Jarvis' Law and the Planning of Mental Health Services

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ADMISSION RATES to Connecticut State hospitals show a strong tendency to reflect Jarvis' law—that is, to vary inversely with distance between the patient's residence and the hospital. The influence of accessibility is independent of the other variables known to affect utilization of State hospitals; it is not an artifact due to population density or the presence of high-risk groups (*1*), and it is not explained by the location of alternative psychiatric service (*2*). It also is not accounted for by errors in classifying the residence of patients on admission (see box).

Jarvis' law should be considered in planning service in future mental health centers, which will have smaller catchment areas than most State hospitals. Jarvis' law will have a particularly strong impact on centers which are constructed in large communities. Connecticut State hospitals are located in small cities; admission rates from within a 10-mile radius are very high. If the same hospitals were located in large cities like Hartford, the number of admissions from the innermost 10-mile zone would be multiplied several-fold (*1a*). These proximal rates are the most realistic predictors of future demand for care in mental health centers. Estimates based on average statewide rates are bound to be low.

Length of Stay by Distance

However, planning cannot be based on admission rates alone. To appraise the full effect of Jarvis' law, it is necessary to know not only how many people come from nearby and from a distance, but how long they stay. Suppose, for example, that 100 patients are admitted from a town within 10 miles of the facility and only 20 patients from a town the same size 50 miles distant. If the 100 local patients stayed only 20 days each, while the 20 distant patients stayed 100 days on the average, then total utilization from the two towns would be equal despite the excess of local admissions. In other words, differences in admission rate would be compensated by differences in length of stay, and Jarvis' law would have no relevance to planning.

In Connecticut some difference in length of stay

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by distance is to be expected. The proportion of patients with diagnosed schizophrenia tends to increase with distance. Only 17 percent of persons admitted from the innermost 10-mile zone are schizophrenic. Of those admitted from a distance of 40 miles or more, 30 percent are schizophrenic (*3*).

In this paper we explore the question of whether resulting differences in average length of stay are sufficient to offset the marked differences in admission rate and to neutralize Jarvis' law. Little attention has been devoted to this question heretofore. Most studies of Jarvis' law have analyzed admission rates only. Weiss and associates (*4*) reported that patients discharged from two State hospitals in Wisconsin stayed somewhat longer if their homes were remote. Person (*5*), on the other hand, noted that place of residence had little effect on promptness of release from Warren State Hospital in Pennsylvania. Neither Weiss nor Person combined information on admissions with information on length of stay in order to assess the net effect of Jarvis' law.

Resident Rates

Another approach to the question is to compare resident rates with admission rates. The resident rate is the prevalence of institutionalized persons at a given point in time, usually at the end of a year.

Arentsen and Strömgren conducted a census of psychiatric patients in Risskov Hospital in Denmark by place of residence. As cited by Bille (*6*), these investigators found that resident rates did not vary with distance, although admission rates for a recent period had clearly reflected Jarvis' law. They concluded that there were more short-term admissions from the immediate neighborhood of the hospital.

Table 1 shows resident rates, by distance, for all patients under 65 years old in Connecticut State hospitals on June 30, 1964. The rates are standardized for age but not for race. For comparison, standardized admission rates (white and nonwhite patients) are given for 1962–63 and first admission rates (white patients only) for the years 1959–63. Jarvis' law does not disappear in the resident rates, although it is less pronounced than in admission rates—the slope is less steep. This suggests that there are differences by distance in average length of stay; their effect is to reduce the influence of Jarvis' law but not to neutralize it entirely.

Note on Reporting of Residence

To check the accuracy of reported towns of residence, records were reviewed of all patients admitted during a 4-year period from two large planning regions in Connecticut. Less than 1 percent were found to be incorrectly coded for town of residence.

Even for this small proportion, there was no systematic bias related to distance from the admitting hospital. Residence in large cities was slightly overstated; for example, five out-of-State residents reported Hartford as their home town. However, no large city (more than 100,000 people) lies within 10 miles of a State hospital in Connecticut. The three largest cities are 10 to 40 miles from a State hospital, one in each 10-mile zone, and the largest of the three, Hartford, is the most distant. Thus, if all such errors were corrected, Jarvis' law would be unaffected. The residence-unknown group was also so small (0.5 percent) that it would have no appreciable effect, even if it belonged entirely in a single zone.

A greater problem was presented by patients transferred from long-term institutions outside the State hospital system—prisons, training schools, nursing homes, and hospitals for the chronically ill. The three State hospitals had different rules for classifying such patients. Only one hospital followed the U.S. Census policy of assigning them to the town of the institution. The other two State hospitals, with some exceptions, assigned them to their home towns; when these patients were reassigned according to the Census policy, Jarvis' law was neither enhanced nor diminished. The long-term institutions, with their high-risk populations, were not concentrated near the State hospitals, but were distributed in all zones.

About 3 percent of patients were admitted from towns outside the State hospital catchment areas. The majority of these were residents of outlying zones in their hospital district who preferred admission to a nearer hospital. If all these admissions were reclassified according to the distance between patients' residence and the hospital they actually entered, the net effect would be to intensify Jarvis' law (*1b*).

Resident rates in State hospitals are heavily influenced by long-term patients. Of the Connecticut resident patients under 65 years old in 1964, 21.6 percent had been on the books for 20 or more years. The median length of stay (all ages) was 7 years for males and 8 years for females (*7*).

Table 2 shows length of stay by distance for resident patients as of June 30, 1966 (*8*). Geriatric patients are included in the data, and length of stay is classified in broad rubrics. Again, we see the heavy contribution to resident rates of the accumulated residue of long-term patients.

There may be a tendency for the proportion of patients hospitalized 10 years or more to increase with distance; if so, it may reflect differences in

diagnosis or administrative barriers to early discharge—barriers of the kind which community based facilities are intended to overcome. This apparent trend cannot be fully assessed, however, until analysis is possible by diagnosis, race, and age. It will also be necessary to control for relative rates of population growth in the towns from which these long-term residents came (*9*). The slower growing towns tend to have a higher proportion of patients admitted many years ago and a smaller proportion of more recently admitted patients.

The resident rate is not a satisfactory index of total utilization. To provide data relevant to mental health centers, it is desirable to distinguish between short-stay and long-stay patients. Also, the experience of discharges and deaths during the year should be added to the experience of year-end residents to arrive at an estimate of total utilization.

Experience of Short-Stay Patients

Short-stay patients are usually defined as those who remain in public mental hospitals less than 2 years. This cutoff point represents a compromise between the much longer stays of most resident patients and the shorter stays of the large majority of admissions (*10*). For experience relevant to mental health centers, a shorter period is more appropriate. (Gruenberg (*11*) defines short-term hospitalization as less than 6 months.) We de-

Table 1. Age-adjusted resident rates (patients aged 15–64 years) per 10,000 in Connecticut State hospitals, by distance from patient's residence to the hospital compared with admission rates and first admission rates

Miles	Resident patients June 30, 1964		Admissions July 1, 1962–June 30, 1963		First admissions July 1, 1959–June 30, 1963	
	Number	Age-adjusted rate[1]	Number	Age-adjusted rate[1]	Number	Age-adjusted rate[2]
0–9	449	37.3	768	67.2	1,052	24.6
10–19	1,482	33.3	2,020	45.9	2,982	18.1
20–29	1,639	29.3	1,952	35.9	3,212	16.1
30–39	1,417	34.7	1,349	34.6	2,098	14.6
40 or more	255	16.4	245	16.6	480	8.7
Total	5,242	30.8	6,334	38.7	9,824	16.2
Residence unknown[3]	60	.....	30	.....	49	

[1] Standard population: Connecticut population, aged 15–64, 1960.
[2] Standard population: white population of Connecticut, aged 15–64, 1960. Rates were averaged over the 4-year period.
[3] State-at-large and residence unknown; out-of-State residents excluded.

Table 2. Resident patients (all ages) in Connecticut State hospitals, June 30, 1966, by length of stay and by distance from patient's residence to the hospital

Years of stay[1]	0–9 miles		10–19 miles		20–29 miles		30–39 miles		40 or more miles		Residence unknown[2]
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Under 1	192	29.7	583	26.8	495	24.4	456	23.6	96	26.5	9
1–2	46	7.1	177	8.1	114	5.6	121	6.3	29	8.0	2
2–5	98	15.2	281	12.9	255	12.6	205	10.6	46	12.7	6
5–10	75	11.6	265	12.2	272	13.4	267	13.8	40	11.1	2
10–20	104	16.1	331	15.2	294	14.5	333	17.2	70	19.3	2
20 or more	130	20.3	543	24.8	599	29.5	550	28.5	81	22.4	67
Total	645	100.0	2,180	100.0	2,029	100.0	1,932	100.0	362	100.0	88

[1] 1–2 means 1 year or more but less than 2, and so on.
[2] 66 State-at-large and 22 residence unknown; out-of-State residents excluded.

cided to restrict short-stay patients to those who had been in the hospital less than 1 year.

When we consider patients in the hospital less than a year, the most striking difference appears to be between the innermost zone (less than 10 miles) and all other zones (table 3). A significantly larger proportion of patients from the immediate neighborhood of the hospital had been in less than 1 month, and a smaller proportion had been in more than 6 months ($X^2 = 6.694$, 2 d.f., $P < .05$). The associated difference in length of stay is small, however; far from adequate to offset differences in admission rates as marked as those in table 1. For short-stay residents from the innermost zone, the mean length of stay was about 2.6 months; for all other short-stay patients, 2.9 months. Here also firm inference must be postponed until we have data on actual length of stay by age, race, and major diagnostic group as well as by distance. The data in table 3 may be influenced by geriatric patients, who have little relevance in the planning of mental health centers.

From available data, it is not possible to derive valid rates of total utilization over time by distance. However, it is possible to estimate roughly how large the differences in average length of stay must be, by distance, to offset Jarvis' law. We did this by adding what we know about the experience of residents at the end of the year to our information about discharges during the year and calculating person-years of service per 10,000 population for each zone.

For resident patients, total years of service received during fiscal year 1965–66 were estimated by using data in tables 2 and 3. One estimate was

Table 3. Patients (all ages) resident less than 1 year in Connecticut State hospitals, June 30, 1966, by length of stay and by distance from patient's residence to the hospital

Months of stay[1]	0–9 miles		10–19 miles		20–29 miles		30–39 miles		40 or more miles		Residence known
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
Under 1	77	40.1	180	30.9	177	35.8	146	32.0	28	29.2	1
1–6	87	45.3	266	45.6	229	46.2	211	46.3	46	47.9	6
6–12	28	14.6	137	23.5	89	18.0	99	21.7	22	22.9	2
Total	192	100.0	583	100.0	495	100.0	456	100.0	96	100.0	9

[1] 1–6 means 1 month or more but less than 6, and so on.

Table 4. Estimated person-years of service per 10,000 in Connecticut State hospitals, July 1, 1965–June 30, 1966, by distance from patient's residence to the hospital: resident patients (all ages) at year's end and discharges during the year

Miles	Number patients discharged	Total years of service: Discharges ×.083 years[1]	Total years of service: All residents[2]	Total years of service: Residents on books less than 1 year[2]	Years of service per 10,000 population[3]: All residents and discharges	Years of service per 10,000 population[3]: Short-term residents and discharges
0–9	1,075	89.2	498.8	49.5	403.1	95.1
10–19	3,076	255.3	1,773.5	187.5	376.4	82.1
20–29	3,111	258.2	1,665.1	140.6	287.1	59.5
30–39	1,717	142.5	1,608.8	141.6	362.0	58.7
40 or more	370	30.7	295.1	31.0	173.2	32.8
Total	9,349	775.9	5,841.3	550.2	326.5	65.4
Residence unknown[4]	65	5.4	82.3	3.3	.....	.....

[1] Since information is not yet available on length of stay of discharges by distance, the number of discharges was multiplied by the average length of stay, one-twelfth of a year. The number of short-term discharges closely parallels the number of admissions, of course, thereby contributing to the persistence of Jarvis' law in these data.

[2] Years estimated from length-of-stay categories in tables 2 and 3.

[3] Population bases: estimated populations aged 15 and over as of July 1, 1966.

[4] State-at-large and residence unknown; out-of-state residents excluded.

made for the entire resident caseload, counting all long-term patients as having received 1 full year of service. A separate estimate was made for those whose length of stay had been less than 1 year. It was necessary to assume that the average length of stay for each class was the midpoint of the interval covered. Thus, patients who had been on the books 6 months or more, but less than 1 year, were assigned 0.75 of a year, and so on.

For discharged patients, we do not yet have comparable information about length of stay by distance of their residence from the hospital. We know only that the average length of stay (net time in residence) for all discharged patients in fiscal 1965–66 was 1 month (*8a*). Thus, for each discharged patient in a zone, we added 1 month of service to the total years of service received during the year by resident patients from the same zone. Then we computed crude rates for years of service provided per 10,000 population aged 15 or over (table 4).

For the short-stay patients, Jarvis' law remains pronounced. Person-years of service per 10,000 population in the innermost zone are almost three times the rate for the outermost zone (table 4). The decline with distance is less than the decline in admission rate (table 1) but greater than the decline in year-end resident rate.

Discussion

The assumptions on which these calculations are based are, of course, highly questionable. One year's observation is not adequate. There is no information about deaths. And, it is highly unrealistic to assume that there is no difference by distance in average length of stay for discharged patients; some of these were long-stay patients who should be excluded from the short-stay group.

The preliminary estimate does indicate that differences in length of stay must be very high indeed in order to nullify Jarvis' law. To offset the decline in person-years of service, by distance, the average length of stay in the outermost zone would have to be three times the length of stay in the innermost zone. It is most improbable that such large differences will be found among short-stay patients. More precise information will show a modified form of Jarvis' law in total utilization rates and will confirm the impression that Jarvis' law should be considered in estimating the demand for service in mental health centers.

This pilot analysis suggests that further study is needed and worthwhile. We plan to analyze total utilization rates in Connecticut State hospitals for a 5-year period through 1969. Actual length of stay will be tabulated for all discharged and deceased patients, by distance, and for the resident population at the end of the period. Utilization rates will be specific for race and for major diagnostic group, and they will be standardized for age. We will use 1970 census data to improve estimates of population. The data on short-stay patients will facilitate the planning of mental health centers. The data on long-term patients may clarify the factors which contribute to chronic institutionalization.

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The results of a few studies have suggested that Jarvis' law may be counterbalanced by differences in length of stay in public mental hospitals. The tendency for admission rates to decrease with distance from patients' residence to the hospital may be neutralized by a tendency for length of stay to increase with distance.

This is not the case in Connecticut State hospitals. Jarvis' law remains apparent in resident rates, although the differences are not as marked as in admission rates. Even when long-term patients are included, variations in length of stay are not sufficient to completely offset Jarvis' law.

For planning mental health centers, it is desirable to have information about total utilization rates, by distance and over time, of short-stay patients under 65 years of age. To estimate total utilization rates, the experience of deceased and discharged patients should be added to the experience of short-stay residents at the end of a given period.

Years of service per 10,000 population were estimated for a 1-year period in Connecticut State hospitals. These estimates showed that differences in average length of stay, by distance, must be very large to neutralize Jarvis' law. It is inconceivable that such large differences in length of stay will be found among short-term patients.

It is expected that when valid, specific figures are available for a longer period, Jarvis' law will persist in total utilization rates of short-term patients. A knowledge of utilization experience, by distance, will be indispensable for planning future community mental health centers.