; in particular, the proximal rates tend to be much higher for towns of 10,000 or more people. Thus, Jarvis' law has a vital bearing on the planning of service in smaller, more numerous facilities in large population centers.

Role of Alternative Psychiatric Service in Connecticut

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THIS PAPER is concerned with whether Jarvis' law in Connecticut is explained by the location of alternative psychiatric service, that is, service other than treatment or aftercare in the State hospital system.

Method

First admission rates were analyzed for the period July 1, 1959 through June 30, 1963. Alternative psychiatric service was counted as of a date as close as possible to the midpoint of the 4-year period. Psychiatric beds in general hospitals were enumerated as of July 1, 1961. Numbers of beds in private hospitals were obtained from the 1961 directory of the American Hospital Association (*16*). Data on psychiatrists (per 100,000) were taken from the Connecticut Department of Mental Health list of licensed psychiatrists and neuropsychiatrists compiled in March 1961. Those specializing in neurology alone were excluded; but nondiplomates who described themselves as specializing in neuropsychiatry were included.

Staff psychiatrists at State hospitals or training schools for the retarded were counted as providing care one-fifth time—they were assumed to have 8 hours a week for private patients or for supervision of outpatients (not aftercare). Full-time faculty members of the Yale University Department of Psychiatry were assumed to have 20 hours a week for community work and private practice—they were counted as providing care one-half time. Out-of-State psychiatrists who maintained a Connecticut license were also counted one-half. These crude adjustments may have overstated the availability of psychiatrists to private patients and community agencies, especially in institutional towns. This is offset somewhat, in the same towns, by the contribution of young physicians in training who were not listed by the State if they were unlicensed.

Man-hours of professional service were obtained from the 1961 "Directory of Outpatient Psychiatric Clinics," compiled by the National Association for Mental Health and the National Institute of Mental Health. Staff psychiatrists, psychologists, and social workers were included as well as psychiatrists and internists who volunteered their services and trainees. Clinics restricted to children or to aftercare of State hospital patients were not counted.

Population bases were official State estimates (by town) as of July 1961, with institutional populations added in accordance with the 1960 U.S. census.

Planning Regions of Connecticut

Alternative service could not be quantified within State hospital zones, because it was not equally accessible to all zone residents. Instead, service was enumerated in the 13 planning regions of the State—the same regions, with minor alterations, which were used in planning comprehensive mental health services (*17*). The regions had been defined by the Connecticut Development Commission on the basis of economic structure, social integration, traffic flow, and service utilization (*18*).

In July 1961 no outpatient services were provided in the two northern rural corners of the State, the Northwestern Planning Region (bordering on Massachusetts and New York) and the